



HAL
open science

Viral Marketing Strategies on Facebook : Analysis, experimentation and case studies on initial seeding populations

Nasri Messarra

► **To cite this version:**

Nasri Messarra. Viral Marketing Strategies on Facebook : Analysis, experimentation and case studies on initial seeding populations. Economics and Finance. Université Montpellier, 2015. English. NNT : 2015MONTD019 . tel-01365275

HAL Id: tel-01365275

<https://theses.hal.science/tel-01365275>

Submitted on 13 Sep 2016

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

THÈSE

Pour obtenir le grade de
Docteur

Délivré par l'**Université de Montpellier**

Préparée au sein de l'école doctorale ECONOMIE ET GESTION – ED 231
Et de l'unité de recherche Montpellier Recherche en Management – EA 4557

Spécialité : Sciences de Gestion – Section CNU N°6

Présentée par Nasri Messarra

Stratégie du marketing viral sur Facebook

*Analyses, expérimentations et études de cas
sur les populations de diffusion initiales*

Viral Marketing Strategies on Facebook

*Analysis, experimentation and case studies
on initial seeding populations*

Sous la direction de : Anne Mione

Soutenu le 08 décembre 2015 devant le jury composé de

Anne Mione, Professeur à l'Université de Montpellier	Directeur de thèse
Christine Balagué, Maître de Conférences HDR, Telecom Ecole de Management	Rapporteur
Gilles Paché, Professeur à l'Université d'Aix Marseille	Rapporteur
Frédéric Le Roy, Professeur à l'Université de Montpellier	Examineur
Gilles N'Goala, Professeur à l'Université de Montpellier	Examineur
Laurence Saglietto, Maître de conférences HDR à l'Université de Nice	Examineur



Version de diffusion :

Cette version ne comporte pas la totalité des reproductions pour des raisons de droits. Certains graphiques ont été volontairement rendus illisibles.

« L'Université Montpellier n'entend donner aucune approbation
ni improbation aux opinions émises dans cette thèse ;
ces opinions doivent être considérées
comme propres à leur auteur ».

“The University of Montpellier doesn't give any endorsement
or approval to the views expressed in this thesis.
These opinions should be considered
those of the author”

Titre**Stratégie du marketing viral sur Facebook**

Analyses, expérimentations et études de cas sur les populations de diffusion initiales

Viral Marketing Strategies on Facebook

Analysis, experimentation and case studies
on initial seeding populations

Résumé

Cette thèse s'inscrit à un moment où le besoin d'une base marketing stratégique pour l'utilisation des réseaux sociaux en ligne se fait sentir (Hoffman et Novak 2012). Elle contribue aux recherches sur le marketing viral sur les réseaux sociaux en ligne et, en particulier l'optimisation de la population initiale de diffusion. Elle suggère des stratégies permettant de rétablir un certain contrôle au profit du stratège marketing sur des plateformes avares en informations et un public qui considère les entreprises comme «indésirables» (Fournier & Avery, 2011).

Le développement de cette thèse est composé de plusieurs chapitres dont quatre ont fait l'objet de communications à des conférences internationales (Euras 2012; INSNA 2014; ISMS 2015; Workshop Stratégie Paris-Dauphine 2014).

Cette thèse commence par une réflexion générale sur la recherche et l'éthique sur les réseaux sociaux en ligne. Elle aborde la question de la reconstitution des graphes sociaux des fans et l'efficacité ou l'inefficacité des faux profils dans le cadre du marketing sur Facebook. Elle traite du bouche-à-oreille négatif dans le cadre d'une population initiale de diffusion optimisée, et de la découverte de ponts surplombant les trous structurels entre deux camps politiques antagonistes.

Les expériences effectuées mènent à une réflexion sur la question des supports disponibles sur Facebook (Pages, Groupes ou Profils) dans le cas des stratégies marketing en général et des stratégies de marketing viral en particulier. Le dernier chapitre met en application les résultats obtenus en gérant une campagne de marketing viral de Personal Branding du temps zéro jusqu'au succès.

Title

Viral Marketing Strategies on Facebook
Analysis, experimentation and case studies
on initial seeding populations

Summary

This dissertation comes at a time where more research is needed in the field of strategic marketing on online social networks (Hoffman & Novak, 2012). It contributes to theory and practice of viral marketing strategies on online social networks and, in particular, initial seeding populations. It suggests methods to increase marketers control on a platform that builds barriers to information and with a public who considers brands on OSN as intruders (Fournier & Avery, 2011).

This dissertation comprises several chapters, amongst which four experiments that have been presented at international conferences (Euras 2012; INSNA 2014; ISMS 2015, *workshop stratégie Paris-Dauphine* 2014).

This dissertation starts with a reflection on research and ethics on online social networks. It then moves to the question of uncovering and building social graphs of fans and analyzes the efficiency and inefficiency of fake profiles as marketing tools on Facebook. We also consider word-of-mouth in the context of an optimized seeding population, and the discovery of social bridges over structural holes between antagonistic political groups. Those experiments lead to a thinking about the choice of the Facebook channels (pages, groups or personal timelines) and their efficiency with different marketing strategies: mass, relational, niche and viral.

The last chapter puts into practice our findings and results by creating a strategy from zero to success of a personal branding campaign using viral marketing.

MOTS-CLES : Stratégie Marketing, Réseaux Sociaux en Ligne, Marketing Viral, BAO, Bouche-à-Oreille, Buzz Négatif, Populations d'Ensemencement, Populations initiales de diffusion, Facebook, Fils d'Actualité Facebook, Pages Facebook, Faux Profils, Profils pot-de-miel Inversé, Ponts Sociaux, Réseaux Politiques.

KEYWORDS: Marketing Strategy, Online Social Networks, Viral Marketing, WoM, NWoM, Seeding Populations, Branding, Fan Attacks, Facebook, Facebook Timelines, Facebook Pages, Fake Profiles, Inversed Honeypot Profiles, Social Bridges, Political Networks.

À mon père Antoine, qui m'a transmis la passion du savoir-plus,

À ma femme Joumana qui a cru en moi et sans laquelle je n'aurais pas pu finir cette thèse,

*À mes enfants, Elsa-Maria, Antoine et Chiara-Sophie, qui sont fiers de moi et dont je suis
moi-même fier,*

*Au Professeur Anne-Mione, à sa direction exceptionnelle et unique, et à sa passion partagée
pour ce travail.*

Abrégé

Lorsqu'en novembre 2011, le professeur Mione et moi-même avons opté pour ce sujet, la littérature sur les stratégies marketing sur les réseaux sociaux en ligne, particulièrement Facebook, était rare. En fait, dans un éditorial du *Journal of Interactive Marketing*, en 2012, Hoffman et Novak (2012) notaient le besoin d'une base marketing stratégique pour l'utilisation des réseaux sociaux en ligne.

Peut-être qu'une des raisons principales de cette complexité à trouver une base stratégique solide pour les réseaux sociaux en ligne, et en particulier Facebook, est le fait qu'une approche par les sciences de gestion uniquement est insuffisante. L'esprit même des réseaux sociaux en ligne et de Facebook trouve son origine dans la théorie des graphes (Euler, 1736), une théorie mathématique que les sociologues ont été les premiers à utiliser dans la recherche. D'ailleurs, un article de Eytan Bakshy (2012), "empiriste" chez Facebook, montre le rapport du modèle Facebook avec les études de Granovetter (1983) et sa théorie des liens forts et des liens faibles. Le bouche-à-oreille et le rôle des influenceurs trouvent, aussi, leur origine en sociologie, avec Lazarsfeld (Lazarsfeld, Berelson, & Gaudet, 1968).

La viralité, terme utilisé abondamment en marketing pour signifier une information qui se propage de manière "contagieuse" sur les réseaux sociaux nous vient de la médecine. La psychologie joue aussi un rôle important sur les réseaux sociaux en ligne: l'image que nous projetons selon nos réactions sur les réseaux sociaux (Gosling, Augustine, Vazire, Holtzman, & Gaddis, 2011), l'effet de Facebook sur la jalousie dans les relations (Eby, 2010; Flynn, n.d.; Lindner, 2012) ou sur l'estime de soi (Gonzales & Hancock, 2011), etc.

Avec plus d'un milliard d'utilisateurs et des outils de ciblage par sexe, région, centres d'intérêts, âge, etc., les chercheurs dans le domaine de la gestion ne sont pas exception non plus et s'intéressent de plus en plus depuis quelques années au sujet (Berthon, Pitt, Plangger, & Shapiro, 2012; Katona, Zubcsek, & Sarvary, 2011; Smith, Fischer, & Yongjian, 2012; Vásquez & Escamilla, 2014; etc.).

Pour comprendre les réseaux sociaux en ligne et trouver un fil conducteur pour cette thèse, il nous a fallu donc nous plonger dans la littérature ante-réseaux sociaux en ligne toutes

disciplines confondues : sociologie, psychologie, gestion, droit et même médecine... Notre librairie d'articles sur Mendeley (2011) compte, après cinq années de recherche, plus de 1 200 articles et documents. Notre objectif, comprendre le marketing viral sur les réseaux sociaux en ligne et en déduire des stratégies marketing efficaces sur Facebook.

Nous nous sommes donc lancés tout d'abord dans des recherches sur l'influence. Nous avons été particulièrement inspirés par les ouvrages de Robert Cialdini (2005; 2001) et des frères Heath (2008; 2010). Les conférences sur YouTube et les articles de Howard Rheingold (2007; 2010) sur les "foules intelligentes" (smart mobs) ou les actions collectives générées par les nouveaux outils de communication nous ont aussi interpellé, surtout qu'avec les réseaux sociaux en ligne, chaque personne devenait une source d'information et l'influence et la viralité jouait avec ou contre les entreprises.

Le choix de la plateforme était aussi important. Facebook, contrairement à d'autres réseaux sociaux, comme MySpace, offre une plateforme où les connections inter-utilisateurs sont optimisées dans le sens de la loi de Reed (2001) selon laquelle l'importance d'un réseau dépend du nombre de connections entre les nœuds de ce réseau. Facebook est aussi un lieu de conversation et de partage d'informations pareil aux "réseaux liquides" décrits par Steven Johnson (2010), ces endroits en milieu professionnel ou amical où les personnes se retrouvent pour discuter de tout et de rien, et qui sont à l'origine des idées et des solutions aux problèmes. Mais, toutes les personnes sont-elles également influentes dans un réseau ? Ou, comme l'écrivent Booth et Matic (Booth & Matic, 2011), le réseau est-il formé de "signifiants" (*somebodies*) et d'"insignifiants" (*nobodies*)? Faut-il chercher des influenceurs pour propager l'information (Galeotti & Goyal, 2009; Muruganatham & Ghandi, 2014) ou, au contraire, comme le conseillent Watts et Dodds (2007), cibler les personnes influençables?

C'est donc, avec des brides de connaissances et de méthodes, issues de plusieurs disciplines apparemment très éloignées les unes des autres, comme la sociologie, la médecine, le droit et la gestion, que nous avons amorcé notre recherche et, ceci, jusqu'au moment où nous avons trouvé trois articles qui sont, pour ainsi dire, au fondement de cette thèse. Le premier, est un article de Hinz, Skiera, Barrot et Becker (2011), qui recense quatre éléments du marketing viral: le message, le réseau des personnes informées, leurs caractéristiques et leur

attitude, et, enfin la population initiale de diffusion. Le deuxième article, est un article de Valente et Myers (2010), issu du domaine de la santé, qui s'axe sur le rôle du messenger lui-même. Le troisième et dernier article, est de Yupin Liu-Thompkins (2012) qui rejoint l'article de Hinz & al. quant à l'importance de la population initiale de diffusion. Ces articles ont donc été à la base de notre questionnement : Quelles stratégies du marketing viral sur Facebook ? Quel rôle et comment choisir, contrôler et optimiser les éléments du marketing viral et, principalement, les populations initiales de diffusion ?

La ligne directrice de la thèse était trouvée. Cependant, à l'instar du manque de littérature scientifique et holistique, l'accès aux données des réseaux sociaux en ligne, principalement Facebook, représentaient un obstacle de taille. Ce n'est que grâce à ma position de consultant dans le domaine de la communication en ligne et à mes contacts privilégiés avec certains de mes clients, que nous avons pu, en trois ans, reconstituer, à partir de plusieurs vrais et faux profils, un réseau d'utilisateurs Facebook formé de plus de 22 000 Libanais reliés entre eux par plus de 400 000 connections (A est ami avec B).

C'est donc, bien armés au niveau théorique et en données, que nous nous sommes lancés dans l'analyse et l'expérimentation.

Le chapitre intitulé "Rethinking Marketing on Facebook" est le résultat d'une longue réflexion sur les expériences que nous avons réalisées ainsi que sur mon expérience sur le terrain en tant que consultant en communication sur Internet dont font partie les réseaux sociaux en ligne. La littérature scientifique, du moins la très grande majorité des articles que nous avons trouvés, traite du Marketing sur Facebook sans différenciation entre les différents supports offerts par Facebook. Ceci est peut-être dû au fait que Facebook impose, d'une certaine manière, aux entreprises l'utilisation des « Pages Facebook » ou, à la limite des « Groupes Facebook », mais interdit l'utilisation de « Pages personnelles » dans un objectif professionnel. Cette politique est bien agencée puisque les deux autres supports offerts ont des limitations au niveau du nombre d'amis ("Pages personnelles") ou de la diffusion des messages ("Groupes"). Or, nos recherches nous ont amenés à conclure que seules les pages personnelles permettent un contrôle presque total sur les éléments nécessaires du marketing viral.

Le chapitre « A Broader Meditation on Research on OSN » propose un cadre éthique à cette thèse et à la recherche sur les réseaux sociaux en général. Dans deux de nos expériences, nous avons utilisé de faux profils et n'avons pas informé les sujets de l'expérience. Ceci, évidemment, soulève plusieurs questions d'ordre moral et éthique. Notre argumentation se base principalement sur les recherches de Hudson & Bruckman (2004) qui montrent que les personnes réagissent différemment s'ils sont au courant d'une expérimentation et que les résultats, dans ce cas, peuvent être biaisés, principalement par l'effet de proximité/spectateur ("bystander effect"). Dans nos expériences, nous avons uniquement dissimulé la nature réelle de nos faux profils. Aucune information fautive ou altérée n'a été publiée par ces faux profils. Hey (1998), d'ailleurs, différencie le fait de ne pas dévoiler toute l'information, du fait de donner de fausses informations.

L'expérience "Spartacus", objet du chapitre "A web of hubs: the Spartacus experiment", a été présentée en poster à la conférence EURAS à Košice, en Slovaquie et est parue dans les actes de la conférence (Messarra & Mione, 2012). L'objectif était de savoir si, en créant un réseau de personnes hautement connectées (des "hubs"), des personnes réelles pourraient être attirées vers un faux profil et lui demanderaient de devenir leur ami. L'expérience a montré que, passé un certain nombre de hubs, des personnes réelles commencent à se joindre au réseau d'amis de notre faux profil. Nous avons appelé ce faux profil un pot-de-miel inversé (inversed honeypot), selon la terminologie du courrier électronique selon laquelle un pot-de-miel est une "vraie" boîte de courrier électronique qui attire de "faux" correspondants (des "spammers"). Dans notre cas, les rôles sont inversés, dans le sens que c'est le profil qui est "faux" et les contacts qui sont de "vraies" personnes. Notre expérience s'aligne avec les recherches de Chen & al. (2009) qui montrent que les personnes sur les réseaux sociaux essaient de maximiser leur réseau en comblant leurs trous structurels ("structural holes") par des "amis" qu'ils rencontrent en ligne ou qui sont recommandés par le système (ici, Facebook) et qu'ils ne connaissent nécessairement pas en réalité. Notre apport a été de démontrer qu'on pouvait artificiellement créer un effet de réseau autour d'un faux profil en sélectionnant méticuleusement ses amis. Le poster présenté à Euras s'arrêtait à ce niveau de la recherche.

Sur le plan de la stratégie marketing, nous avons poussé l'expérience plus loin en essayant de voir si des messages à succès publiés sur les pages personnelles de personnes réelles auraient

le même impact sur le mur de ce pot-de-miel inversé. L'expérience a montré que ce n'était pas le cas. Donc, même si ce faux profil attire de vraies personnes et que son réseau est optimisé, il ne peut servir de vecteur de diffusion et, encore moins, d'acteur dans une campagne de marketing viral. Cette recherche vient à un moment où des milliers de marques se font volontairement "aimer" par des faux profils pour augmenter leur nombre de "fans" et d'"amis" (Julian, 2013a, 2013b).

Le chapitre "Negative WoM and its transmission on OSN : the determining role of the seeding population" répond à une question théorique : peut-on accentuer l'effet du WoM négatif en redistribuant les mêmes messages à une population initiale de diffusion optimisée autour de faux profils créés pour cette expérience ?

Pour cette expérience, nous avons sélectionné les personnes actives de la page Facebook d'une entreprise et les avons attirées vers deux faux profils créés pour l'expérience. La technique pour attirer les fans d'une marque vers des profils personnels a été décrite, sous le nom de "cover experiment" à la conférence Sunbelt 2014 de l'*International Network for Social Network Analysis* à Tampa (Etats-Unis) dans le cadre d'une présentation intitulée « Honey-pot profiles and malevolent e-reputation attacks on Facebook » (Messarra & Mione, 2014). Une fois les personnes actives rassemblées autour des deux faux profils, nous avons republié des posts négatifs recopiés de la page Facebook de l'entreprise ciblée. Cette action a généré sept fois plus de réactions et engagé trois fois plus de personnes que lorsque ces messages avaient été postés sur la page de l'entreprise. Cette expérience a été exposée en détail au Dauphine Workshop Strategy 2014 de l'Université Paris-Dauphine (France). Cette expérimentation fait l'objet d'un article qui est actuellement en troisième révision au *Journal of Advertising Research (JAR)*.

En 2015, suite à un changement dans les règlements de Facebook, chaque utilisateur avait le choix ou non de cacher ses amis. Seuls, restaient visibles, dans les deux cas, les amis communs. Sur un autre plan, il devenait très difficile d'avoir accès à la liste d'amis d'amis (liens faibles). Puisqu'on ne pouvait plus reconstituer les graphes sociaux de nos profils expérimentaux et de leurs amis, ces mesures représentaient, à notre avis, un handicap et une barrière pour la recherche poussée des réseaux d'influence et des stratégies marketing,

principalement le marketing viral. Ceci aussi représentait une barrière pour les stratégies du marketing sur les réseaux sociaux puisqu'ils ne pouvaient plus reconstituer les graphes sociaux de leurs clients.

Pour cela, dans le chapitre « Using Fake and Real Profiles to Uncover and Rebuild a Fan's Social Graph », nous avons tenté une expérimentation simple qui consiste à recomposer les graphes sociaux des personnes à partir des amis communs de plusieurs profils. En ajoutant les amis communs de chaque profil ciblé avec plusieurs autres profils auxquels nous avons accès, nous avons pu reconstituer jusqu'à 28% du graphe social de ces personnes.

Dans le chapitre "Finding Bridges for Political Influence", les derniers événements politiques au Liban créant des divergences profondes entre les deux courants politiques principaux, le "8 mars" et le "14 mars", nous ont poussés à nous demander s'il était possible de trouver, à partir des réseaux sociaux, des "ponts" surplombant les trous structurels entre les deux clans. Une première analyse sur Twitter a confirmé la scission entre les deux clans. En prenant deux sujets controversés, nous avons démontré que les clans se comportaient en "groupes polarisés", c'est-à-dire qu'ils s'ignoraient mutuellement sur les réseaux sociaux même pour les sujets les plus critiques (Smith, Rainie, Himelboim, & Shneiderman, 2014). En utilisant les profils de trois politiciens différents sur Facebook, formant un graphe social de 22 000 personnes et de plus de 350 000 connections, nous avons pu retrouver plus de mille ponts entre un politicien du 8 mars et un autre du 14 mars. Ces "ponts" ont, selon Burt (2004), un potentiel de conviction supérieur à une personne engagée dans un des deux clans. Ce groupe de "ponts" pourrait ainsi servir de population initiale de diffusion pour faire passer des idées innovantes ou simplement "différentes", comme le suggère Burt.

Jusqu'aujourd'hui, la réflexion sur les stratégies marketing sur Facebook reste embryonnaire. Dans cette thèse, nous avons posé plusieurs questions concernant le contrôle des éléments du marketing viral sur Facebook et, en particulier, l'optimisation des populations de diffusion initiale et nous pensons avoir trouvé des réponses innovantes et pertinentes à ces questions. Le dernier chapitre « Making Sense of Everything: A Personal Branding Case Study from Start to Finish » met en application les résultats obtenus en prenant en charge une campagne de marketing viral du début jusqu'à l'aboutissement. Cette expérience, documentée et analysée,

sans biais puisqu'elle ne se passe que sur Facebook, montre concrètement l'efficacité de la stratégie de marketing viral définie à partir des résultats, réflexions et analyses théoriques de cette thèse.

La reconnaissance et l'intérêt qui nous ont été portés lors de conférences et de workshops où nous avons présenté notre travail est une preuve de la qualité de ces recherches et de leurs résultats. Il est vrai que cette thèse ne saurait prétendre répondre à toutes les questions. Cependant, elle pave la voie et met les bases pour une réflexion scientifique et pratique pour les stratégies marketing sur Facebook et sur les autres réseaux sociaux.

Remerciements

Prétendre que ce travail est le travail unique de l'auteur de cette thèse serait de l'ingratitude.

Il m'aurait été impossible de commencer cette thèse sans l'aide de mon père Antoine, du Président de l'Université Franco-Libanaise à Tripoli, Le Professeur Mohamad Salhab, de Monsieur Jean-Paul Fernandez, délégué aux Relations Internationales à l'Université Montpellier 1 et du Professeur Jean-Louis Jacquin.

L'encouragement de mes parents, Evelyne et Antoine, pour entreprendre ce projet de thèse qui promettait d'être épuisant à tous les plans, était aussi essentiel pour le succès de cette thèse. Leur aide continue tout au long des cinq années qu'il m'a fallu pour terminer ce projet et leur présence à mes côtés est une grâce inestimable.

Je remercie aussi ma femme Joumana et mes enfants, Elsa-Maria, Antoine et Chiara-Sophie, pour leurs sacrifices, leur patience et leur support inconditionnel.

Je remercie toutes les personnes qui m'ont accueilli à Montpellier et m'ont soutenu pendant cinq longues années : le Professeur Frédéric Le Roy, le Professeur Monique Lacroix, le Professeur Hervé Chapert, et beaucoup d'autres.

Je remercie mon directeur, le Professeur Anne Mione, qui m'a repêché pour un changement de direction sans me connaître, et qui, par sa direction, a été à mes côtés à chaque instant de cette thèse pour l'enrichir de ses remarques et de ses réflexions.

Sommaire

Résumé	3
Summary	4
Abrégé	7
Remerciements	14
Sommaire	15
1 Introduction Générale (Français)	17
1 Introduction (English)	51
2 A Broader Meditation on Research on OSN	81
3 Using Fake and Real Profiles to Uncover and Rebuild a Fan's Social Graph.....	99
4 A web of hubs: the Spartacus experiment.....	113
5 Negative WoM and its transmission on OSN : the determining role of the seeding population.....	138
6 Finding Bridges for Political Influence	159
7 Rethinking Marketing on Facebook	174
8 Making Sense of Everything: A Personal Branding Case Study from Start to Finish	189
9 Discussion and Conclusion (English)	206
10 Discussion et Conclusion (Français)	212
Annexe 1: Dauphine Conference	218
Annexe 2: INSNA Conference	228
Annexe 3: Euras Conference.....	234
Annexe 4: Marketing Science Conference.....	239
Table of figures	250
Table of tables.....	252
Bibliography	254

Contents.....	272
---------------	-----

1 Introduction Générale (Français)

1.1 Les réseaux sociaux en ligne, une longue histoire

1.1.1 Les années 1970-2006

Les réseaux sociaux en ligne ne sont pas une technologie récente. L'histoire de la communication en ligne remonte aux années 70. Les réseaux, évidemment, se limitaient aux universités ou aux grandes entreprises ou organisations dotées d'ordinateurs "mainframe" géants dont la puissance n'égalait pas celle des petits téléphones mobiles de nos jours. Le premier système de communication groupée est probablement le système BBS (Computerized Bulletin Board System) développé par Ward Christensen et Randy Seuss en 1978 (J. Lee, 2013). Le principe est simple : les utilisateurs se connectent via un système *telnet* ou un autre système client-serveur et publient des messages sur un "tableau digital" que tous les autres utilisateurs peuvent lire. Ce système continuera à être utilisé pendant presque deux décennies.

Le système "Usenet" voit le jour en 1980. Ce système qui ressemble aux forums d'aujourd'hui est en fait le précurseur du *world wide web*. Les groupes Usenet, imaginés par Tom Truscott et Jim Ellis, étaient définis comme des systèmes de discussion à l'échelle planétaire (Wikipedia, 2015). Le système était simple : les utilisateurs pouvaient partager ou publier des messages que d'autres utilisateurs pouvaient lire ou auxquels ils pouvaient répondre. Cependant, contrairement aux forums, un fil d'information Usenet pouvait être repris et réutilisé par d'autres serveurs, rendant ces informations publiques et libres de droits. Les systèmes Usenet sont toujours utilisés, plus de trente ans après leur création, notamment comme des substituts payants au système P2P (*peer-to-peer*), pour télécharger des fichiers multimédia, des logiciels ou d'autres types de fichiers (Juhoon Kim, Schneider, Ager, & Feldmann, 2010). Nous mentionnerons notamment le site américain Giganews et le site européen Usenext qui offrent des abonnements mensuels permettant des téléchargements de plusieurs giga-octets de films, séries télévisées, ou autres.

En 1988, un développement majeur voit le jour. Contrairement à tous les systèmes précédents, il s'agit d'un système qui permet une communication en temps réel ! C'est le système IRC ou le "*Internet Chat Relay*". Avec ce système, les utilisateurs peuvent se connecter à des "*chat rooms*" ou "chambres de conversations", discuter, s'entraider, jouer ou partager des fichiers. Le système IRC est un réseau de chambres de conversations où chaque chambre est appelée conduit (*channel*). Les conduits peuvent être domiciliés sur des serveurs différents qui fonctionnent en autonomie. La popularité de ce système s'est vu décroître avec le temps, en partie remplacé par des systèmes de messagerie instantanée beaucoup plus faciles à utiliser liés aux téléphones mobiles, comme Whatsapp, Facebook Messenger et d'autres. Pourtant, des dizaines d'utilitaires IRC restent disponibles sur Internet, tels mIRC, X-Chat, HydraIRC, KVIrc, NetTalk et Quassel.

En 1994, le W3 consortium conçoit le premier logiciel, WIT, basé sur le protocole des forums. Les forums sont un système typique de contenu généré par les utilisateurs (*User Generated Content – UGC*) et une évolution naturelle des Bulletin Boards et des autres systèmes de discussion. Cette évolution offre une interface plus conviviale et familière puisqu'elle utilise comme support informatique le navigateur web, rendant le système accessible à n'importe quel utilisateur lambda. Les forums sont basés sur le système « thin client » ou « client léger » où l'utilisateur n'a pas besoin d'une machine spécifique ou d'un logiciel spécifique pour accéder aux informations et les modifier. Les forums comptent des millions d'utilisateurs aujourd'hui qui publient quotidiennement un nombre innumérable de messages sur tous genres de sujets (Cai, Yang, Lai, Wang, & Zhang, 2008). Aujourd'hui, le logiciel de prédilection, disponible en deux versions, gratuite et payante, pour créer des forums est le logiciel *vBulletin*. Il supporte aujourd'hui 44% des forums sur le web, suivi par *Oracle Right Now* qui est utilisé pour développer 26% des forums (Built With, 2015).

C'est presque au même moment que les forums que les premiers blogs ont commencé à se développer. Il s'agissait au début d'une sorte de journal personnel où le créateur pouvait raconter sa journée ou ses impressions personnelles. Le *New York Magazine* attribue le premier blog créé à un étudiant de Swarthmore, Justin Hall, en 1994 (Thompson, 2006). Les blogs se multiplient et évoluent, devenant des supports politiques, techniques, sociaux, etc. Le même article du *New York Magazine*, parle d'une étude qui montre qu'en 2005, 32 millions

d'américains lisent des blogs et que durant la même année 100 millions de dollars ont été dépensés en publicités sur les blogs. Un des blogs les plus notoires actuellement est le Huffington Post. Le site de surveillance (*monitoring*) Alexa, classe le Huffington Post comme le 107^{ème} site le plus visité de la planète et le 32^{ème} aux Etats-Unis (Alexa, 2015). En 2011, l'entreprise *NM Incite* avait réussi à retracer plus de 181 millions de blogs sur Internet, une augmentation importante par rapport aux 36 millions de sites trouvés en 2006 (Nielsen, 2011).

1.1.2 Les connections inter-utilisateurs ou la révolution des réseaux sociaux en ligne

Seulement, tous les réseaux sociaux en ligne cités plus haut, se caractérisaient par une forme sociale principalement en étoile. Soit, nous avons au centre l'utilisateur qui pose la question et tout autour, ceux qui y répondent. Soit, nous avons plusieurs utilisateurs qui posent une question à un utilisateur central et celui-ci y répond. Dans une étude récente, Marc Smith (2014) définit plusieurs modèles de structures de réseaux dans le cadre des communications sur Twitter. Les mêmes structures telles que définies pourraient être appliquées à d'autres réseaux de communication. Si nous voulions définir les réseaux antérieurs à 2007, nous parlerions de réseaux de support (*support network*) et de réseaux de diffusion (*broadcast networks*). Dans le premier cas, les utilisateurs demandent de l'aide à un utilisateur central qui répond (cas d'un service de support technique). Dans le second, un utilisateur central diffuse des informations à une multitude d'autres utilisateurs (cas d'un service d'information). Dans les deux cas, les interactions entre les utilisateurs, à part l'utilisateur principal, sont inexistantes ou rares.

Or, la loi de Reed (2001) estime que la valeur d'un réseau dépend des connections du deuxième niveau. Pour qu'un réseau soit donc important, il ne suffit pas qu'il y ait beaucoup d'interactions entre plusieurs individus et un service ou un individu central, mais que ces individus dialoguent entre eux et créent ainsi une valeur supérieure à la valeur du service ou de la plateforme elle-même. Ainsi, par exemple, les plateformes de support en ligne offertes par les entreprises trouvent leur vraie valeur non pas dans la communication client-entreprise, mais dans les communications entre les clients eux-mêmes sur la plateforme.

Un des meilleurs exemples de sites basés sur les interactions entre les membres est le site e-Bay. Ce site propose des ventes aux enchères inter-utilisateurs. Chaque utilisateur devient une source d'information : vendeur, acheteur, commentateur, évaluateur... La valeur du réseau e-Bay dépend principalement et presque uniquement du nombre d'utilisateurs de ce réseau et de leurs interactions.

Un autre exemple, digne d'être cité, serait les MMORPG, ou les *Massive Multiplayer Online Role-Playing Games*. Il s'agit de jeux en ligne pouvant accueillir des milliers de joueurs simultanément. Chaque joueur se crée un personnage (ou *avatar*) et peut jouer dans le monde virtuel offert par le MMORPG à sa convenance. Lorsqu'il sort du jeu en s'isolant pour "dormir" dans une maison ou dans un coin, le monde, lui, continue à fonctionner avec les joueurs encore en ligne. Historiquement, le premier MMORPG date de 1997 (Kelly, 2004). Il s'agit du jeu "Ultima Online" ou UO, conçu par Richard Garriott. Dans ce jeu, les utilisateurs finissent par se créer des groupes, nommés "Guildes", et s'organisent pour contrôler des zones, attaquer en groupe, optimiser l'utilisation des ressources et se partager les tâches. Sur UO, le nombre de joueurs dans une guildes peut atteindre plusieurs centaines de joueurs, tel que les "Europa Player Killers", Les "Lands End Inc." ou le "Clann Marrach Fad [M^F]" (Allen, 2004).

Un de ces jeux de rôle, Second Life, fondé en 2003 par Linden Lab, offre une particularité intéressante, il propose un monde virtuel "réaliste" : les joueurs vivent dans un monde semblable exactement pareil à notre monde réel, ils ont un métier, louent une maison, font des achats, invitent des amis, louent des services, etc. En 2013, dix ans après sa création, le site compte 36 millions de membres (Linden Lab, 2013). Des entreprises comme IBM y voient des opportunités marketing et des opportunités commerciales et ouvrent des "boutiques" ou des centres d'information dans le monde de Second Life (Mennecke, Mcneill, Ganis, & Townsend, 2008).

Ellison et Boyd (2007) définissent les réseaux sociaux en ligne comme des services web permettant aux individus :

1. De se créer un avatar ou un profil public lié au système,
2. De communiquer avec d'autres utilisateurs du système auxquels ils sont liés,

3. De voir leurs connections et les connections des autres utilisateurs dans le système.

Cette définition de 2007 intègre un élément important qui différencie les blogs et les forums, par exemple, des réseaux sociaux en ligne comme Facebook. C'est le fait que les utilisateurs peuvent avoir accès aux connections des autres utilisateurs. Cette nouvelle variable permet aux utilisateurs d'élargir plus facilement et plus naturellement leur réseau. L'intérêt des réseaux sociaux en ligne selon Ellison et Boyd étant donc de permettre aux utilisateurs de se connecter à des personnes auxquelles ils ne se seraient pas connectés autrement. Une étude montre d'ailleurs que les utilisateurs essaient d'optimiser leur réseau en trouvant des ponts pour remplir les trous structurels de leur réseau (Chen et al., 2009). Dans cette étude, les auteurs mentionnent le fait qu'indiquer le chemin social dans le graphe social vers une personne inconnue encouragerait la personne qui reçoit l'information à accepter cet inconnu dans son réseau.

Ce nouvel élément confirme l'hypothèse selon laquelle Facebook a pu surpasser MySpace justement grâce à ses fonctions de connexions de deuxième niveau tels que la fonction automatique "les personnes que vous connaissez peut-être" (Mui, 2011). Ces fonctions ont contribué à créer des réseaux d'amis impressionnants et il n'est pas rare de trouver des personnes avec 500, 1 000 ou même 5 000 amis ! Ceci est d'autant plus intéressant que, théoriquement, selon Robin Dunbar, un anthropologiste et chercheur notoire, la limite du nombre de connections qu'un individu peut avoir avec d'autres individus à un moment donné est de 150 à 200 (Dunbar, 1993).

Il est regrettable qu'aujourd'hui, Facebook, limite de plus en plus l'accès aux amis d'amis et l'extraction de la liste d'amis, rendant la tâche d'analyser et d'optimiser un réseau d'amis ou de fans, extrêmement difficile. Si l'intérêt premier d'un réseau social en ligne est de permettre aux utilisateurs de voir le réseau des autres utilisateurs, et si Facebook révoque ce service, ne met-il pas son existence en danger ? Nous avons vu des moteurs de recherche dominer le web pendant des années, comme Altavista. Lycos et Infoseek, et nous les avons vus disparaître au profit de Google qui offrait un meilleur service.

1.1.3 Un survol rapide des plateformes les plus importantes

Les réseaux sociaux en ligne les plus importants en 2015 et qui répondent au critère selon lequel un utilisateur a une visibilité totale ou partielle sur son réseau et celui de ses connections sont : Facebook, Twitter, LinkedIn, Instagram et Google+.

1.1.3.1 Facebook

En 2015, Facebook reste le réseau social en ligne le plus utilisé avec 1 440 millions d'utilisateurs actifs mensuellement dont 936 millions actifs quotidiennement (source SocialBakers.com, 2015). La plateforme sociale Facebook est fondée en 2004. Originellement conçue pour les étudiants de Harvard, elle s'étend progressivement aux autres universités. Le site connaît un succès inattendu très rapidement: alors qu'ils ciblaient des centaines de personnes par email, le nombre des enregistrements se fait par milliers en quelques heures, comme le raconte un des fondateurs, Dustin Moskovitz (Zeevi, 2013). Peter Theil, fondateur de PayPal est un des premiers investisseurs dans le projet. Il achète 10.2% des parts à un demi-million de dollars. En 2006, Facebook, jusque-là limité aux universités américaines, devient publiquement ouvert à tous les enregistrements et n'importe quelle personne, de n'importe quel pays, peut s'enregistrer librement (Mashable, 2011). Dans plusieurs pays, Facebook devient le site le plus visité et dépasse le moteur de recherche Google. En 2007, Facebook ouvre ses portes aux entreprises en créant les "Facebook Pages". La plateforme connaît des modifications majeures continuellement. Pour les utilisateurs, des fonctions leur permettant d'avoir accès et de mettre à jour leur flux par application mobile, des fonctions en rapport avec le droit à protéger certaines informations personnelles, des fonctions d'édition et un historique des modifications, la possibilité de suivre ou de ne pas suivre certains amis, une échelle de priorité par rapport aux informations proposées (par exemple, l'option de voir certaines informations "en premier"), etc. Pour les entreprises, En 2012, Facebook introduisait les *Global Pages*, permettant à une entreprise d'avoir une page différente par pays ou par groupe de pays. L'avantage du système est l'unification de certaines statistiques pour toutes les pages. Ainsi, par exemple, le visiteur voit le nombre de fans total de toutes les pages, même s'il visite la page de n'importe lequel des pays. En 2014, Facebook a lancé son "Business Manager", permettant à plusieurs utilisateurs, à partir d'une application centrale, de partager le même compte publicitaire et d'avoir des droits d'accès identiques et

différents par rapport à une ou plusieurs pages Facebook. Cette fonction est essentielle pour les entreprises ou les personnes gérant plusieurs pages Facebook puisqu'elle centralise toute la gestion des permissions et des accès à partir d'une application centrale unique.

1.1.3.2 Google+

Bien que considéré comme un des réseaux sociaux en ligne avec le moins d'utilisateurs, soit 300 millions, Google+ est en fait bien plus que cela. Google a, en fait, créé un écosystème social complet, étroitement lié. Le réseau social Google dépasse largement le cadre de Google+ puisqu'il intègre les utilisateurs du système d'exploitation de téléphonie mobile, Android, les utilisateurs du réseau social de la vidéo en ligne, YouTube, les utilisateurs de la plateforme de messagerie, Gmail, qui intègre aussi les groupes de messagerie, la plateforme de blogueurs gérée par Google, Blogger, les systèmes d'analyse de sites, Google Analytics, ainsi que d'autres services directement ou indirectement liés à l'obtention et à la diffusion d'information sur ses réseaux sociaux comme, par exemple, l'historique des recherches effectuées ou la géolocalisation en continu des utilisateurs de mobile. Il ne serait pas exagéré d'admettre que la plupart des utilisateurs d'Internet, sinon tous, sont, d'une manière ou d'une autre "fichés" dans le réseau social de Google. Google+ est, avec l'utilisation croissante des téléphones mobiles basés sur le système Android, appelé à avoir de plus en plus d'utilisateurs. Une particularité intéressante à mentionner de Google+ est la possibilité de diviser ses amis en "cercles" et de les cibler avec des informations différentes. Une fonction qui offre des possibilités intéressantes qui ne sont pas disponibles sur d'autres plateformes, comme Twitter et qui commencent à être copiées sur Facebook. Une utilisation de cette fonction peut être de partager différents types d'informations avec différentes personnes, comme avoir un fil d'informations traitant de cuisine ou de philosophie, et un autre traitant de sujets techniques.

1.1.3.3 Twitter

Twitter est défini comme le réseau social du microblogging. Cette définition qu'on retrouve sur Internet montre la particularité de ce réseau social. Si Facebook est le réseau d'amis, Twitter est celui des pairs ou celui de l'information. Plusieurs journalistes l'utilisent pour diffuser des informations en plein reportage. Les blogueurs l'ont automatiquement adopté et relié à leur blog. Les utilisateurs sur Twitter ne se "suivent" pas parce qu'ils se connaissent

mais suivent ceux qui fournissent des informations qui seraient susceptibles de les intéresser. Twitter est beaucoup moins populaire que Facebook. Il compte 316 millions d'utilisateurs actifs mensuellement qui génèrent 500 millions de tweets quotidiennement (SocialBakers.com, 2015). Une autre particularité importante de Twitter est qu'il s'agit d'un réseau social à graphe orienté. C'est-à-dire que, contrairement à Facebook qui veut que si A est ami avec B, donc B est de facto ami avec A, sur Twitter, une personne peut "suivre" une autre sans que ceci ne soit réciproque.

1.1.3.4 Instagram

Instagram est le réseau social des jeunes par excellence. Exclusivement utilisable à partir d'applications mobiles iPhone et Android, il compte aujourd'hui 300 millions d'utilisateurs. Plus de 50% des utilisateurs d'Instagram ont entre 18 et 29 ans. Instagram est le site de l'information par la photo. L'utilisateur poste une photo et l'enrichit d'un commentaire. Les entreprises y trouvent leur compte en publiant des photos de produits, d'événements, et même de clients. Mais l'intérêt principal est pour les jeunes qui essaient de se lancer. Tel, par exemple, ce jeune photographe, Chris Ozer, qui a gagné sa réputation sur Instagram (Price, 2014).

1.1.3.5 LinkedIn

LinkedIn reste un peu en retrait par rapport aux autres réseaux avec seulement 97 millions d'utilisateurs. LinkedIn est le réseau des professionnels. Avec un moteur d'affichage de contenu adapté aux employeurs et aux chercheurs d'emploi, LinkedIn est le lieu privilégié de ceux qui cherchent des professionnels et des spécialistes ou de ceux qui cherchent des emplois. Une liste de postes disponibles et adaptés aux besoins et au profil de l'utilisateur lui est proposée par email ou via la plateforme LinkedIn. Pour les plus jeunes ou ceux qui cherchent à pousser leurs études, une fonction "recherche d'université" indique les formations et les universités où des entreprises comme Google, Facebook, Microsoft, Apple et autres chasseurs des têtes. Le problème majeur de LinkedIn est en rapport avec la loi de Reed, puisque cette plateforme a très peu de fonctions encourageant les connections du second niveau. Pour cela, LinkedIn se réinvente en créant des fonctions de groupes, en permettant aux utilisateurs de voir les connections de leurs contacts et d'avoir même accès au profil des personnes qui ont eu accès à leur page.

1.1.3.6 Autres plateformes de réseaux sociaux en ligne

Statistiquement, l'américain moyen passe, aujourd'hui, 37 minutes par jour sur les réseaux sociaux en ligne (MarketingTechBlog, 2015). Une étude récente que nous effectuons sur un échantillon de vingt personnes au Liban et qui est en cours d'analyse montre que ces personnes passent entre 2 à 4 heures par jour sur leur téléphone mobile, dont, une grande partie sur les réseaux sociaux en ligne.

Les plateformes de réseaux sociaux en ligne que nous avons décrites plus haut ne sont que quelques-unes des multiples plateformes de réseaux sociaux qui jonchent Internet aujourd'hui. Des réseaux moins peuplés mais non moins intéressants, comme par exemple le réseau social des chercheurs, *Research Gate*, mériteraient de faire l'objet d'analyses approfondies et d'études. Seulement, l'objectif de cette thèse ne rentre pas dans ce cadre.

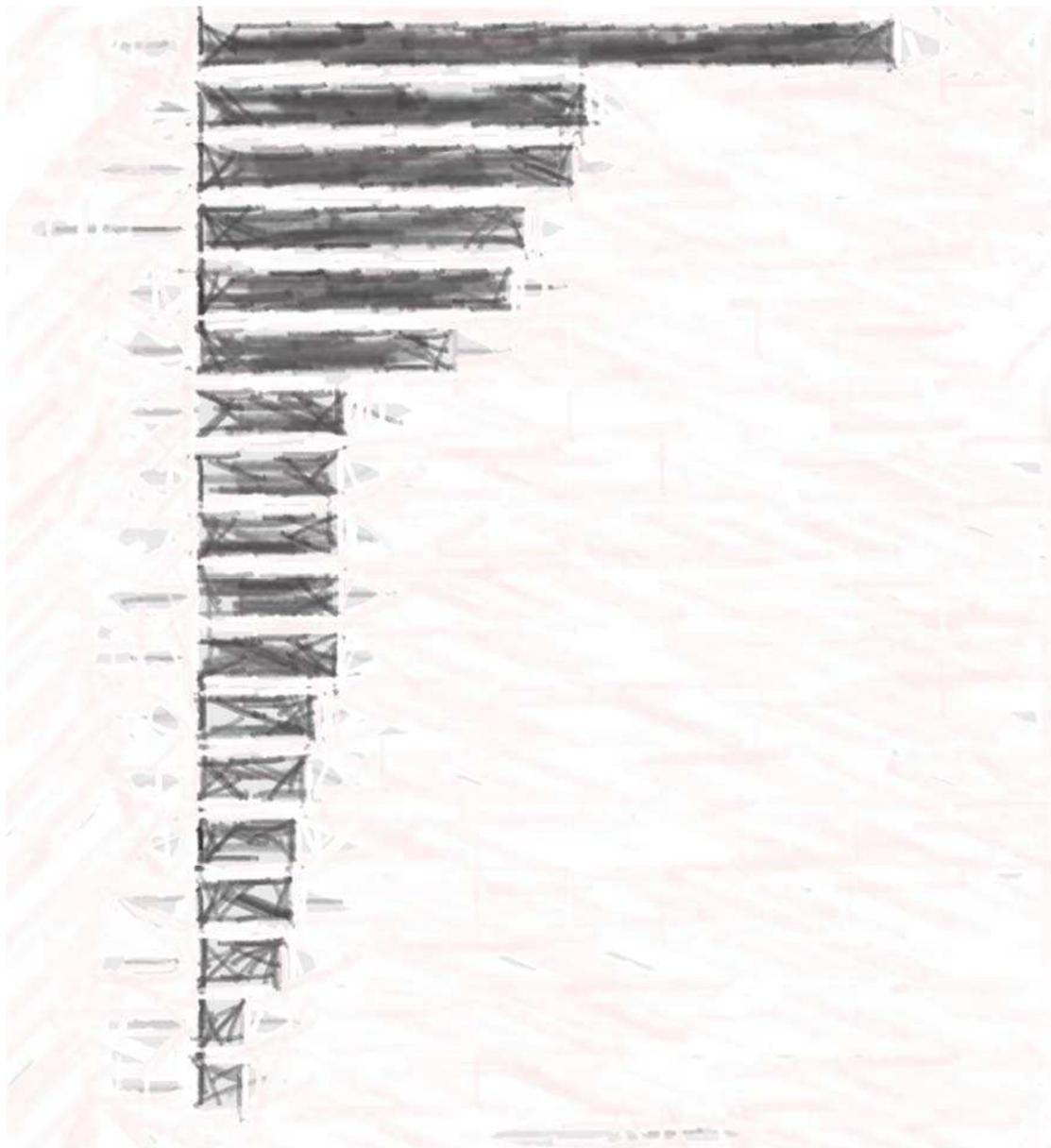


Figure 1: Nombre d'utilisateurs actifs en millions sur les réseaux sociaux en ligne avec le plus grand nombre d'utilisateurs (Statista, 2015)

1.2 Des mathématiques à la stratégie : la recherche sur les réseaux sociaux en ligne

Le concept des réseaux trouve son origine dans les mathématiques avec la théorie des graphes. Une théorie développée par Euler (1736) pour résoudre un problème mathématique simple: peut-on traverser la ville de Königsberg sans passer deux fois par le même pont?

Cette théorie mathématique consistait, entre autres, à relier des points des deux côtés de chaque pont ou des points dans une même zone. Une théorie qui pouvait être appliquée à plusieurs disciplines. Pourtant, il a fallu plusieurs centaines d'années pour que cette théorie ne bénéficie d'une terminologie commune et ne soit décrite avec précision dans l'ouvrage de Frank Harary, "*Graph Theory*" (1969). A partir de ce moment, les chimistes, les sociologues, les neurologues, les mathématiciens, les électriciens, et d'autres chercheurs dans d'autres disciplines, ont pu parler le même langage et contribuer efficacement au même savoir. Ainsi, les mêmes résultats pouvaient s'appliquer aux rapports humains ou aux réactions chimiques, selon que le poids des connections représentait des interactions humaines (par exemple, des rencontres) ou des réactions chimiques (comme la température).

En sociologie, le papier de Granovetter (1983), "la force des liens faibles", qui utilise la théorie des graphes, est un des articles les plus cités en matière de sociologie. Dans ce papier, Granovetter explique comment ce sont les liens faibles, ou les "connaissances" ou "amis d'amis", et non les liens forts, soit les amis intimes, la famille, etc., qui peuvent aider une personne à trouver un emploi. La théorie des graphes dans les sciences sociales a évolué avec des concepts tels que les vides ou les trous structurels (R. S. Burt, 2004b) et les connexion à poids négatif (Leskovec, Huttenlocher, & Kleinberg, 2010). Dans le cas d'un vide structurel, deux groupes d'individus peuvent ne pas avoir de connexion commune. Les deux groupes ne peuvent donc pas communiquer entre eux, créant un vide structurel entre eux. Une personne qui comble ce vide structurel relierait les deux groupes et servirait de lien entre ces deux groupes. On parle alors de "pont" entre ces groupes. Les liens entre deux personnes ne sont pas nécessairement binaires, par exemple, être amis (1) ou pas (0). Ces liens peuvent être traduits en nombre de rencontres, en années passées ensemble, en argent donné, en argent demandé, en attaques verbales, et, ainsi, peuvent avoir un poids négatif ou positif.

Un autre questionnement se pose au niveau de la position d'un individu par rapport aux autres dans le graphe (Landherr, Friedl, & Heidmann, 2010). Une personne qui a le plus grand nombre de connexions (degré) est-elle plus importante qu'une personne qui se trouve au centre du graphe (centralité) ou qui est connectée à des personnes qui, elles, sont très importantes et très connectées (centralité de Katz) ? En fait, plusieurs types de calcul de centralité permettent d'évaluer le rôle, en tant que *hub* (personne ayant plusieurs connexions), *bridge* (personne créant un pont entre deux groupes) ou *fringe* (personne positionnée à l'extrémité du graphe), et son importance (degré, centralité de Katz, centralité de proximité, etc.).

La théorie des graphes et, particulièrement, les recherches de Granovetter, sont au centre de l'intelligence du système Facebook, comme l'explique Eytan Bakshy, un empiriste de l'équipe Facebook (2012).

Le bouche-à-oreille ou BAO ou WoM (Word of Mouth) est aussi un des champs scientifiques de la sociologie qui font l'objet de recherches et d'études sur les réseaux sociaux. C'est en réalisant que les électeurs faisaient leur choix politique non pas en écoutant les candidats et les médias mais des pairs qui transmettaient les messages, que Lazarsfeld (1968), un des précurseurs, a commencé les recherches dans ce sens. Sur les réseaux sociaux en ligne, le terme "viralité" a été emprunté de la médecine pour décrire une information qui se propage par le BAO de manière contagieuse et rapide.

La diffusion de l'information, particulièrement sur Twitter, est aussi un champ d'étude de prédilection. Une étude récapitulative des types de discussions sur Twitter a fait l'objet d'un papier écrit par Marc Smith et al. (2014). Dans cette étude, les auteurs définissent six types de discussions sur Twitter:

1. Les foules polarisées (*Polarized Crowds*): c'est le cas de groupes aux idées divergentes. Ces groupes, même dans le cas d'un sujet critique qui les intéresse, s'ignorent mutuellement. C'est le cas des groupes politiques antagonistes.
2. Les foules serrées (*Tight Crowds*): Ces discussions se caractérisent par des personnes très connectées qui discutent entre elles et reprennent les mêmes

- idées. C'est le cas, par exemple, des personnes présentes à des conférences qui lisent, commentent, aiment et partagent les informations de leur collègues.
3. Les communautés de marques (*Brand Clusters*) : Il s'agit de sujet d'intérêt commun, par exemple des produits très connus ou des acteurs. Dans ce cas, plusieurs personnes, à la base sans connexion les uns aux autres, discutent du sujet. Ces personnes discutent du sujet sans pour autant discuter entre eux.
 4. Les communautés groupées (*Community Clusters*) : C'est le cas de sujets populaires où plusieurs communautés se forment autour d'influenceurs. Chaque communauté peut couvrir dans sa discussion un aspect différent du sujet. Les groupes sont généralement de taille moyenne avec un grand nombre de personnes déconnectées (*singleton*).
 5. Les réseaux de diffusion (*Broadcast Network*) : Il s'agit des réseaux créés par les sources d'information. Un utilisateur au centre du réseau diffuse l'information qui est commentée, aimée ou partagée par les autres utilisateurs. Graphiquement, la forme du graphe est en étoile avec, au centre, l'utilisateur qui diffuse l'information et qui joue le rôle de "*hub*".
 6. Réseau de support (*Support Network*) : Il s'agit, par exemple, d'un service qui s'occupe du support technique ou des plaintes des consommateurs. Il s'agit aussi d'un *hub* mais, cette fois, les communications vont de la communauté vers l'utilisateur central.

Mais, la sociologie n'est pas la seule discipline qui s'intéresse aux réseaux sociaux. Si les réseaux sociaux ne relevaient que de la sociologie, des théories comme la loi de Reed (2001) devraient s'appliquer à toutes les plateformes de réseaux sociaux en ligne et ceci impliquerait que la valeur de ces réseaux croîtrait exponentiellement et que, par conséquent, la valeur du réseau lui-même croîtrait exponentiellement. Or, ce n'est pas le cas et on observe en réalité une certaine saturation ou même des diminutions du nombre d'utilisateurs. Ceci est dû à des facteurs psychologiques : toutes les personnes ne sont pas intéressées à former des groupes, à participer à des discussions, à partager des informations, etc. Chaque personne essaie de transmettre une image basée sur ses actions et ses réactions sur les réseaux sociaux en ligne. Les personnes extraverties, par exemple, cherchent à étendre leur personnalité IRL (*In Real Life*, dans la vie réelle) aux réseaux sociaux en ligne. Gosling et al. (2011) suggèrent que les

personnes extraverties sont plus actives sur les réseaux sociaux en ligne et ont un plus grand nombre d'amis que les introvertis.

Gonzales et Hancock (2011) suggèrent que l'accumulation d'amis est un stimulant pour l'amour-propre. Ainsi, malgré la limite théorique calculée par le sociologue-anthropologue Dunbar (1993) selon laquelle le nombre maximal de personnes avec lesquelles une personne donnée peut garder le contact et qui varie entre 150 et 200 personnes, certains utilisateurs Facebook ont 500, 1 000, voire 5 000 amis.

Même si les sociologues ont été les premiers à développer des outils mathématiques et statistiques basés sur la théorie des graphes pour étudier les réseaux, il est indispensable pour cerner tous les aspects d'une recherche dans ce sens de prendre en compte les éléments mathématiques et psychologiques inhérents aux réseaux sociaux et aux interactions des groupes sociaux.

1.2.1 La perspective en sciences de gestion

Dans "*The economics of information technology: An introduction*", Varian et al. (2004) décrivent comment, pour les nouvelles technologies, les gens appliquent les anciennes techniques au nouvel environnement avant de trouver de nouvelles méthodes leur permettant d'utiliser la nouvelle technologie à son plein potentiel. A titre d'exemple, les auteurs racontent comment il a fallu des dizaines d'années avant que les usines ne réalisent que l'utilisation de l'électricité serait plus efficace si les bâtiments des usines avaient une structure horizontale (travail en chaîne) au lieu de la structure en tour qui servait à utiliser toute la chaleur générée par la production au charbon (la chaleur était utilisée au premier niveau pour la production et au dernier niveau pour le chauffage des bureaux de l'administration). Un autre exemple serait les premières versions de l'email qui étaient une réplique du courrier traditionnel dans leur logique. L'email au format HTML, l'intégration d'image, et d'autres services sont venus agrémenter le système au fur et à mesure. Mais, la vraie révolution s'est passée avec la messagerie instantanée, principalement la messagerie instantanée des applications mobiles qui permet le partage instantané de photos, de fichiers et de messages auditifs, ainsi que la discussion groupée ou les listes de diffusion.

"L'Internet n'a pas changé les lois de l'Economie". C'est la constatation de Stan Liebowitz (2002), auteur du livre "*Rethinking the networked economy: the true forces driving the digital marketplace*". L'auteur de l'ouvrage était assez critique dans sa réflexion. La technologie, effectivement, amène des changements à nos méthodes et à nos possibilités, mais, les principes fondamentaux restent les mêmes. Cette réflexion peut s'appliquer aussi aux principes de gestion et de marketing appliqués aux réseaux sociaux en ligne.

Pourtant, un élément important change la donne. Sur les réseaux sociaux en ligne, le dialogue entreprise-consommateur se passe de manière traditionnelle. Le marketing mix, dans ce sens, reste inchangé. Qu'il s'agisse des 4P (*Place, Product, Promotion, Price*) ou des 7C (*Corporation, Commodity, Cost, Communication, Channel, Consumer et Circumstances*), les règles restent les mêmes sur les réseaux sociaux en ligne, comme ailleurs. L'élément perturbateur de l'équation est la communication inter-consommateurs qui est totalement en dehors du contrôle de l'entreprise. Ceci est d'autant plus grave que les moyens de diffusion offerts par les réseaux sociaux en ligne sont impressionnants dans ce sens et que, contrairement à une situation hors-ligne, les plaintes et messages d'insatisfaction se propagent beaucoup plus rapidement et à une population plus large. Le marketing sur les réseaux sociaux en ligne se caractérise donc par une perte de contrôle par rapport au marketing traditionnel (Mangold & Faulds, 2009).

Un des premiers à voir venir ce revirement par rapport au contrôle est l'auteur Howard Rheingold (2002). L'auteur parle de populace intelligente (*smart mobs*) qui serait à l'origine d'actions collectives pour initier des changements politiques et sociaux. Il parle d'"hyper-coordination" de la populace grâce aux applications connectées des téléphones mobiles, et donne comme exemple les manifestations qui ont eu lieu dans différents pays et qui ont renversé plusieurs régimes.

Fournier et Avery (2011) parlent des entreprises "non invitées" (*uninvited brands*). Pour les deux chercheurs, les praticiens en marketing se sont heurtés à la réalité que les réseaux sociaux en ligne étaient créés pour les individus, pas pour les entreprises ! Pour ces chercheurs, l'entreprise doit accepter la délégation de contrôle sur les réseaux sociaux en ligne. Si l'entreprise accepte cette réalité, elle doit accepter que le marketing se transforme

en une forme de relations publiques, que la construction de la marque cède la place à la protection de la marque, que la valeur de la marque est fonction de risque, et que le travail des marques à court terme peut l'emporter sur les marques de référence.

Pour ces raisons, Woodcock et al. (2011) suggèrent que les entreprises se concentrent en priorité sur le retour d'informations des consommateurs et sur leur engagement. Le retour d'information (*feedback*) peut être une source d'amélioration et d'innovation. Ce retour peut être verbal et direct, comme des commentaires ou des appréciations, ou indirect, comme des analyses effectuées par rapport à l'utilisation (heures d'accès, comparaison des commentaires par rapport à un produit ou un autre, origine géographique des accès, etc.).

Dans un ouvrage holistique sur le sujet, "*Communities dominate brands*", Ahonen et Moore (2005) suggèrent que la communication marketing, à partir d'aujourd'hui, devrait être créative, engageante, amusante, bidirectionnelle et personnelle.

Malgré cette complexité, les réseaux sociaux, particulièrement Facebook avec son milliard et demi d'utilisateurs, présente des attraits et des atouts intéressants pour les stratèges en marketing. Des *success stories*, comme celle du *Ice Bucket Challenge* qui a généré plus de 2,4 millions de vidéos de supporters (Phing & Yazdanifard, 2014), sont la preuve irréfutable de l'efficacité du marketing viral. Ceci, devient dès lors, un média incontournable pour les entreprises. Bien sûr, en prenant conscience des dangers et des impératifs de ce média. Notamment, la nécessité d'épouser la technologie, d'être continuellement à jour, de former efficacement des personnes capables de prendre en charge, et de limiter la bureaucratie pour améliorer le temps de réponse (Berthon et al., 2012).

Vásquez et Escamilla (2014) recommandent l'usage de meilleures pratiques (*best practices*), surtout dans le cadre des PME qui n'ont pas le savoir-faire et le potentiel nécessaire pour gérer une communication sur les RSO. Les chercheurs proposent cinq pratiques : utiliser l'outil pour un avantage compétitif (1), fournir de l'information en temps réel (2), aider les utilisateurs à créer de la publicité (3), habiliter (*empower*) les utilisateurs à influencer les autres (4) et considérer les avantages et les désavantages susceptibles de pousser à l'incertitude (5). Ces pratiques sont représentées graphiquement dans le schéma ci-dessous.



Figure 2: Meilleures pratiques des PME en matière de communication sur les RSO (Vásquez et Escamilla, 2014).

Un autre aspect important des réseaux sociaux en ligne est le fait que chaque plateforme est différente des autres et que les stratégies devraient donc être différentes dépendamment de la plateforme ciblée. Smith et al. (2012) suggèrent ce qui suit :

1. Le contenu généré par les utilisateurs en rapport avec une marque pour s'auto-promouvoir est nettement supérieur sur YouTube (75%) que sur Facebook (30%) ou Twitter (13%).
2. La centralité de la marque dans le contenu généré par les utilisateurs est supérieure sur Twitter (76%) que sur Facebook (66%) ou YouTube (42%).
3. La réponse aux actions marketing de la marque sont au plus bas sur YouTube (0-2%) et diffèrent selon la marque sur Facebook et Twitter.
4. Un fait inattendu : la perception de la marque diffère selon les plateformes et selon les marques. Dans le sens que, pour certaines marques les mentions positives sont supérieures sur Twitter, alors que pour d'autres, ce sont les mentions négatives qui sont le plus élevées sur cette plateforme.

En marketing, la recherche s'est surtout intéressée au marketing viral. L'intérêt des réseaux sociaux est, effectivement, la possibilité de propager l'information comme un virus contamine une population. Les principes fondamentaux du marketing viral sur les réseaux sociaux en ligne sont ceux du BAO, aussi appelé la théorie de la diffusion à deux temps (*two step flow theory*) par son fondateur, Paul Lazarsfeld (1968). Les études récentes sur le BAO et sur la viralité profitent de cet accès fortuit à l'information qu'offrent les réseaux sociaux en ligne. A

titre d'exemple, Stanley Milgram, en 1967, qui déduit par expérimentation qu'il fallait six connections pour faire passer un message d'un inconnu aux USA à un autre. Les résultats de l'expérience de Milgram, appelé "*Small World Experiment*" ou "*Six Degrees of Separation*", furent souvent contestés (Kleinfeld, 2002), principalement à cause du facteur humain. Or, avec les réseaux sociaux en ligne, il n'est plus nécessaire d'exiger une intervention humaine puisque les connexions sont "visibles" et peuvent être extraites et analysées mathématiquement. D'ailleurs Facebook a reproduit l'expérience de Milgram à l'échelle de ses utilisateurs et, donc, de la planète entière, et trouvé qu'en fait, il s'agirait plutôt de 4,7 degrés de séparation et non pas six (Backstrom, Boldi, Rosa, Ugander, & Vigna, 2011).

Aral et Walker (Aral & Walker, 2011) trouvent par exemple que les messages personnalisés par rapport à un produit se propagent nettement moins que les messages à caractère passif.

Cependant, l'étude la plus complète que nous avons consulté concernant le marketing viral, est probablement l'article rédigé par Hinz et al. (2011) et qui définit quatre facteurs principaux pour le marketing viral :

1. Le contenu : Toute stratégie marketing sur les réseaux sociaux en ligne a pour point d'entrée le contenu. Si le contenu est partagé ou crée un engagement (aimer, commenter, placer dans les favoris, etc.), le message peut devenir viral. Berger et Milkman (2009) trouvent par exemple que les messages positifs sont plus viraux que les messages négatifs et que le contenu qui donne des émotions fortes, négatives ou positives, comme l'effroi ou l'excitation, est partagé plus généreusement. A propos de la durée, les produits intéressants, reçoivent plus de BAO instantanément, mais moins à long terme que les produits qui sont largement plébiscités, populaires ou qui restent dans l'esprit des consommateurs plus longtemps, comme le montre l'expérimentation et les analyses de Berger et Schwartz (2011). La même recherche montre que qu'offrir gratuitement (*giveaway*) le produit augmente la diffusion par le BAO, alors qu'offrir des coupons ou des échantillons, ne contribue pas forcément à plus de viralité. L'auteur Malcolm Gladwell (2002) parle de l'effet "collant" de certains messages (*stickiness factor*) qui deviennent partie inhérente de la culture, comme par exemple le nom de marque "Xerox" qui est devenu synonyme de "photocopie".

2. La structure du réseau : Bampo et al. (2008) soulignent l'importance de la structure sociale du réseau pour la diffusion du message. Les auteurs évaluent différentes stratégies de diffusion sur différents types de réseau : des réseaux aléatoires (*Random Network*) où les connexions dépendent de probabilités, des réseaux sans frontières (*Scale-Free Networks*), comme par exemple l'Internet, et des réseaux petit monde (*Small World Network*) caractérisés par des regroupements (*clustering coefficient*) serrés et un diamètre réduit. Les différentes simulations testées dans cette recherche montrent des différences dans la diffusion et dans la propagation des messages, non pas seulement à cause du nombre de personnes ciblées, mais, aussi par rapport à la structure du réseau. Ainsi, si cibler plus de personnes sur un réseau aléatoire peut aboutir à une diffusion nettement supérieure, ce n'est pas le cas pour un réseau petit monde. Les auteurs suggèrent que l'objectif du stratège marketing serait de cibler suffisamment de personnes pour atteindre un seuil épidémique (*epidemic threshold*) sans pour autant tomber dans le *mass marketing* et réaliser des dépenses inutiles.
3. Les caractéristiques du comportement des destinataires du message et leurs incitations : En 1967, Johan Arndt suggérait quatre catégories d'acheteurs : les pionniers, les adeptes précoces, les adeptes tardifs et les non-adeptes (Arndt, 1967). Les résultats de la recherche montrent aussi que le BAO avait tendance à aller des utilisateurs qui considéraient l'acquisition comme à bas risque (*low-risk perceivers*) vers les utilisateurs qui y voyaient un risque élevé (*high-risk perceivers*). Aussi, l'auteur remarque que le flot le plus important circulait entre les acheteurs potentiels qui se promettaient d'acheter en même temps ("si tu achètes, j'achète !").
4. La stratégie d'ensemencement (*seeding strategy*) : Aral, Muchnik et Sundararajan (2011) suggèrent que cibler plus de 0.2% de la population totale aboutit à des pertes financières puisque le gain généré par l'adoption d'un nouveau consommateur est inférieur au gain réalisé par l'adoption naturelle de ce consommateur, c'est-à-dire sans recours à une stratégie d'ensemencement. Par définition, l'ensemencement est une stratégie visant à convertir les personnes influentes d'un réseau susceptibles d'utiliser leur position, influence ou contacts au sens large pour déclencher des adoptions en cascade (Domingos & Richardson, 2001). Liu-Thompkins (2012) suggère que les stratégies virales en ligne nécessitent une stratégie d'ensemencement qui

implique le choix de la première génération de personnes ciblées. Elle suggère que la qualité du message influe sur la taille du seuil épidémique et que la population ciblée devrait avoir des liens forts avec le messenger.

A ces quatre facteurs, Thomas Valente (2010), trouve que "le messenger est aussi important que le message". Le chercheur suggère que le messenger lui-même est le moyen (*medium*) et qu'il faut tenir compte non seulement du message mais aussi du porteur du message et de ses relations interpersonnelles avec la population ciblée.

1.2.2 Les stratégies d'influence sur les réseaux sociaux en ligne et la microfluence sur Internet

Le rôle des individus en tant qu'influenceurs trouve probablement ses origines dans la littérature politique avec Lazarsfeld (1968) dans un article intitulé "le choix du peuple" où il suggère que le choix politique des individus ne se fait pas sur base du discours des candidats ou des médias, mais par le biais de personnes influentes dans leur milieu.

Ronald Burt (2004, 2009) s'intéresse aux vides structurels (*structural holes*) et trouve que les ponts (*bridges*) entre deux groupes dans un réseau social ont plus de chance de faire passer des idées innovantes que des personnes appartenant à l'un ou l'autre des groupes. Leurs idées seront accueillies positivement et ne seraient pas rejetées automatiquement, comme ce serait le cas si la personne appartenait à un groupe antagoniste.

Pour Daniel Heiderich (2009), Internet est un "magma d'influence" où chaque acteur essaie d'influencer les autres. Il parle de "microfluence" pour définir l'influence discrète ou quantique qui s'opère par le biais de messages courts, photos, dessins, vidéos ou podcasts, qui peuvent se propager facilement par simple copier-coller ou par d'autres moyens, comme par exemple, l'option "partager" sur les réseaux sociaux en ligne et dans les applications mobiles. Heiderich considère qu'un individu exposé à des stimuli identiques et répétés sera enclin à s'approprier les messages qui correspondent à ces stimuli.

Dans la littérature sur les réseaux sociaux en ligne, Trusov et al. (2010) trouvent que quelques amis seulement peuvent influencer un utilisateur donné et que ces influenceurs varient d'un utilisateur à un autre rendant la tâche de cibler les influenceurs difficile.

Robert Cialdini (2001) définit sept principes de l'influence:

1. L'Affinité (*liking*) : Les personnes aiment ceux qui les aiment. L'idée est de trouver des points communs avec la personne qu'on désire influencer. On retrouve par exemple ce phénomène dans les séries télévisées comme "*Desperate Housewives*" où chaque actrice a un profil différent (Susan Mayer, la brune tête en l'air; Lynette Scavo, la femme au foyer "no life"; Bree Van de Kamp, la rousse sophistiquée; Gabrielle Solis, la bombe latino; Edie Britt, la briseuse de foyers) permettant à différentes spectatrices de s'identifier et d'avoir de l'empathie pour l'une ou l'autre des actrices et, donc, à s'attacher à l'émission.
2. La réciprocité ou donner pour recevoir. Dans la vie quotidienne, nous "rendons" les invitations, nous offrons des cadeaux de la même valeur que ceux que nous recevons... Sur les réseaux sociaux, particulièrement, les réseaux orientés, c'est-à-dire ceux où une personne peut suivre une autre sans qu'elle ne soit automatiquement suivie à son tour, comme Twitter ou Instagram, les utilisateurs "exigent" la réciprocité en mentionnant dans leur messages le *hashtag* #f4f ou "follow for follow" qui engage la personne à rendre la pareille à la personne qui la suivrait.
3. La preuve sociale : Les personnes ont tendance à "suivre le courant". Cialdini donne l'exemple d'un groupe de personnes faisant une quête pour une œuvre de charité. L'expérience montre que les personnes auxquelles on expose une liste des personnes de leur entourage qui ont déjà contribué, s'alignent avec la tendance générale et réagissent pareillement.
4. La cohérence (*consistency*) : Les personnes restent engagées par rapport à leurs idées initiales, surtout si celles-ci ont été écrites noir sur blanc. La raison est que les personnes essaient de paraître comme cohérentes par rapport aux autres. Pour cela, Cialdini suggère que, pour produire un changement durable, il faudrait éviter la pression ou les menaces. Au contraire, une personne convaincue continuera toujours dans le même sens.
5. L'expertise (*Authority*) : Cialdini suggère que les personnes sont influencées par les personnes qui sont une autorité dans leur domaine. Il propose d'exposer son autorité (dire qu'on a tel ou tel diplôme, raconter ses années d'expérience, etc.) et

de ne pas considérer que l'interlocuteur va deviner ou percevoir le niveau de connaissances.

6. La rareté (*Scarcity*) : Le fait qu'une chose soit rare ou qu'une offre ait une date d'expiration, peut pousser les personnes à l'action presque dramatiquement.

Dans un ouvrage intitulé "*Switch*", les frères Chip et Dan Heath (2010) se demandent "comment créer le changement lorsque le changement est difficile?". Ils considèrent qu'une personne a un aspect rationnel qu'ils comparent à un cavalier et un côté émotionnel qu'ils comparent à un éléphant qui est souvent difficile à faire avancer.

Heath et Heath proposent :

- Au niveau rationnel, diriger le cavalier :
 - o Positiver, éviter de se concentrer sur les problèmes
 - o Etre clair et éviter toute confusion, préciser un "script" ou une feuille de route
 - o Montrer la destination, créer une "carte postale" de l'objectif
- Au niveau émotionnel, motiver l'éléphant :
 - o Trouver le bon sentiment, la bonne connexion entre l'individu et la cause
 - o Réduire les changements en demandant de petits changements par étape et de petites récompenses en cours de chemin pour maintenir le moral
 - o Encourager les personnes en leur montrant qu'ils peuvent s'améliorer, en développant leurs compétences, etc.
- Dessiner le chemin, ce qui semble être un problème humain est en fait un problème de situation :
 - o Nettoyer la voie en enlevant les obstacles en rapport avec l'environnement
 - o Créer des habitudes pour passer en mode "auto-pilote" et simplifier la tâche au cavalier
 - o Rallier la meute parce que le comportement est contagieux

1.3 Le problème du contrôle des éléments du marketing viral

Il est évident que le problème majeur des stratégies de marketing sur les réseaux sociaux en ligne est la perte de contrôle. Les entreprises sont "victimes" de la prise de contrôle des

consommateurs qui trouvent dans les réseaux sociaux en ligne un lieu privilégié pour "dominer les marques". La perte de contrôle se fait aussi au niveau des plateformes de réseaux sociaux en ligne qui, sans cesse, limitent l'accès à l'information et créent des barrières de plus en plus difficiles à surmonter. A titre d'exemple, Facebook ne permet pas à une entreprise présente sur sa plateforme d'avoir accès à tous les noms de ses propres fans !

Les recherches actuelles, en sociologie et en gestion, adoptent le plus souvent le statut de l'analyste ou de l'observateur. Cette thèse essaie de contribuer à la littérature existante en prenant une position active et en associant les observations scientifiques et théoriques issues des expérimentations à des recommandations pratiques destinées aux praticiens. Pour cela, nous prenons une posture originale qui est active, dans le sens qu'elle manipule les éléments ou modifie l'environnement, par exemple en utilisant un flux d'information personnel (*timeline*) au lieu de la page Facebook de l'entreprise, et non pas passive, dans le sens qu'elle agit avant d'observer les résultats de son action.

1.3.1 Questionnements

La base de notre réflexion repose sur une constatation et une question principale d'où découlent quatre questions secondaires :

- Puisque les entreprises ne sont pas les bienvenues sur les réseaux sociaux et sont discréditées de facto (Fournier & Avery, 2011), peuvent-elles optimiser les populations initiales de diffusion (Oliver Hinz, Skiera, Barrot, & Becker, 2011) pour les utiliser comme vecteurs de diffusion ou d'influence?

Dans ce contexte, nous essayons principalement de répondre à trois questions secondaires :

- Quelle est la marge de contrôle accordée aux entreprises sur les réseaux sociaux en ligne, et, dans ce cadre, quels seraient quelques-unes des stratégies marketing possibles (Rethinking Marketing on Facebook, page 174)?
- Dans le cadre d'actions sociales ou politiques, quel serait l'effet d'une optimisation de la population d'ensemencement et du support sur le BaO négatif (Negative WoM and its transmission on OSN : the determining role of the seeding population, page 138) ?

- Peut-on reconstituer une population initiale de diffusion constituée de ponts (*bridges*) politiques (Finding Bridges for Political Influence, page 159) ?
- Comment optimiser une population de diffusion pour une campagne de personal branding (Making Sense of Everything: A Personal Branding Case Study from Start to Finish, page 189)?

Les analyses et expérimentations tentent de suivre un chemin théorique et expérimental pour aboutir à une réflexion théorique et pratique qui définirait des stratégies, des moyens et des méthodes d'optimisation du marketing viral sur Facebook à partir du contrôle des éléments du marketing viral et, principalement, la sélection ou la création de populations initiales de diffusion utilisables à cet effet.

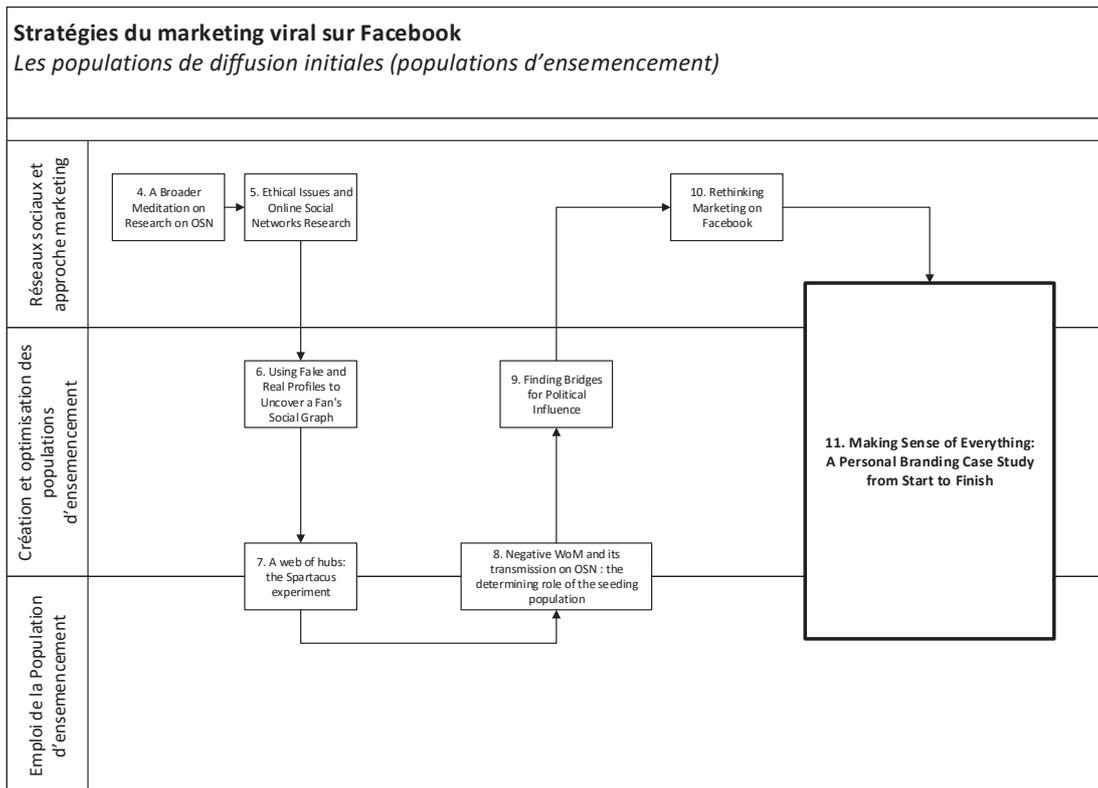


Figure 3: De la réflexion à la synthèse

1.3.2 Paradigme et méthodes

L'aspect innovant de ce champ de recherche rend une approche positiviste difficile à évaluer dans des situations réelles. Nous sommes dans un contexte humain, social. On peut difficilement modéliser les réactions humaines sans une marge d'erreur importante. Les caractéristiques personnelles individuelles influent sur le comportement et chaque individu et peuvent ou ne peuvent pas créer des réactions en chaîne qui ne pourront pas être expliquées mathématiquement.

Une approche constructiviste ou anti-positiviste nécessiterait un apport d'informations de chaque sujet pour comprendre sa propre perception en rapport avec les réseaux sociaux en ligne en général et nos expériences en particulier. Il y a un écart important entre ce que les sujets disent et ce qu'ils font dans des situations réelles, spécialement lorsqu'il s'agit d'espaces public en ligne. Hudson & Bruckman (2005) relatent plusieurs problèmes qui pourraient biaiser la recherche. Il parlent même de l'effet de proximité (*bystander effect*) lorsque les sujets sont informés de l'expérience (Hudson & Bruckman, 2004).

Notre approche est orientée vers l'action (*action-oriented*) et essaie d'ébranler certaines idées et pratiques. Kant définit le criticisme comme une question sur les limites de notre savoir: "que pouvons-nous savoir?". Il parle d'une révolution Copernicienne en référence à Copernic qui a inversé le rôle du soleil et des planètes. Kant suggère que la connaissance était dictée par les objets et leur observation. L'esprit tirait sa connaissance des objets sans y ajouter de la connaissance. Kant pensait qu'il y avait quatre niveaux de connaissance : ce que les choses sont, comment nous les percevons, comment notre sensibilité les reçoit et comment nous les comprenons. Kant invite les chercheurs à laisser leur esprit apporter du savoir aux objets. Le criticisme a évolué, surtout dans les recherches en sociologie et en politique. Nous choisissons l'approche d'Habermas et son approche critique (1985). Habermas suggère que ce qui est généralement accepté ne peut pas être considéré comme de la connaissance et qu'il doit faire l'objet de questionnements (Baynes, 1992). Dans ce paradigme, la connaissance est basée sur des expériences empiriques et la modification de l'environnement est acceptée comme un moyen d'atteindre la connaissance. Habermas définit trois types de connaissance : technique, pratique et émancipation (MacIsaac, 1996).

La connaissance technique implique le contrôle et la modification de l'environnement. La connaissance pratique est définie par les interactions sociales ou l'action communicative. L'émancipation est définie par la réflexion et la connaissance de soi.

Type of Human Interest	Kind of Knowledge	Research Methods
Technical (prediction)	Instrumental (causal explanation)	Positivistic Sciences (empirical-analytic methods)
Practical (interpretation and understanding)	Practical (understanding)	Interpretive Research (hermeneutic methods)
Emancipatory (criticism and liberation)	Emancipation (reflection)	Critical social sciences (critical theory methods)

Table 1: Types de connaissance dans la théorie critique d'Habermas (MacIsaac, 1996)

Les théoriciens critiques suggèrent deux méthodes de recherche : idéologie critique et recherche-action.

Table 2: Méthodes de recherche (Dash, 2005)

L'idéologie critique est de se poser des questions sur ce qui semble évident (Friesen, 2008), "la terre est-elle ronde?", "La terre tourne-elle autour du soleil?", etc.

La méthode de recherche-action est définie par Peter Reason et Hilary Bradbury comme un processus qui "tente de réunir l'action et la réflexion, la théorie et la pratique, la participation avec les autres, la quête de solutions pratiques pour des problèmes urgents qui concernent les personnes, et plus généralement l'épanouissement des individus et de leur communautés" (Brydon-Miller, Greenwood, & Maguire, 2003).

Dans cette dissertation, nous utilisons la recherche-action sur Facebook. Au moment de la rédaction de cette thèse, Facebook est le réseau social en ligne le plus large sur Internet avec plus d'un milliard et quatre cent millions d'utilisateurs. Nous explorons le graphe social d'utilisateurs Facebook. Nous expérimentons avec différentes structures et différents groupes de personnes et analysons comment cela affecte les actions et réactions des utilisateurs. Notre recherche traite de relations humaines. Cependant, nous pensons que la

plateforme elle-même joue un rôle et affecte les résultats. Pour tester différentes structures de réseau, nous créons de faux profils et les utilisons pour envoyer des messages, nous déplaçons des utilisateurs d'une Page Facebook vers un Fil d'actualité, nous définissons une méthode pour retrouver des personnes enjambant des trous structurels politiques, etc. Notre rôle en tant que chercheurs actifs n'est pas d'observer mais d'agir en définissant des méthodes qui pourraient être utilisées par des décideurs : des personnes qui essaient d'optimiser leur capital social, des consommateurs qui essaient d'agir contre une marque, des politiciens cherchant à introduire de nouvelles idées, etc. Nous identifions les acteurs et analysons leur marge de manœuvre, puis suggérons des méthodes pour optimiser leur contrôle sur des situations qui semblent apparemment entièrement hors de leur zone de contrôle.

Cette thèse rentre dans le champ de la stratégie marketing. Notre contribution aide à comprendre les stratégies marketing sur les réseaux sociaux en ligne. Elle apporte de nouvelles idées à propos des populations initiales de diffusion, des stratégies d'ensemencement, du marketing viral et du BAO négatif. Elle apporte aussi une contribution à la méthodologie avec des configurations et des manipulations originales. Ces méthodes pourraient être réutilisées par des chercheurs et des stratèges marketing qui désirent prendre des actions contrôlées sur leur réseau.

Cette approche est innovante à un moment où la recherche et la compréhension des réseaux sociaux en ligne est nécessaire (Hoffman & Novak, 2012). La recherche-action qui est l'approche utilisée dans cette thèse définit de nouvelles perspectives d'analyse et de pratique. Les expériences définies dans cette thèse pourraient être reprises dans des situations réelles et leurs résultats montrent clairement le niveau de succès et d'échec dans chaque cas.

1.3.3 Analyses et expérimentations

Le développement de cette thèse est composé de plusieurs chapitres rédigés en anglais, dont l'un est un article en troisième révision au *Journal of Advertising Research* (JAR) et dont quatre ont fait l'objet de communications à des conférences internationales (Euras, 2012; INSNA, 2014; ISMS, 2015) et au workshop stratégie Paris-Dauphine (2014) :

1.3.3.1 *From ethics in management and IT research to the ethics of research on online social networks (page 85)*

Les pratiques douteuses ou illégales comme la diffusion de rumeurs sont coutume sur Internet et Facebook ne fait pas exception (M Ott, Cardie, & Hancock, 2013; Myle Ott, Cardie, & Hancock, 2012; Snopes.com, 2013; Wassim Nasr, 2014). Facebook estime le nombre de faux profils sur sa plateforme à plusieurs dizaines de millions (Protalinski, 2014; Sweney, 2012), certains utilisés pour gonfler l'égo des politiciens et des acteurs, d'autres pour espionner un conjoint ou pour diffuser des rumeurs (Elphinston & Noller, 2011; Myle Ott et al., 2012; Ratkiewicz, Conover, & Meiss, 2011).

Le chercheur peut-il utiliser ces techniques pour comprendre et prévenir les dangers inhérents aux réseaux sociaux en ligne ?

Ce chapitre est un survol de la littérature sur le sujet et un débat sur la question entre chercheurs défendant le choix d'utiliser la rétention d'information ou la tromperie (*deceit*) et les chercheurs défendant le droit aux sujets de la recherche d'être entièrement informés.

1.3.3.2 *Using Fake and Real Profiles to Uncover and Rebuild a Fan's Social Graph (page 99)*

Malgré les plateformes ouvertes et publiques où ils publient des informations, les utilisateurs considèrent leurs interactions comment étant du domaine du privé (Bassett & O'Riordan, 2002; J. Hudson & Bruckman, 2005; J. M. Hudson & Bruckman, 2004). Ils supposent donc que ces plateformes publiques doivent leur permettre de protéger ce qu'ils considèrent comme "privé".

Les noms des amis est un des éléments que beaucoup d'utilisateurs décident de protéger sur Facebook. Les raisons sont multiples : un partenaire jaloux (Elphinston & Noller, 2011; Vitak, 2008; Wang et al., 2013), des clients ou des employés frustrés (Fournier & Avery, 2011; Hollenbeck & Zinkhan, 2006) qui peuvent avoir accès au noms des amis d'un directeur, des activistes et des terroristes dans le cadre d'une guerre médiatique (Gaines-Ross, 2010a; Snopes.com, 2013; Wassim Nasr, 2014; "the Lebanese Forces Official Website," 2014; etc.), etc.

La reconstitution du réseau d'amis et, plus exactement la reconstitution du réseau des fans d'une marque, n'est pas disponible à l'entreprise, aux stratégies marketing et sociaux, et aux chercheurs.

Notre expérience essaie de démontrer si, par l'utilisation de faux et de vrais profils, un utilisateur ou une entreprise pourrait reconstituer la population d'amis d'un utilisateur qui a choisi de rendre cette liste invisible. Nous utilisons comme cible 10 personnes ayant rendu privée leur liste d'amis et 8 profils réels et fictifs totalisant 13,394 amis uniques pour reconstituer les listes d'amis cachées.

Les résultats varient entre 3.94% et 28% d'amis exposés :

Profil Cible	Nombre total d'amis	Amis mutuels avec l'expérimentateur	Amis exposés	Ratio
M.H.	1,168	19	46	3.94%
T.	2,300	61	226	9.83%
V.	290	13	37	12.76%
M.G.	1,041	46	171	16.43%
M.A.	383	18	63	16.45%
C.	401	12	32	7.98%
N.N.	530	77	123	23.21%
R.	1,250	39	56	4.48%
M.N.	700	141	196	28.00%
N.H.	1,069	21	64	5.99%
Moyenne				12.91%

Table 3: Pourcentage d'amis exposés

1.3.3.3 A web of hubs: the Spartacus experiment (page 99)

Nous savons sur les réseaux sociaux que les utilisateurs essaient de maximiser leurs connections en remplissant les trous structurels de leur réseau même si cela signifie de devenir amis avec des inconnus (Chen et al., 2009). Nous savons aussi l'importance de la population initiale de diffusion dans la création du marketing viral (Liu-Thompkins, 2012).

Les questions auxquelles nous répondons dans ce chapitre, sont les suivantes :

- Peut-on créer un réseau de "hubs" sociaux à partir d'un faux profil ?
- Ce réseau peut-il attirer de nouvelles personnes qui essaieront alors de maximiser leur propre réseau en se connectant à celui-ci en tant qu'amis ?

- Ce faux profil pourrait-il être un diffuseur efficace d'informations de bouche-à-oreille ?

A la première question, nous trouvons qu'il est effectivement possible, à partir d'un groupe de condisciples de 5 personnes, de développer un réseau d'amis formé de hubs sociaux sur Facebook autour d'un faux profil de plus de 400 personnes.

A la deuxième question, nous trouvons qu'effectivement, des utilisateurs de Facebook vont être attirés par ce réseau et demander à devenir amis du faux profil. Depuis sa création en 2012, le faux profil a reçu presque deux cents demandes de connexion.

A la troisième et dernière question, nous trouvons que ce faux profil, malgré plus de 600 amis, ne réussit pas créer le moindre engagement (aimer, commenter, partager) sur des messages qui ont pourtant eu du succès ailleurs.

1.3.3.4 Negative WoM and its transmission on OSN : the determining role of the seeding population (page 138)

Les stratégies de communication sur les réseaux sociaux s'axent principalement sur le contenu du message (JA Berger & Milkman, 2009; Valos, Bednall, & Callaghan, 2007), négligeant souvent les autres éléments à l'origine du marketing viral (O Hinz et al., 2011), comme la structure du réseau (Bampo et al., 2008), le comportement des récepteurs du message (Arndt, 1967; Liu-Thompkins, 2012), la population initiale de diffusion (Bampo et al., 2008; Liu-Thompkins, 2012) et le messenger (Sprague & Wells, 2010; Valente & Myers, 2010).

La communication sur les "Facebook Pages", le support proposé aux entreprises sur Facebook (<https://www.facebook.com/help/174987089221178#What-is-a-Facebook-Page?>), limite fortement le contrôle des éléments du marketing viral lorsque les consommateurs essaient de se plaindre. Qu'en serait-il si les messages de consommateurs mécontents étaient postés sur des profils particuliers et non sur la page de l'entreprise ?

Notre expérience reprend des messages négatifs existants postés sur la page d'une entreprise réelle et les publie sur les pages personnelles de profils fictifs créés en optimisant la

population initiale de diffusion. La méthode donne un engagement quatre fois supérieur aux résultats observés lorsque les messages étaient publiés sur la page de l'entreprise.

L'expérience met en avant le rôle du support Facebook utilisé dans la diffusion d'une communication virale (Facebook Pages ou fil d'actualité personnel) et l'importance de la population initiale de diffusion.

1.3.3.5 Finding Bridges for Political Influence (page 159)

La discussion actuelle au niveau des campagnes politiques sur les réseaux sociaux en ligne essaie de comprendre et d'analyser des phénomènes tels que le BAO, la diffusion d'informations et de rumeurs, le marketing politique et les politiques d'influence (Berinsky, 2012; Carpini & Williams, 2001; Finke & Harris, 2012; Huang, 2013; Mercanti-Guerin, 2010; Ratkiewicz et al., 2011). Cependant, d'un point de vue social, l'efficacité du marketing viral et de la communication politique est dans le choix des personnes à cibler et dans leur rôle en tant que liens faibles ou forts, influenceurs ou influençables, etc. (M. Granovetter, 1983; Lazarsfeld et al., 1968; Liu-Thompkins, 2012; Watts & Dodds, 2007).

Dans ce contexte, le rôle des ponts (bridges) entre personnes de tendances politiques différentes est essentiel pour faire circuler l'information entre camps opposés (rumeurs, informations compromettantes, tentatives de "conversion" vers l'autre camp, nouvelles idées, etc.).

Peut-on utiliser Facebook pour trouver ces ponts sociaux ?

Notre expérience s'appuie sur une base de données créée à partir de vrais et de faux profils politiques ayant entre eux 15,344 amis, connectés par 341,345 liens.

Après analyse, l'expérience nous permet de déceler les personnes connectées aux groupes politiques opposés avec leur degré (nombre de connections).

Cette expérience ouvre la voie vers des recherches plus poussées dans le sens du marketing politique sur les réseaux sociaux en ligne, notamment en utilisant ces "ponts" comme vecteurs de communication et en testant les résultats sur l'un et l'autre groupe de supporters.

Elle pourrait aussi être utilisée dans le marketing d'entreprise pour trouver et cibler des consommateurs d'une marque concurrente ou des consommateurs indécis.

1.3.3.6 *Rethinking Marketing on Facebook (page 85)*

Avec la communication publique entre consommateurs, les réseaux sociaux amènent un nouveau paradigme au monde du marketing (Mangold & Faulds, 2009). Les changements que les réseaux sociaux en ligne amènent au marketing sont débattus dans plusieurs articles (Mangold & Faulds, 2009; Trusov, Bucklin, & Pauwels, 2009; Woodcock, Green, & Starkey, 2011, etc.).

Cependant, la plupart des chercheurs s'intéressent au marketing viral et au bouche-à-oreille sur les réseaux sociaux, négligeant d'autres techniques marketing qui pourraient être utilisées sur les réseaux sociaux, comme le marketing de masse et le marketing relationnel.

Aussi, sur Facebook, trois supports de communication différents peuvent être utilisés, les fils d'actualité personnels, les groupes, et les pages Facebook. Chacun de ces supports ayant ses propres spécificités.

Dans ce chapitre, nous nous prenons quatre stratégies marketing (masse, niche, viral et relationnel) et nous proposons le support adéquat sur Facebook pour chaque stratégie. En prenant les critères spécifiques pour chaque type de stratégie marketing et en les combinant avec les limites et les avantages de chaque support sur Facebook, il en ressort la conclusion suivante :

	Facebook Timelines	Facebook Groups	Facebook Pages
Mass Marketing			X
Niche Marketing			X
Viral Marketing	X		

Relationship		X	X
Marketing			

Table 4: Stratégies Marketing sur Facebook

1.3.3.7 Making Sense of Everything: A Personal Branding Case Study from Start to Finish

Ce dernier chapitre représente une synthèse de nos recherches. Il s'agit d'une expérimentation de l'étape zéro, un auteur qui n'avait rien écrit auparavant, à l'étape finale, l'auteur est reconnu et abordé par une maison d'édition, basée sur une stratégie marketing sur Facebook que nous avons définie.

La réussite de cette expérience *In Real Life* (cas réel) sur Facebook sans interférences extérieures (publicité hors-ligne, utilisation d'autres supports, publicités sur Facebook, etc.), sa durée (plus de deux ans) et la quantité d'informations recueillies et analysées sur les 253 posts publiés, est d'une importance magistrale pour de futures recherches sur le sujet.

Elle est aussi essentielle pour les stratégies marketing puisqu'il ne s'agit pas d'une simulation mais d'un cas réel et que l'aboutissement de la stratégie est concret : l'auteur a été contacté par deux maisons d'éditions et, non seulement il sera publié, mais il sera présenté par la maison d'édition au Salon du Livre de Beyrouth.

1 Introduction (English)

1.1 Online Social Network, a Long Story

1.1.1 The 1970 to 2006 years

Online Social Networks (OSN) are not a new technology. Their origin goes back to the seventies. At that time, networks were limited to university and large organizations with huge mainframe computers whose power did not exceed those of recent mobile phones. The first communication system was probably the BBS (Computerized Bulletin Board System) developed by Ward Christensen and Randy Seuss in 1978 (J. Lee, 2013). With this system, users could connect via telnet or another client-server system and publish messages on a digital board that other users could access. This system was still in use almost two decades later.

The Usenet system, a predecessor of the WWW, was created in 1980. Usenet groups, conceived by Tom Truscott and Jim Ellis, were defined as worldwide discussion systems (Wikipedia, 2015). The concept was simple: users could share or publish messages that others could read and reply to. The specificity of Usenet discussions is that they could be reused by any server making this information public and rights-free. Usenet systems are used today, more than 30 years following their creation, as a paid substitute to P2P (peer-to-peer) platforms, for multimedia and software downloads (Juhoon Kim et al., 2010). Examples of those sites are the American site Giganews and the European Usenext, both offering monthly subscriptions to download hundreds of gigabytes of movies, Tv series, etc.

In 1988, we witness a big breakthrough. Contrary to previous systems, a real-time discussion system is created, the IRC (Internet Relay Chat) system. This software allowed users to connect to chat rooms, discuss, help each other, play or share files. The IRC system was made of discussion rooms called channels. Those channels could be hosted on different servers and worked autonomously. The usage of IRC slowly decreased as new, more sophisticated systems were created. Especially, systems developed for mobile devices, like Whatsapp,

Facebook Messenger and others. Yet, dozens of IRC utilities are still available for use and download on the web, e.g. mIRC, X-Chat, HydraIRC, KVIrc, NetTalk et Quassel.

In 1994, the W3 consortium created the first forum-based software, WIT. Forums are a typical user generated content (UGC) system and a natural evolution of Bulletin Boards and other discussion based systems. This new evolution comes with a user-friendly interface and only needs a thin client, a browser on any device, to be used. Today's forums are visited and used by millions of people who read and write about almost any subject (Cai et al., 2008). Anyone today can easily host a forum. Many ready-to-use platforms are available for free or at a price to setup a forum in minutes or hours. 44% of forums are built today using vBulletin which has a paid and a free version, followed by Oracle Right Now used on 26% of the forums on the web (Built With, 2015).

The first blogs were created at almost the same time as forums. Earlier blogs were personal journals with thoughts, impressions and stories about the author. The *New York Magazine* reports that the first blog ever created was built by a student at Swarthmore in 1994, Justin Hall (Thompson, 2006). Blogs evolved becoming support tools for politicians, technicians, brands, etc. The same article reports that, in 2005, 32 million Americans read blogs and a 100 million dollars are spent in ads on blogs. One of the most notorious blogs today is the Huffington Post. For the monitoring site Alexa, the Huffington Post is the 107th most visited site of the planet and the 32nd most visited site in the US (Alexa, 2015). In 2011, *NM Incite* was able to track more than 181 million blogs, a significant increase compared to the 36 million blogs reported in 2006 (Nielsen, 2011).

1.1.2 User to User Connections, the Real Breakthrough in OSN

Most of the platforms described earlier in this chapter had a social network in a star shape. The author or technician was at the center of the discussions and there were very few side discussions. In a recent study, Marc Smith (2014) defined several communication structures on Twitter. The same structures could be used to analyze other discussion networks. A definition of the networks created before 2007, would be support networks or broadcast networks. In the case of support networks, users ask a central person for help and this person

replies to their requests. In the second case, discussion networks, a central person, a news service for example, diffuses information to others. In both cases, little or no interaction exists between other users.

However, Reed's law (2001) suggests that the value of a network depends on second level connections. Therefore, for a network to have value, it is not only important to have many connections to the central node, but to have many interactions between users. Those second level interactions create a greater value than the value of the service itself. For example, support platforms offered by brands to help customers, find their primary value, not through the support provided by the brand, but by inter-consumer help through consumer to consumer discussions.

E-Bay is one of those sites where value is created by users. This site offers user-to-user auction sales. Each user becomes a source of information: seller, buyer, reviewer... The real value of e-Bay comes, almost uniquely, from the number of users of this network and their interactions.

Another example, worth mentioning, is the MMORPG or *Massive Multiplayer Online Role-Playing Games*. Those online games can put together thousands of users in a virtual world. Each user creates his own avatar to play with. When he leaves the virtual world by choosing a safe (virtual) place to sleep in, other players continue to live and play. Historically, the first MMORPG was created in 1997 (Kelly, 2004). The game, called Ultima Online or UO, was developed by Richard Garriot. In this game, users started building groups, called "guilds", and organized themselves to control areas, attack in groups, optimize resources and develop strategies. In UO, the number of users in a guild could reach several hundreds of players. We will mention the "Europa Player Killers", the "Lands End Inc." and the "Clann Murrach Fad [M^F]" (Allen, 2004).

One of those MMORPG games, developed in 2003 by Linden Lab and called "Second Life", had an interesting specificity: it offered its users a "second" realistic life in a realistic world. Users of "Second Life" have to get a job, rent a place, buy and sell services and products, invite friends... In 2013, ten years after its creation, the "Second Life" website has more than 36 million members registered (Linden Lab, 2013). Companies, like IBM, see in "Second Life"

marketing opportunities and open shops or information centers in the virtual world (Mennecke et al., 2008).

Ellison et Boyd (2007) define online social network as web services allowing people to:

1. Create avatars or profiles linked to the system,
2. Communicate with other users they are linked to ,
3. See their connections and other users' connections in the system.

This definition of 2007 distinguishes blogs and forums from OSN like Facebook and Twitter. The distinction mainly resides in the third condition, the fact that users have access to other users' connections. This new element allows users to grow their personal network in a natural way. The important element of those OSN, based on Ellison and Boyd, being that such platforms allow users to expand their network in a way that they could not have done otherwise. In fact, another study shows that users try to fill the structural holes in their networks using platform specific features like "people you may know" and "mutual friends" and become friends with suggested friends even if those connections are total strangers to them (Chen et al., 2009).

This new addition, the access to other users' connection, supports the theory saying that Facebook was able to outmatch MySpace thanks to second level connections (Mui, 2011). The "find friends" function on Facebook helped create large personal networks of "friends" and, it is not rare to see people with 500 or even 5,000 friends! This is especially interesting because of the fact that, based on Robin Dunbar, a renowned anthropologist, the maximum number of people a person can be connected to at a given moment is 150 to 200 (Dunbar, 1993).

It is unfortunate that Facebook has been limiting dramatically the access to friends of friends and even to one's own friends' list, which now requires several clicks and cannot be extracted automatically. This makes the task of optimizing one's friends or fans network extremely difficult. If the most important feature in an OSN is to allow users to see other users' network, does revoking this option puts Facebook's existence in danger? We have seen search engines,

like Infoseek, Lycos and Altavista, dominate the Internet for years and fall one after the other after the launch of Google.

1.1.3 A Quick Glance at the Most Important OSN

The most important OSN in 2015 to which the above definition applies, mainly the fact that they let the user see his own network and other people's network in part or in total, are: Facebook, Twitter, LinkedIn, Instagram et Google+.

1.1.4 Facebook

In 2015, Facebook is still the most used OSN with more than 1.4 billion active users monthly and 936 million active users daily (source SocialBakers.com, 2015). This platform was launched in 2004. Initially created for Harvard's students, the platform progressively welcomes students from other colleges. Facebook unexpectedly grows at a very fast pace. Dustin Moskovitz narrates that, while targeting and expecting a few hundreds of users, the number of registrations exceeded thousands in a few hours (Zeevi, 2013). Peter Theil, founder of Paypal, is one of the first investors in the project. He buys 10.2% of the shares for half a million dollars. In 2006, Facebook, which was at the time limited to colleges, opens registrations to the public and anyone, anywhere, can become a Facebook user (Mashable, 2011). In several countries, Facebook becomes the most visited site and surpasses Google. In 2007, Facebook allows companies and brand to have a distinct presence with "Facebook Pages". The Facebook platform is being continuously updated and we see major changes sometimes several times a year. For Facebook users, we have recently seen new features allowing mobile access to most functions, different mobile applications for timelines, pages, groups and messages, new privacy features, a post editing option with a history of modifications, the option to follow or not specific friends and pages, the option to prioritize some information and put it "on top" of the timeline, etc. For companies, in 2012, Facebook introduced *Global Pages*, allowing a company to personalize the user experience depending on his geographical location. The advantage was that brands could centralize the management and analytics of several pages, sometimes in different languages and with different content. In the case of *Global Pages*, the number of fans is added up in all the pages

of the brand. In 2014, Facebook launched the "Business Manager", allowing several users to manage one or more Facebook pages with the same advertising accounts. This feature is a big breakthrough for businesses and media agencies because all the advertising information and all the permissions become manageable from a single location.

1.1.5 Google+

With only 300 million users, Google+ is considered one of smallest online social networks. Nevertheless, Google+ is only the small visible part of an underlying Google ecosystem. A system linked to all Android phone users, the OSN of videos, YouTube, Gmail, Google groups, the blogging platform, Blogger, the website optimization and analytics system, Google Analytics and Google Webmaster Tools, as well as other services directly or indirectly linked to getting or diffusing information on OSN, like, for instance, search history on Google, and usage statistics from Google's browser, Chrome. It is not an aberration to consider that most Internet users, or even all, are one way or another, linked to the Google social network. Google+, with the continuously increasing usage of the Android mobile system, will definitely grow.

One worth mentioning feature of the Google+ system is the fact that you can put your connections in "circles" and target them differently. A feature that offers interesting capabilities that are being copied by platforms like Facebook and unavailable on other platforms like Twitter. With this feature, you can, for example, have two different communication threads, one about cooking, one about technical problems and a third about personal thoughts and distribute each thread to a different circle.

1.1.6 Twitter

Twitter is defined as the microblogging social network site. A definition that can be looked up on the Internet and that shows the specificity of this OSN. If Facebook is the network of friends, Twitter is the network of peers or the network of information. Many journalists use it to diffuse information while on the field. Many bloggers have automatically linked it to their blogs. Twitter users do not "follow" each other because they know each other but because

they share information that could be interesting to both. Twitter is not as popular as Facebook and has only around 316 million active users who publish around 500 million tweets every day (SocialBakers.com, 2015).

Another interesting feature of Twitter is the fact that it is a directed graph, i.e. that, unlike Facebook where if A is friend of B, then B is automatically a friend of A, on Twitter, a user can follow another without this being reciprocated.

1.1.7 Instagram

Instagram is the OSN of younger people. It can only be updated using smartphones and tablets. Today, 300 million users are registered on Instagram with 50% of this population in the 18-29 years age range. Instagram is the website of information through photos. A user can post a photo directly from his cell phone and attach a comment or a legend to it. Companies publish product photos, event photo or client photos, amongst other things on their Instagram wall. But, Instagram can be an impressive tool for personal branding and young people trying to "make it", like, for instance, Chris Ozer, a young photographer who won his reputation on this platform (Price, 2014).

1.1.8 LinkedIn

LinkedIn is far behind with only 97 million users. It is the network of professionals. The platform is optimized to display information for employers and people looking for jobs. LinkedIn is where professionals can find jobs from a list of available positions. LinkedIn's search engine adapts to their experience and needs to return relevant results. LinkedIn provides students with a function to lookup the best university according to their career plan and the company they plan to work for in the future. The major weakness of LinkedIn is that it does not encourage second level interactions as per Reed's law (Reed, 2001). This is why it is reinventing itself with new group functions and features allowing people to see who accessed their page and the networks of their business contacts.

1.1.9 Other OSN Platforms

Statistically, an American spends 37 minutes per day on OSN (MarketingTechBlog, 2015). A study we are currently working on in Lebanon shows that people spend 2 to 4 hours per day on their mobile phones, from which a significant time spent on online social networks.

OSN platforms we described in this chapter are only some of the many OSN platforms available on the Internet. Some less popular, but nonetheless interesting OSN, are focused towards specific types of users and needs. For example, Research Gate, is an OSN for researchers and academics. Digging deeper and studying those networks would be valuable. Yet, this would be out of the scope of this dissertation which purpose is to investigate marketing strategies on OSN, specifically Facebook.

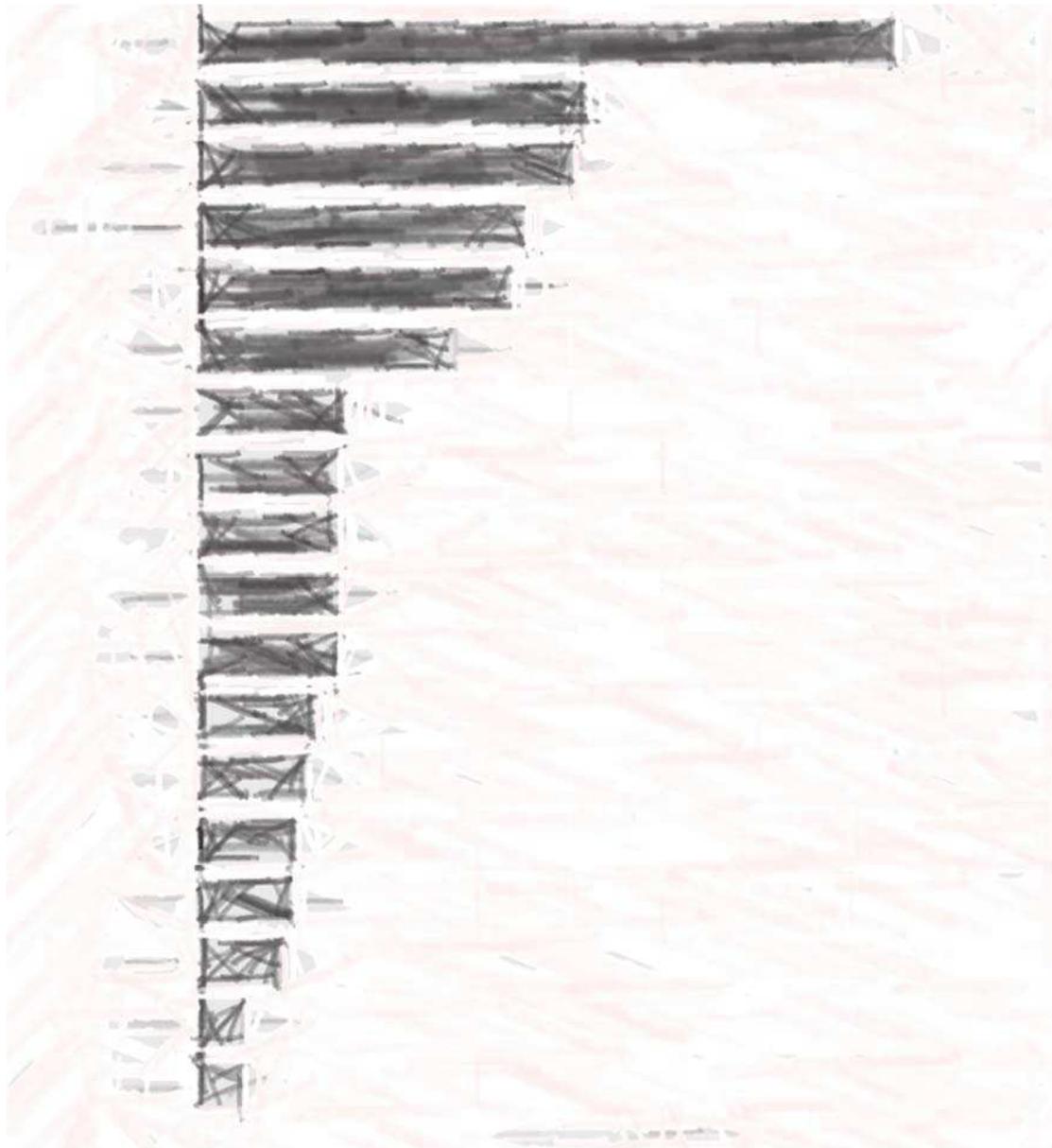


Figure 4: Number of active users in millions for the most popular OSN (Statista, 2015)

1.2 From Mathematics to Strategy: Research on OSN

The concept of networks finds its origin in mathematics with the graph theory. A theory that started with Euler (1736) who was trying to find a solution to a simple problem: could someone visit the city of Königsberg without crossing the same bridge twice?

This theory used, amongst other techniques, a method to display graphically the connections between the different areas. Graph theory could easily be reproduced and applied to other research fields. However, it took several centuries before a precise description and a common terminology was found in a book written by Frank Harary, "*Graph Theory*" (1969). It is at that time that chemists, sociologists, neurologists, mathematicians, electricians, and other researchers from other disciplines, started talking the same language and creating theories and experiments that would contribute to a common knowledge. The results found in one discipline could be tested and experimented in another discipline. Researchers found that some results could be both applied to chemical reactions and human relationships. In one case, the weight of a connection was determined by a chemical reaction (temperature) while in the other it depended on human interactions (number of dates).

In Sociology, the paper written by Granovetter (1983), "The strength of weak ties", that used graph theory as a background, is one of the most cited articles in sociology. In this paper, Granovetter explains how weak ties, i.e. acquaintances or "friends of friends", and not strong ties, i.e. close friends, could help in finding new jobs and accessing innovative ideas. In sociology, graph theory evolved with concepts like structural holes (Burt, 2004) and connections with negative weight (Leskovec et al., 2010). With structural holes, two groups of people are completely isolated from one another. A person who fills this void and links both groups together will build a "bridge" between the two groups. Connections between two people are not always binary (Yes, No). They can have weights that can be defined by the number of meetings, the number of years spent together, money given or taken, insults, and, therefore, can have a negative or positive value.

Other theoretical questions in sociology focus on the position of the individual in the network (Landherr et al., 2010). A person who has the largest number of connections (degree) is not always more important than a person who's position is at the center of the graph (centrality) or a person who is connected to people who are very well connected (Katz centrality). In fact, several centrality formulas exist to evaluate the role of the individual as a hub (many connections), a bridge (creating a link between two groups) or a fringe (someone located at the graph extremity), and his importance (degree, Katz centrality, closeness centrality, etc.)

Eytan Bakshy (2012), an empirist at Facebook explains that graph theory and, especially, Granovetter researches, are at the core of the Facebook model.

Word of Mouth (WoM) is also one of the scientific fields in sociology related to social networks. It is by realizing that voters made their choice, not by listening to candidates, but by listening to people of their entourage that Lazarsfeld (1968) started his investigations on WoM. On OSN, the term "viral" has been borrowed from medicine to describe an information that spreads rapidly from one person to another through WoM.

Information diffusion, mainly on Twitter, is also a growing field of research. A holistic article about the types of discussion on Twitter was written by Marc Smith & al. (2014). In this study, the authors detect six types of discussions on Twitter:

1. Polarized Crowds: These are groups with opposite ideas. Even on critical issues affecting those groups, each group ignores the other. This is the case of divergent political groups.
2. Tight Crowds: People are tightly connected, discuss extensively, take the same ideas and share them. This is the case of people in group meeting and conferences sharing their experience and thoughts.
3. Brand Clusters: This is the case of popular products, brands and people, like actors. Many people are talking about the subject but do not necessarily know each other. They are talking about the subject without really talking to each other.
4. Community Clusters: This is the case of popular subjects where communities build up around some influencers. Each community can discuss the subject from a different perspective. Groups are usually medium sized with a large number of singletons.
5. Broadcast Networks: This is the case of networks created around a source of information, like a newspaper. At the center of the network, a user diffuses information that is shared, commented or favorited by others. Graphically, this is a star shaped network with a hub at the center.
6. Network Support: This is the case of companies providing technical support or handling customer complaints. This is also a star shaped network with a hub at the

center. Yet, the connections are directed from the users to the hub, not the other way around.

Sociology is not the only discipline interested by social networks. In fact, if networks only depended on sociology, theories, like Reed's law (2001), would apply to all online social networks and this would mean that all those networks would grow exponentially and their value will also grow at the same rate. However, in reality, this is not the case and we observe saturations and even a decrease in the number of users. This is due to psychological factors: not all people are evenly interested to create groups, join discussions, share information, etc. Each person tries to convey an image based on its own actions and reactions on OSN. Extraverts try to expand their IRL (In Real Life) personality to social networks. Gosling & al. (2011) suggest that extravert people are more active online and have more friends than introverts.

Gonzales et Hancock (2011) suggest that more friends is a self-esteem booster. This is why, even with a theoretical limit of connections a person can have at a given time, which is 150 to 200 based on the socio-anthropologist Dunbar (1993), it is not uncommon to see people with 500 friends, a thousand friends or 5,000 friends!

Even if the first mathematical and statistical tools to draw and study networks were built by sociologists, it is important, in order to study online social networks, to take into consideration mathematical and psychological elements that define social networks and human interactions in social groups.

1.2.1 Online Social Networks Research in Business and Management

In "*The economics of information technology: An introduction*", Varian & al. (2004) discuss how people apply old techniques to new technologies before finding methods to use those new technologies to their full potential. For instance, the authors narrate how it took several years before factories realized that electricity would be better used if buildings had a large base (production lines) instead of the regular horizontal shape used to optimize coal energy (heat was used at the bottom for production and at the upper levels to heat offices). Another example would be earlier version of emails that were a replica of snail mail as a general

approach. HTML emails (using fonts, colors, tables, etc.), image inclusion, and other services, came many years after the first email. Still, the real email revolution came several years later with instant messaging on mobile phones (Whatsapp) where a user could share a photo, a file, sound bites, etc., with one or many users (groups) or lists of diffusion and get a delivery and read receipt instantly.

In "*Rethinking the networked economy: the true forces driving the digital marketplace*", Stan Liebowitz (2002) stated that the Internet did not change the laws of economics. We also believe that technology brings change to our methods and capabilities, not to the founding principles of science and our nature. This reasoning could as well apply to OSN and we could assert that "OSN did not change the laws of business and marketing".

However, a new element should be taken into consideration. On OSN, the enterprise-to-consumer communication works in a traditional way. The marketing mix remains unchanged. Whether it is about the 4P (*Place, Product, Promotion, Price*) or the 7C (*Corporation, Commodity, Cost, Communication, Channel, Consumer and Circumstances*), the rules are the same on social networks and elsewhere. The disrupting element in the equation is the consumer-to-consumer communication that is out of the control of the company. More so, the means of dissemination available on OSN is impressive and, unlike offline situations, dissatisfaction messages and complaints can reach a huge population in no time. Online marketing is therefore characterized by a loss of control when compared to traditional offline marketing (Mangold & Faulds, 2009).

One of the first researchers to perceive this change in the balance of power and control is Howard Rheingold (2002). The author describe collective actions of consumers as "smart mobs". Those hyper-coordinated people, thanks to mobile applications, can initiate social and political changes. Rheingold supports his theory with organized manifestations and popular movements in several countries that ended up in toppling political regimes.

Fournier & Avery (2011) write about "*uninvited brands*". For the two researchers, marketing practitioners were stunned when they realized that OSN were built for people, not brands! They write that brands should accept this delegation of control. If the brand consents to this reality, it has to realize that marketing is going to change into some kind of public relations

model and that OSN are more about defending and protecting the brand than building and promoting it. Value and risk become interdependent and short-term efforts of newcomers can win over long-term brands.

For this reason, Woodcock & al. (2011) recommend that companies focus in priority on customers' feedback and on their engagement. Feedback could be a source of improvements and innovations. This feedback could be direct, like comments and "likes", or indirect like analytics regarding the time the information was accessed, comparison between the comments on one product and another, geographic localization of comments, etc.

In a holistically work on the subject, "*Communities dominate brands*", Ahonen et Moore (2005), suggest that marketing communication, from now onward, should be creative, engaging, fun, bi-directional and personal.

Even on such "deadly grounds", OSN, and in particular Facebook with its billion and a half users, could not be more appealing to marketing strategists. Success stories like the Ice Bucket Challenge that generated more than 2.4 million consumer videos (Phing & Yazdanifard, 2014), are the undeniable proof of the efficiency of viral marketing. This makes marketing on OSN for brands an inescapable must. Brands should be aware of the need to embrace technology, be up-to-date, efficiently train qualified people, and reduce bureaucracy to improve response time (Berthon et al., 2012).

Vásquez & Escamilla (2014) suggest the usage of best practices, especially with SME that don't have the potential to manage OSN communication efficiently. They recommend five rules: create the tool for a competitive advantage (1), diffuse information in real time (2), help users create advertising (3), empower users to influence others (4) and consider both advantages and disadvantages leading to uncertainty (5). Those rules are show in the following figure.

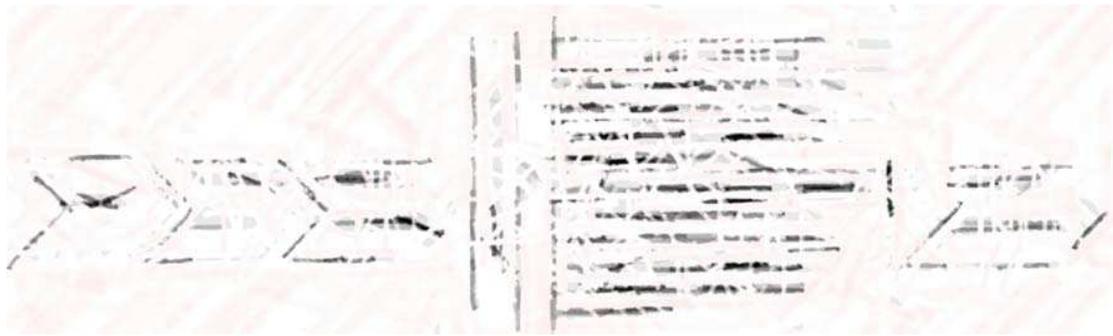


Figure 5: Best practices for SME in OSN communication (Vásquez et Escamilla, 2014).

Another important aspect of OSN is the fact that each platform is different than the others and that strategies should therefore be different depending on the platform. Smith & al. (2012) suggest that :

1. Content generated by users to auto promote themselves with reference to the brand is significantly higher on YouTube (75%) than on Facebook (30%) and Twitter (13%).
2. The centrality of the brand in the content generated by users is higher on Twitter (76%) than on Facebook (66%) and YouTube (42%).
3. Engagement to marketing actions of the brand are at their lowest on YouTube (0-2%) and differ depending on the brand on Facebook and Twitter.
4. An unexpected fact: The brand is perceived differently depending on the platform and depending on the brand. In a way that, for some brands, positive mentions are higher on Twitter, while for others, negative mentions are higher on the same platform.

In marketing, research has mainly focused on viral marketing. This is because the appeal of OSN is mainly about the possibility to diffuse information like a virus that contaminate the whole population. The principles of marketing on OSN are, in fact, those of the WoM, also called the two step flow theory by Paul Lazarsfeld (1968). Recent studies use the fortuitous abundance of information provided by OSN to study WoM and virality in a way that was not possible before. As an example, the Milgram experiment in 1967, found that one would need six connections to send a message from one person to another in the USA. The results of Milgram's experiment, also called the "*Small World Experiment*" or "*Six Degrees of*

Separation", were criticized (Kleinfeld, 2002), mainly because of the human factor. However, with OSN, connections can be analyzed with little or no error margin. In fact, Facebook reproduced the Milgram experiment on all its users and found out that there are in average 4.7 degrees of separation, not six (Backstrom et al., 2011).

Aral and Walker (2011) find that personalized messages regarding a product create less engagement than passive broadcast messages.

Still, the most comprehensive paper we consulted regarding viral marketing is probably the article from Hinz et al. (2011) that defines four essential factors for viral marketing success:

1. Content: Every marketing strategy on OSN has a message as an entry point. If this message is shared or creates an engagement (like, comment, share, add to favorites, etc.), the message can go viral. Berger and Milkman (2009) find that positive messages are more viral than negative messages and that content that brings arousal, is more easily shared. Interesting products receive more WoM instantly but less on the long run than products who are popular and stick in the mind of users, as shown by the experiments and analysis of Berger et Schwartz (2011). The same study supports the fact that giving away the product increases WoM but giving coupons and samples do not necessarily affect WoM. Malcolm Gladwell (2002) talks about the stickiness factor of some messages who become part of the culture, like the name Xerox that became a synonym of photocopy.
2. The network structure: Bampo & al. (2008) stress on the importance of the network structure for information diffusion. The authors test different diffusion strategies on different types of networks: Random networks where connection depend on probabilities, Scale-free networks with no boundaries like the Internet, and Small world networks with tight clustering coefficient and a short diameter. Tested simulations show discrepancies in the diffusion of messages, not only because of the number of people targeted (seeds) but also depending on the network structure. Targeting more people on a random network may result in a larger diffusion. This does not apply to small-scale networks. The authors suggest that the objective of the marketer should be to target enough seeds to reach an *epidemic threshold*. Yet, not

exceed this number to avoid falling into the mass marketing trap and high expenditures.

3. The characteristics of the recipients and their behavior: In 1967, Johan Arndt reported four types of buyers: pioneers, early adopters, late adopters, non-adopters (Arndt, 1967). The results of this research showed that WoM would flow from users who considered acquiring the product (*low-risk perceivers*) to high-risk perceivers. The author also noticed that the larger flow moved between potential buyers who were deciding to buy simultaneously ("I'll buy if you buy").
4. The seeding strategy: Aral, Muchnik and Sundararajan (2011) suggest that targeting more than 0.2% of the total population is a losing strategy because the profit generated by the adoption of a new customer is lower than the gain generated by his natural adoption (without a seeding strategy). By definition a seeding strategy attempts to convert influential people of a network that could use their position, influence or contacts to force a chain of adoptions (Domingos & Richardson, 2001). Liu-Thompkins (2012) suggests that viral strategies need a seeding strategy that implies choosing the first generation of targeted people. She also finds a correlation between the quality of the message and the size of the epidemic threshold, and that the targeted population should have strong links with the creator of the message.

To those four factors, Thomas Valente (2010) finds that the messenger is as important as the message. The author writes that "the messenger is the medium" and that it is important to take into consideration the carrier of the message and his personal relationship with the population.

1.2.2 Influence and Microfluence Strategies on OSN

The role of individuals as influencers finds its origins in political literature with Lazarsfeld (1968) in an article titled "The People's Choice" where the author suggests that the choice of individual does not depend on the speeches of candidates or medias, but through influential connections in their network.

Ronald Burt (2004, 2009) focuses on structural holes and finds that bridges between two groups can be a vector for new and innovative ideas for the groups they link. Bridge's ideas are not automatically dismissed unlike the ideas of members belonging to an opposite group.

For Daniel Heiderich (2009), the Internet is a "magma of influence" where each player attempts to influence others. He calls "microfluence" the "discrete and microscopic influence" that operates through small messages, drawings, photos, videos and podcasts, or any element that one can easily share and diffuse on a website, social networks and mobile apps. Heiderich suggests that people exposed to the same stimuli repetitively will embrace the messages communicated.

In OSN literature, Trusov & al. (2010) find that a few friends only can influence a user and that influencers change from one user to the other making the task of targeting influencers very difficult.

Robert Cialdini (2001) defines seven principles of influence:

1. Liking: People like those who like them. People are more easily influenced by people with whom they find similarities or common interests. As an example, in the TV series *Desperate Housewives*, each actress has a different profile allowing a wide range of female spectators to identify themselves and empathize with one or the other star. In this series, Susan Mayer is the clumsy, head in the cloud housewife, Lynette Scavo is the frustrated "no life" taking care of four kids, Bree Van de Kamp, the sophisticated red head, Gabrielle Solis, the sexy Latino, Edie Britt, the home wrecker...
2. Reciprocity is the fact of giving back. In every day's life, we invite those who invite us, offer gifts to those who send us gifts, etc. On OSN, especially on directed networks, i.e. networks where a user can follow another without an automatic follow-back, like Twitter or Instagram, users demand reciprocity by adding the hashtag #f4f or "follow for follow" that engages a user to follow-back.
3. Social Proof: People "follow the trend". Cialdini gives the example of a group of people collecting money for a charity. His experiment shows that people who see

a list of people from their circle who have already contributed act in a analogous fashion.

4. Consistency: people stick to their initial thoughts, especially if they wrote them on paper. The reason is that people like to look consistent in the eyes of their peers. Cialdini suggests that, to produce a long-lasting change, pressure and threats should be avoided. A convinced person will follow up in the same direction.
5. Authority: Cialdini suggests that people are influenced by those who are an authority in their field. Exposing one's experience and know-how contributes to influencing others. Small bits of information, like diplomas, years of experience, references, etc., can contribute to increase the power of influence.
6. Scarcity: Experience has shown that people react almost dramatically when they know that something is scarce (expiry date, limited quantities, etc.).

In a book called "Switch", the Heath brothers, Chip and Dan (2010) investigate change in difficult situations: "how can you create change when change is hard?". They write that a person has a rational side, the rider, and an emotional side, the elephant. The elephant is quickly tired and difficult to move.

Heath & Heath suggest the following approach:

- On the rational side, direct the rider:
 - o Think positive, don't focus on the problems
 - o Prepare a roadmap, avoid confusion
 - o Show a "postal card" of the destination
- On the emotional level, motivate the elephant:
 - o Find the good feeling, the right connection between the person and the cause
 - o Divide the path into short milestones and give rewards at each step to maintain the motivation
 - o Encourage people by showing them that they can learn, improve and evolve.
- Draw the path: what looks like a human problem may just be a situation problem:
 - o Remove obstacles in the environment
 - o Create habits and go auto-pilot to make tasks easier to the rider

- Rally the herd because behavior is contagious

1.3 The Problem of Control in Viral Marketing

It is obvious that the main issue with marketing strategies on OSN is the loss of control. Companies become the target of customers who find in OSN an ideal place to take control. OSN platforms also limit access to companies making them more vulnerable and with almost no place for manoeuvres. For instance, Facebook does not even allow a company to get the list of its own fans!

Scientific literature in sociology and management takes the position of the observer and analyst. This thesis attempts to take an active position using a mixture of experiments, observations, methods and advices that could be used by scientists and practitioners alike. We take an original and active position that tweaks the elements and the environment, e.g. by using timelines instead of the Facebook page of a company, and observing the reactions to a given action we initiate.

1.3.1 Theoretical Questions

Our thinking is based on an observation and an essential question that lead to our main inquiries:

- If brands are not welcome on OSN and are automatically discredited (Fournier & Avery, 2011), would it be possible for them to optimize initial seeding populations (O Hinz et al., 2011) and use them as influence vector?

In this context, we try to give an answer to four questions:

- What is the control margin brands can have on OSN, and, in this context, what would be the possible marketing strategies they could use (Rethinking Marketing on Facebook, page 174)?
- In the case of social and political actions, what would be the outcome of the optimization of a seeding population in the context of negative WoM (Negative WoM

and its transmission on OSN : the determining role of the seeding population, page 138)?

- Can we use Facebook to build a seeding population of bridges between two political parties (Finding Bridges for Political Influence, page 159)?
- How to optimize the seeding population of a Facebook personal timeline for personal branding?

The analysis and experimentations are an attempt to find a theoretical and experimental path that would lead to a theoretical and practical thinking to define viral marketing optimization strategies, means and methods, and, most importantly, the selection and creation of initial seeding population for this purpose.

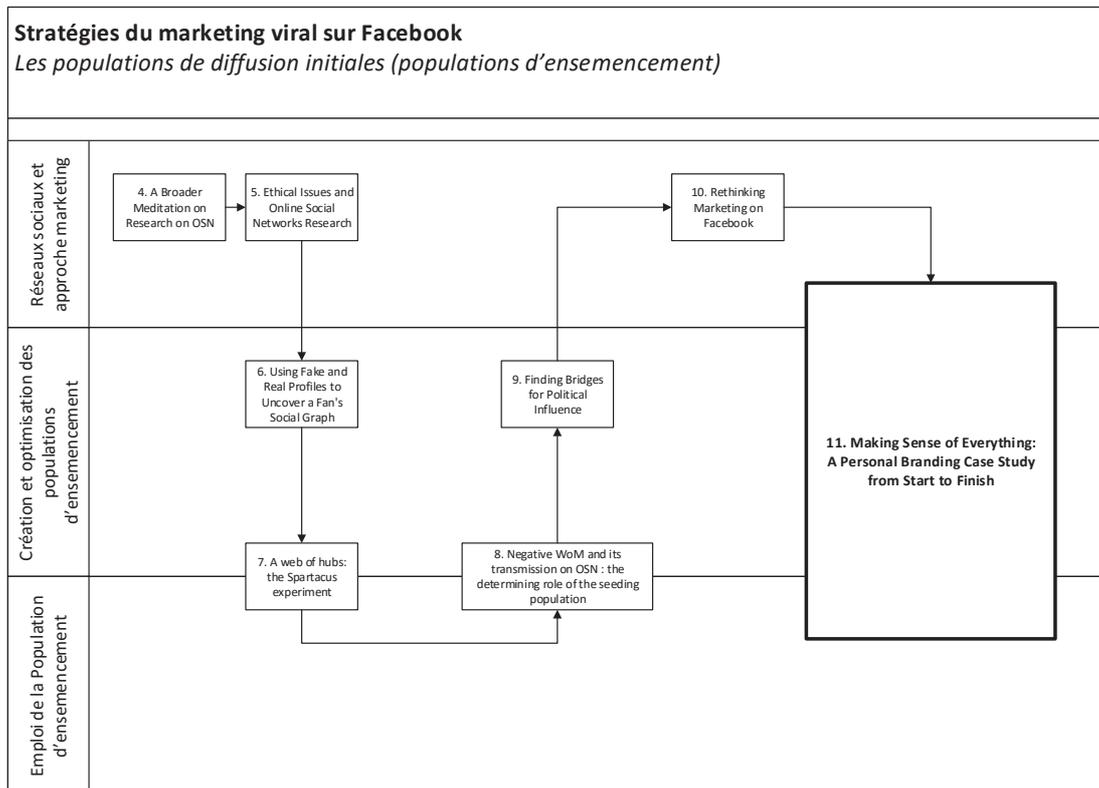


Figure 6: from thinking to synthesis

1.3.2 Research Paradigm and Methods

The novel aspect of this research field makes the results of a positivist approach difficult to evaluate in real life situations. We are in a social, human context. How people behave or react cannot be mathematically modeled without an important margin of error. Personal, psychological characteristics of each individual affect his behavior and reactions a given situation.

A constructivist approach or an anti-positivist approach would require significant input from each user to determine his own perception of online social networks in general and our experiments in particular. There is a discrepancy between what people say and what they do, especially when it comes to online public spaces. Hudson & Bruckman (2005) discuss many problems related to culture and perception of privacy that may bias a research. They also find a bystander effect when subjects are aware of the experiment (Hudson & Bruckman, 2004).

Our approach is action-oriented and tries to shake established ideas and practices. Kant defines criticism to be a questioning of the limits of knowledge: "what can we know?". He talks about a "Copernican revolution" in reference to Copernic who switched the roles of the sun and the planets. Kant suggests that knowledge was dictated by objects and their observation. The mind was acquiring this knowledge from the objects without adding to it. Kant believed that there are four levels to knowledge: how things are, how we perceive them, how our sensibility receives them and how we understand them. Kant invites researchers to let their mind bring knowledge to the objects. Criticism has evolved and was mainly used in social and politics research. We opt for Habermas' critical theory approach (1985). Habermas argues that it is impossible to know what is generally accepted without subjecting it to questioning (Baynes, 1992). In this approach, knowledge is based upon empirical investigation and tweaking the environment is a mean to reach knowledge. Habermas defines three kinds of knowledge: Work (Technical), Practical and Emancipatory (Maclsaac, 1996). Work or instrumental refers to the control or tweaking of the environment. Practical is defined by social interaction or "communicative action". Emancipatory is defined by self-reflection or self-knowledge.

Practical	Technical	Theoretical
<ul style="list-style-type: none"> Practical knowledge Knowledge of how to do things Knowledge of the world as it is 	<ul style="list-style-type: none"> Technical knowledge Knowledge of how to do things Knowledge of the world as it is 	<ul style="list-style-type: none"> Theoretical knowledge Knowledge of the world as it is Knowledge of the world as it should be
<ul style="list-style-type: none"> Practical knowledge Knowledge of how to do things Knowledge of the world as it is 	<ul style="list-style-type: none"> Technical knowledge Knowledge of how to do things Knowledge of the world as it is 	<ul style="list-style-type: none"> Theoretical knowledge Knowledge of the world as it is Knowledge of the world as it should be
<ul style="list-style-type: none"> Practical knowledge Knowledge of how to do things Knowledge of the world as it is 	<ul style="list-style-type: none"> Technical knowledge Knowledge of how to do things Knowledge of the world as it is 	<ul style="list-style-type: none"> Theoretical knowledge Knowledge of the world as it is Knowledge of the world as it should be

Table 5: Types of knowledge in Habermas' critical theory (MacIsaac, 1996)

Critical theorists suggest two types of research methods: ideology critique and action research.

Practical	Technical	Theoretical
<ul style="list-style-type: none"> Practical knowledge Knowledge of how to do things Knowledge of the world as it is 	<ul style="list-style-type: none"> Technical knowledge Knowledge of how to do things Knowledge of the world as it is 	<ul style="list-style-type: none"> Theoretical knowledge Knowledge of the world as it is Knowledge of the world as it should be
<ul style="list-style-type: none"> Practical knowledge Knowledge of how to do things Knowledge of the world as it is 	<ul style="list-style-type: none"> Technical knowledge Knowledge of how to do things Knowledge of the world as it is 	<ul style="list-style-type: none"> Theoretical knowledge Knowledge of the world as it is Knowledge of the world as it should be
<ul style="list-style-type: none"> Practical knowledge Knowledge of how to do things Knowledge of the world as it is 	<ul style="list-style-type: none"> Technical knowledge Knowledge of how to do things Knowledge of the world as it is 	<ul style="list-style-type: none"> Theoretical knowledge Knowledge of the world as it is Knowledge of the world as it should be
<ul style="list-style-type: none"> Practical knowledge Knowledge of how to do things Knowledge of the world as it is 	<ul style="list-style-type: none"> Technical knowledge Knowledge of how to do things Knowledge of the world as it is 	<ul style="list-style-type: none"> Theoretical knowledge Knowledge of the world as it is Knowledge of the world as it should be

Table 6: Research Methods (Dash, 2005)

Ideology critique is about asking questions about things that are considered to be self-evident or obvious (Friesen, 2008), like "can earth be round?", "can earth revolve around the sun?".

Action research is a method defined by Peter Reason and Hilary Bradbury as a process that "seeks to bring together action and reflection, theory and practice, in participation with others, in the pursuit of practical solutions to issues of pressing concern to people, and more generally the flourishing of individual persons and their communities" (Brydon-Miller et al., 2003).

In this dissertation, we use action research on Facebook. At the time of writing this thesis, Facebook is the largest OSN on the Internet with more than 1.4 billion users. We look into the social graph of users. We experiment different structures and different edges (friends) and analyze how they affect the action and reaction of other users. Our research is about human relations. Yet, we believe that the platform has a role to play and affects the outcome. To experiment different structures, we create fake profiles to test how people engage with their messages, we move users from a Facebook page to a Facebook timeline and reuse the same messages, we define a method to find political bridges, etc. Our role as action researchers is not to observe but to take action and define methods that could be used by decision makers: people trying to optimize their social capital, consumers who would like to take action against a brand, politicians wanting to introduce new and innovative ideas, etc. We identify actors, analyze their margin of manoeuvre, and suggest methods to optimize their control over a situation that is apparently out of their control.

Our dissertation falls into the marketing strategy field. Our contribution helps understand marketing strategies on OSN. It brings new insights about seeding populations, seeding strategies, viral marketing and negative WoM. We also bring a contribution to methodology with our original setups and configurations. These methods can be reused by researchers and marketers to take controlled actions on their online social networks.

This is a pioneering approach at a time where more research and more investigations are needed in this field (Hoffman & Novak, 2012). The action-oriented approach used in this dissertation defines new perspective for analysis and practice. Our experiments are executed IRL (in real life) and their results show the level of success or failure for each method.

1.3.3 Analysis and Experimentations

This dissertation consists of several chapters, amongst which a paper currently under third revision at the Journal of Advertising Research (JAR) and four experiments that have been presented at international conferences (Euras, 2012; INSNA, 2014; ISMS, 2015) and the *workshop stratégie Paris-Dauphine* (2014):

1.3.3.1 *A broader Meditation on Research on OSN (page 81)*

Rumor diffusion is something very common on the Internet (M Ott et al., 2013; Myle Ott et al., 2012; Snopes.com, 2013; Wassim Nasr, 2014). Facebook estimates the number of fake profile to be several tens of millions (Protalinski, 2014; Sweney, 2012). Some of those profiles are used to increase the self-esteem of actors and politicians, others to stalk a lover or diffuse rumors (Elphinston & Noller, 2011; Myle Ott et al., 2012; Ratkiewicz et al., 2011).

Can a researcher use this technique to understand and prevent dangers that are part of online social networks?

This chapter investigates the literature about the subject between scholars defending the right to withhold information or deceiving subjects and scholars who believe that subjects should be aware of every detail of an experiment.

1.3.3.2 *Using Fake and Real Profiles to Uncover and Rebuild a Fan's Social Graph (page 99)*

Users see their interaction on open and public spaces as private (Bassett & O'Riordan, 2002; J. Hudson & Bruckman, 2005; J. M. Hudson & Bruckman, 2004). They assume that online platforms protect their information or, at least, give them the means to keep this information private.

The list of friends is one of the elements that many users hide on Facebook. There are many reasons for this: a jealous partner (Elphinston & Noller, 2011; Vitak, 2008; Wang et al., 2013), customers or frustrated employees (Fournier & Avery, 2011; Hollenbeck & Zinkhan, 2006) that could stalk a manager, even activists or terrorists as part of an online warfare (Gaines-Ross, 2010a; Snopes.com, 2013; Wassim Nasr, 2014; "the Lebanese Forces Official Website," 2014; etc.), etc.

Rebuilding the social graph of a brand's fan is not available for a company or marketing and social strategists and scholars.

Our experiment is an attempt to determine if, by using real and fake profiles, a user or a brand could rebuild the social network of a user who has his friends list hidden. We use a target of 10 users who chose to hide their network of friends and eight real and fake profiles with a total of 13,394 unique friends in order to rebuild the hidden lists.

Results vary between 3.94% and 28% of uncovered friends:

Target profile	Total number of friends	Mutual friends with the experimenter	Exposed friends	Ratio
M.H.	1,168	19	46	3.94%
T.	2,300	61	226	9.83%
V.	290	13	37	12.76%
M.G.	1,041	46	171	16.43%
M.A.	383	18	63	16.45%
C.	401	12	32	7.98%
N.N.	530	77	123	23.21%
R.	1,250	39	56	4.48%
M.N.	700	141	196	28.00%
N.H.	1,069	21	64	5.99%
Average				12.91%

Table 7: Percentage of uncovered friends

1.3.3.3 A web of hubs: the Spartacus experiment (page 113)

Users seek to maximize their connections using the "mutual friends" feature on Facebook to fill structural holes in their networks even if this means becoming friends with people they don't know (Chen et al., 2009). We also know the importance of the seeding population in the creation of viral marketing (Liu-Thompkins, 2012).

In this chapter, we attempt to answer the following questions:

- Can we create a network of hubs around a fake profile?
- Can this network attract new users trying to maximize their own network of friends?
- Can this fake profile become an efficient vector of diffusion for WoM?

To the first question, we find that it is possible, starting with a small group of 5 people, to build a network of social hubs on Facebook and reach more than 600 people.

To the second question, we find that other users on Facebook will be attracted by this network and will send friend requests to the fake profile. Since its creation in 2012, this fake profile has received dozens of friend requests.

To the third questions, we find that this fake profile, even with more than 600 friends, has been unable to create engagement around messages that were successful in terms of engagement on the timelines of real users.

1.3.3.4 Negative WoM and its transmission on OSN: the determining role of the seeding population (page 138)

Communication strategies on social network focus mainly on the content of the message (JA Berger & Milkman, 2009; Valos et al., 2007), neglecting other essential elements of viral marketing (O Hinz et al., 2011), like network structure (Bampo et al., 2008), the behavior of the recipients (Arndt, 1967; Liu-Thompkins, 2012), the seeding population (Bampo et al., 2008; Liu-Thompkins, 2012) and the messenger (Sprague & Wells, 2010; Valente & Myers, 2010).

Communication on Facebook pages, the medium suggested for brands and companies (<https://www.facebook.com/help/174987089221178#What-is-a-Facebook-Page?>), strongly restricts control over the elements of viral marketing when it comes to consumer complaints. We wonder what would happen if unhappy customers would post complaints on their personal timelines and not the Facebook page of the company.

Our experience reuses negative messages that were posted on the page of a real company and republish them on personal timelines of two fake profiles created with an optimized seeding population. This method shows an engagement with negative WoM four times higher than the engagement that happened on the Facebook page of the company.

This experiment stresses the importance of the medium used on Facebook (page, group, timeline) for a viral communication and the importance of the initial seeding population.

1.3.3.5 Finding Bridges for Political Influence (page 159)

Research on political campaigns on online social networks investigates WoM, diffusion of information, diffusion of rumors, political marketing and political influence (Berinsky, 2012; Carpini & Williams, 2001; Finke & Harris, 2012; Huang, 2013; Mercanti-Guerin, 2010; Ratkiewicz et al., 2011). However, from a social research perspective, the efficiency of viral marketing and political communication is in the people to target and their role as weak or strong links, influencers or easily influenced, etc. (M. Granovetter, 1983; Lazarsfeld et al., 1968; Liu-Thompkins, 2012; Watts & Dodds, 2007).

In this context, the role of bridges between people of antagonist political groups is essential to bring new ideas and spread information to non-supporters (rumors, critical information, conversion attempts, etc.).

Can we use Facebook to fill structural holes between political groups?

Our experiment uses a database built around the profiles of Lebanese politicians. The combined network is 15,344 users large with 341,345 connections.

Data analysis help us find people connected to both groups with the number of connections with each political group.

This experiment clears the way for more research in political marketing on OSN, mainly through the usage of bridges as vectors of communication or as an initial seeding population. The same experiment could be used as a marketing strategy to convert customers of a competitive brand.

1.3.3.6 Rethinking Marketing on Facebook (page 174)

With the public discussion between customers, online social networks bring a new paradigm to the marketing world (Mangold & Faulds, 2009). Changes they bring to marketing has been discussed in several articles (Mangold & Faulds, 2009; Trusov, Bucklin, & Pauwels, 2009; Woodcock, Green, & Starkey, 2011, etc.).

However, most articles discuss viral marketing and WoM neglecting other types of marketing that could be used on online social networks, like mass marketing or relational marketing.

Moreover, Facebook offers three different supports for communication: personal timelines, groups and Facebook pages. Each one of these supports having its own specificities.

In this chapter, we take four marketing strategies (mass marketing, niche marketing, viral marketing and relational marketing) and suggest the right support for each strategy. After combining each marketing strategy with the limits and advantages of each support, we build a matrix linking each marketing strategy with the support that can be used as a vector to make it succeed.

	Facebook Timelines	Facebook Groups	Facebook Pages
Mass Marketing			X
Niche Marketing			X
Viral Marketing	X		
Relationship Marketing		X	X

Table 8: Marketing strategies on Online Social Networks

1.3.3.7 Making Sense of Everything: A Personal Branding Case Study from Start to Finish

This last chapter is a synthesis of our dissertation. It is an experimentation from start to finish of viral marketing for personal branding. An author who has never written satiric literature uses Facebook as the only support for personal branding. The experiment starts with the first post in 2013 and ends with a publisher’s offer to publish a book for the author in 2015.

The success of this real life case study on Facebook without any interferences from outside sources (offline advertising, other supports used for branding, Facebook advertising, etc.), its

duration (over 2 years), and the amount of information collected and analyzed, is of importance for future research on the subject.

It is also essential for marketing strategists because it is not a simulation but a live case that had a tangible result: the author was approached by two publishers and will be published and presented at the main book fair in Beirut (Lebanon).

2 A Broader Meditation on Research on OSN

2.1 Résumé (Français)

L'étude des réseaux sociaux ne peut pas se faire autrement qu'avec une vision et une approche multidisciplinaire. En effet, une étude dans le domaine de la gestion peut-elle négliger les aspects sociologiques, psychologiques et même philosophiques inhérents à la nature des réseaux sociaux ?

Ce chapitre est une réflexion sur l'évolution de la technologie et les dangers qui en découlent (Zolfagharifard, 2015), particulièrement la singularité de Kurzweil (1999). Et, surtout, une réflexion sur le rôle du chercheur et les approches à adopter. En effet, comment utiliser des données publiquement disponibles mais contradictoirement perçues par les utilisateurs comme privées ? Quels sont les droits des utilisateurs et, aussi, des chercheurs ?

Nous citons quelques un des droits fondamentaux des utilisateurs, comme le droit à l'oubli, ou le droit d'être laissé seul. Et débattons le rôle des entreprises qui sont attaquées sur les réseaux sociaux par les « foules intelligentes » (Rheingold, 2010).

Au niveau de la recherche, Hudson et Bruckman (2004) remarquent que lorsque les utilisateurs sont informés de l'expérience, ils réagissent différemment ou, tout simplement, prennent le rôle de spectateur.

Nous débâtons les questions éthiques en psychologie, sociologie et dans le domaine de la gestion et nous citons en particulier Hey (1998) pour qui ne pas avouer la vérité ou une partie de la vérité n'est pas synonyme de tromperie.

D'autres chercheurs nuancent aussi l'aspect éthique de la recherche. Saunders et al. (Saunders, Lewis, & Thornhill, 2009) considèrent que la priorité dans la recherche en gestion est de ne pas faire du mal aux sujets.

Finalement, Cooper (2014) définit quatre règles qui serait un justificatif éthiquement acceptable :

- Ne pas faire du mal aux sujets au-delà du seuil d'une expérience économique normale sans tromperie.
- La difficulté de réaliser l'expérience sans tromperie.
- Les sujets sont informés de l'expérience lorsqu'elle prend fin.
- La valeur de l'étude mérite les risques potentiels associés à l'utilisation de la tromperie.

2.2 Introduction

Tackling online social networks (OSN) is a tricky situation. Even with clear objectives and a solid personal vision and experience, there is more to this technology than what meets the eye.

Indeed, it is hard to study online social networks from a narrow perspective. Can we look at them from a marketing perspective and disregard the sociological aspect of those networks? Can we overlook the fact that these networks are made of strong and weak social connections? Can we forget the psychological issues that make a person engage with a message and diffuse it to others? Can we overlook the technological issues that make a technique more efficient than another? Can we neglect legal and ethical issues, and the way OSN platform users perceive their rights? Can we even overlook the philosophical crisis that comes bundled with the way OSN change our everyday life?

2.3 The Philosophical and Legal Approach

In his book, "The Age of Spiritual Machines", Ray Kurzweil introduced the term "singularity" to describe the moment in time where the human brain will be unable to comprehend progress (Kurzweil, 1999). Even if Kurzweil predictions, based on the law of accelerating return (M. Buchanan, 2008), place this "singularity" in year 2045, many scientists and businessmen are worried about it today. While John Horgan calls for a "hopeful skepticism" believing that we have reached the limits of our discoveries and that science has ended (Horgan, 2004), the point where computers will be as powerful as the human brain are only

a few years away (Moravec, 1998). Several scientists, like Moravec (1998) and Stephen Hawking (Zolfagharifard, 2015) believe that the AI species will displace humans from existence. In the book and movie *EX Machina* (Garland, 2015), a humanoid robot outsmarts both its inventor and the scientist in charge of evaluating its performance, leaving them both for dead (or almost). Even though, as "gods" of a new species (Herzfeld, 2002), we should treat the AI problem with rationalism, some very much related and down to earth concerns are imminent.

While progress has made giant exponential steps, our brains and our nature have not evolved. Yes, we have fancy electronic gadgets and live artificial lives with our avatars. Yet, crime in the name of God or wealth is still very much present in our societies. Hatred, racism, injustice, discrimination, are a plague inherent to most human societies. We are Stone Age men with nuclear weapons.

How does this concern OSN? Facebook's database is a log file of all human activities and connections of a billion people. It even knows things about "you" that you do not know about yourself, like what your friends are saying about you, or who is stalking you on its platform, and who is viewing your profile. It even keeps records of people who are not on Facebook, people it calls "shadow profiles" (Elmer, 2015). What would happen if an activist or a terrorist hacks this system? The data that he will have under his fingertips is so important he could almost do anything, from geographically locating anyone of these billion people to recording their communications, taking photos with their devices, accessing emails on their mobile phones, reading their notes via the Facebook application... The question is no longer how to protect ourselves: we definitively moved out of any safe zone a long time ago. Facebook is not a savior of men, it is a business and it is already treating us as Guinea pigs and using our privacy as a by-product (K. Hill, 2014). What is at stake? How do we enforce our right to be forgotten (Franceschi-Bicchierai, 2014; McNealy, 2012; R. K. Walker, 2012), our right to our own image (Jung, 2011; Stemple, 2012) and our "right to know" (Emerson, 1976).

2.4 Perspectives for Studying Online Social Networks

We believe it is important to investigate the OSN problem from a legal and philosophical perspective. Mainly, the blurry line between the real and the virtual, and our slow

relinquishing of values we held sacred for a long time, like privacy and our right to control our own data. The Internet has been slowly altering the way we use our memory (Sparrow, Liu, & Wegner, 2011), the way we use our brain (Wegner & Ward, 2013), the way we are (Carr, 2008). It is time we ask ourselves if the machine is an extension of our brain or if we are slowly becoming an interface of the machine, like a mouse, a keyboard or a USB coffee machine. With more and more research on artificial intelligence and genetics, and our Frankenstein-ish dreams of becoming gods through genetic manipulation, body alteration and creating humanoids and robots to our own image, it is becoming urgent, at a time where more and more scientists and businesspersons (Herzfeld, 2002; Horgan, 2004; Kurzweil, 1999; Zolfagharifard, 2015) are sounding the alarm, to rethink our evolution and the evolution of our inventions and, soon to be, creations.

This dissertation does not carry the ambition to answer such profound questions. While its author believes that Facebook, Twitter, LinkedIn and other online social networks, will eventually be replaced by a new generation of social networks, in the same manner Google dethroned, against all odds, other search engines like Altavista and Yahoo, this dissertation focuses on understanding and using this technology efficiently from a strategic marketing perspective.

Varian, Farrell and Shapiro (2004) describe how we usually try to use new technology by using old methods until we fully embrace what the new technology is about. The Heath brothers (2008) write that it is important to make people relate to things they already know. Even if marketers have already and largely embraced online social networks, based on my experience as a consultant, I find they are still using this technology with old methods. Social Media Managers and Social Media Advertising companies are using basic niche marketing techniques with the hope to generate viral marketing. Our objective is to understand virality on online social networks and find scientific methods that can be used for marketing strategy.

We believe that, even if research on online social networks is still at its beginnings, existing research on social networks, influence, consumer psychology, information diffusion, etc., provides a solid theoretical background that can be used as a solid foundation for our empirical studies.

2.5 From ethics in management and IT research to the ethics of research on online social networks

2.5.1 Introduction

Online social networks are a dangerous place. In 2002, Howard Rheingold, announced the dawn of "smart mobs". He believed that groups of people could coordinate and act collectively more intelligently and efficiently thanks to exponentially increasing network links between them, in what he called "smart mobs" or "technology enabled collective action" (Rheingold, 2007). The term "thumb tribes" was later used in popular press to describe people who act coordinate and act collectively by texting. At a conference in 2010, he also stressed on the fact that "smart mobs" could be acting for "good" or "bad": the same technology used to fight dictatorship, corruption, exploitation, etc., could be also used as a weapon in the hands of terrorists and criminals.

As we write this thesis, "someone" has been massively diffusing images and videos on Facebook attributed to Syrian anti-regime groups. The first of these posts, around 2013, displays a young girl savagely raped with a crucifix shoved down her throat. It was later on proven that those images came from a short movie of Canadian special effects artist Remy Couture (snopes.com, 2013). Many other images and videos where posted after this one and attributed to groups like the Islamic State (IS). Those photos were shared extensively before reporters of France 24 published a report showing that many images were not related to the IS (Wassim Nasr, 2014). However real and immoral crimes against Christians by Muslim extremists in Syria and Iraq took place, images massively shared on Facebook are not evidence of those acts. Instead, they have created a feeling of terror amongst Christian populations in nearby countries, like Lebanon. Who started spreading these images? For what purpose? Whatever the answers to those questions are, there is no doubt that online social media is used today to spread rumors and terrorize communities.

On a less severe way, we know that politicians and public figures use fake profiles to increase the number of friends and followers they have on Facebook and Twitter (Julian, 2013). Politicians even use fake or real profiles to spread rumors, increase diffusion of messages or create the appearance of widespread support for the ideas of a politician (Ratkiewicz et al., 2011).

The same methods are used by businesses to deceive customers using fake opinion posts and tweets (Myle Ott et al., 2012).

Popular culture gave names to different type of fake or vindictive profiles, like "zombie profiles" who follow someone on Facebook while, at the same time, concealing their identity. The owners of those profiles can be a jealous husband or wife. Elphinston & Noller (2011) using an Intrusion questionnaire show that there is a non-negligible impact between what happens on Facebook and real life.

Impersonators are also another type of dangerous account sometimes impossible to detect. During our work, we have found many fake profiles for politicians scoring the allowed maximum of 5,000 friends. This phenomenon, known as "cybersquatting" or "twitterjacking" (on Twitter), is not uncommon and is addressed in the Anticybersquatting Consumer Protection Act in the USA (Jung, 2011; Tumbridge, 2010).

Online social networks in general and Facebook in particular offer little protection to the user facing these threats. Facebook estimates the number of fake profiles to 80 million accounts at least (Protalinski, 2014; Sweney, 2012) and detecting them mainly depend on member's reporting or complaints. Moreover, Facebook's system help those users obfuscates their own personal data by allowing them to hide their names as followers, and by restricting brands to retrieve the name of more than a few hundreds of fans.

Those widespread practices pose a threat to individuals, communities and businesses. Fighting methods against this phenomenon are still on their infancy and sometimes users are left clueless and completely vulnerable as offenders hide at distant geographic locations following concurrent and contradictory international laws and anonymous proxy servers.

2.5.2 Protection of Privacy

Privacy protection and the right to one's information is a great concern for people and governments. In Germany, in 1977, data protection led to a new constitutional right for the individual. The "right to be left alone", which is the right to pass on or withhold information. This right derives from the constitutional right to free development of the personality. Since the Federal Data Protection Act 1977, data processing is only permitted based on statutory legislation with the agreement of the individual concerned. It has thus been made possible for the individual to keep track of his personal data. In 1983, Germany's Supreme Court gave the right of the individual to determine the use of his own personal data handling by the public administration and by private data processors.

The European Data Protection Directive of 1995 ensured that data are protected in the same manner throughout the single European market. The Directive expands the rights of the individual to be informed and challenges the way his data are handled. The individual has the right to know which government agencies have access to which kind of personal data.

Even though laws are meant to apply similarly to all people, interpretations vary and exceptions occur. For instance, in 2012, the European Court of Human Rights (ECHR) issued two rulings upholding the right of the media to report on celebrities and limiting celebrities' right to privacy. In *Axel Springer AG v. Germany* and *Van Hannover v. Germany*, the court examined if privacy of the actor and the members of the royal family of Monaco was violated when newspaper published photos of their life without their consent. In both cases, the court considered there was no violation of Article 10 of the European Convention on Human Rights, which protects freedom of expression, and Article 8 of the Convention on Human Rights, which guarantees a right to respect for private and family life.

On a smaller scale, Google is confronted to a dilemma when it receives requests from European citizen asking it to remove their names from search results. In the US, following the Sex Offender Registration and Notification Act (SORNA), a sex offender has to register in a public database in order to be monitored and tracked nationwide. What happens when an European sex offender asks to be removed from Google search? On a case per case basis, Google is sometimes rejecting the right to be forgotten (Hall, 2014).

More dramatically, Werro (2009), describe discrepancies between European and US laws concerning privacy rights as a schism, suggesting that this difference may be attributed to Americans' unilateral protection of freedom of the press under the 1st amendment and ECHR article 8. More recently, Walker (2012) suggests that only few aspects of the European "right to be forgotten" would be compatible with U.S. constitutional law.

Habermas (1962) illustrates how varied historical experiences may cause expectations of privacy to differ from one culture to another, while Bell (2004) anecdotally narrates how a male tea-server in China found it natural and politically correct to ask her if she was menstruating because it impacted the choice of tea. For Habermas (1962), notions of privacy are based on implicit and constantly evolving social contracts.

On the other hand, U.S. regulations on research state that private information includes information about behavior that occurs in a context in which an individual can reasonably expect that no observation or recording is taking place and information which has been provided for specific purposes by an individual and which the individual can reasonably expect will not be made public. (45 CFR 46, Section 102(f), emphasis added). In the U.S. Supreme Court decision ("Katz v. United States, 389 U.S. 347", 1967), the court argued that the Fourth Amendment protects people, not places. What a person knowingly exposes to the public, even in his own home or office, is not a subject of Fourth Amendment protection. However, what he seeks to preserve as private, even in an area accessible to the public, may be constitutionally protected.

The term "reasonable" used in U.S. regulations as well as the ambiguity that may result from the interpretation of the relation between places and information, leaves some latitude for scholars and universities to use and report information.

In this section, we have focused on European and US laws. Other countries may have completely different laws. How about China, KSA, Australia, Korea, Russia...? What about governmental agencies? How much of our private data can they access? How can we be sure that everything that goes on the web is not backed-up "somewhere"? How do we handle a conflict between an American user invoking the first amendment and an European user invoking his "right to be left alone"?

We do not have an answer to these questions.

2.5.3 Ethics in Research

Legally, based on the U.S. federal regulations governing research (45 CFR 46.116.d), informed consent may be waived only when four conditions are met:

1. The research involves no more than minimal risk to the subjects;
2. The waiver or alteration will not adversely affect the rights and welfare of the subjects;
3. The research could not practicably be carried out without the waiver or alteration;
4. Whenever appropriate, the subjects will be provided with additional pertinent information after participation.

In academic research, ethics refers to the appropriateness of behavior in relation to the rights of the subjects or the people that are affected by it (Saunders et al., 2009). Cooper and Schindler (2008) define ethics as the "norms or standards of behavior that guide moral choices about our behavior and our relationships with others". Because "moral choices" and "behavior" are perceived differently depending on the researchers, subject and even culture, can we assume a level of abstraction in the concept of "ethical research"?

Saunders and al. (2009) suggest that "research ethics relates to questions about how we formulate and clarify our research topic, design our research and gain access, collect data, process and store our data, analyze data and write up our research findings in a moral and responsible way".

Yet, the real problem resides in differences in norms among research disciplines when it comes to ethics, especially when it comes to studying the web (Bruckman & Karahalios, 2010). Deception is generally accepted in psychology while it is, in theory at least, totally banned in economic experiments. In fact, until now, a very large amount of studies in social psychology continue to involve the use of deception (Korn, 1997), leaving the debate on morality and ethics in research widely open. One of the most famous studies in psychology, focusing on the conflict between obedience to authority and personal conscience, was carried out by Stanley Milgram, a psychologist at Yale University, in 1963. In this experiment, the learner

was a confederate with electrodes attached to his arms. The subject was asked to inflict increasingly higher electric shocks to the learner up to a level that was marked "XXX". Corrigan (2013) and Korn (1997) write about a long history of deception-based research in social psychological traditions, there is a long history of using deception-based research when the topic cannot be studied differently. A recent study shows that 63 out of 117 studies published in the *Journal of Experimental Social Psychology* used deception (Hertwig & Ortmann, 2008).

Economic scholars address the problem in a completely different way. In a reference book on experimental methodology, Friedman and Sunder (1994) clearly states that researchers should not "deceive subjects or lie to them." Based on Cooper (2014), this ban has existed ages before this book. The ban certainly far precedes these books and most likely dates back to experiments by Vernon Smith and Charles Plott in the early 1900s. Yet, in game theory, in economics, many lab experiments use deception. Riach and Rich (2002) give examples of deception in field experiments on discrimination. Recently, an experiment to determine Muslim discrimination in the marketplace in France, used CVs of fake candidates with Christian or Muslim-like names to test the acceptance or rejection of potential employers (Adida, Laitin, & Valfort, 2010). In his "note on deception in economic experiments", Cooper (2014) discusses examples where subjects are told they are playing games versus another subject when, in reality, the other player is a confederate of the experimenter or a computer. He also discusses the fact of payoffs based on something other than the announced rules or tampering with the outcomes. He also discusses the use of deliberate ambiguity and obfuscation of decisive elements of the experiment. Cooper (2014) suggests that the problem is not with the acceptance or rejection of deception in economic experiments, rather about the worry that any tolerance in this case will lead to a chain reaction that will spread to other experimenters and destroy the credibility of all economic scholars.

In a stunning example of mixed norms, Cooper (2014) narrates his confusion when he was asked to write an editorial about two articles in the *Journal of Wine Economics* (JWE) that used clear cases of deception. In both experiments, researchers lied about the name and price of the wines they offered to subjects. He writes that, as an editor-in-chief for *Experimental Economics*, he would have desk-rejected both papers. Yet, he concludes that his concern do

not apply to the JWE and that it would be a matter of judgment to decide if the difficulty to collect data without deception is sufficient to allow deception.

Business and management research sees two main perspectives to analyze the problem: deontology and teleology. The deontological view argues that deception and unethical methods cannot be a mean to an end and that results do not justify the use of such methods. In contrast, the teleological perspective argues that deception can be justified by the ends. Consequently, depending on the importance of the results, acting unethically can be accepted (Saunders et al., 2009).

Because of the divergence in opinion and the need to find a proper balance between the use of methods that could be considered un-ethical, like deception, the value of the expected results, and the impossibility to achieve the study differently, college ethical committees have been created and should be sought for consultancy and approval (Greener, 2008a).

2.5.4 The special case of the Internet

The Internet poses new challenges for research ethics. Despite significant efforts from the American Psychological Association, the American Association for the Advancement of Science, and the Association of Internet Research, many questions regarding the ethical conduct of online research remain (J. Hudson & Bruckman, 2005). In fact, varied ethical codes with important discrepancies exist between academic and professional organizations (J. Hudson & Bruckman, 2005). Until today, a blurred line remains between what is public and what is private on the Internet. Boundaries between both areas is not always clearly defined (Bruckman, 2002; Sen & Lerman, 2007). Online studies are therefore a new source of research opportunities that often introduce unforeseen ethical challenges related to privacy, anonymity, and mixed norms. Often, researchers have to walk on dangerous grounds and find themselves in unfamiliar territory (Bos & Karahalios, 2009). Online research spans geographic boundaries, different and sometimes contradictory norms and multiple disciplinary domains, yet, still use disparate methods (Bos & Karahalios, 2009). This is especially the case when we study online social networks from a non-social perspective, like business or economy. Our own experience shows that it is very difficult to obfuscate the social and psychological aspect

of online social networks even when doing research from a marketing or economic perspective.

While in offline research, there is a clear difference between what is "public" and what is "private", these categories are imprecise in an online setting (J. Hudson & Bruckman, 2005). Other underlying concepts like "published", "unpublished", "ownership", "anonymous" and "identified", require reinterpretation and pose dilemmas. For example, while it is considered ethical in offline public settings, to observe people in mall, analyzing interactions on the Facebook page of the same mall sound much less ethical. Why is information in newspapers public and why can't we clearly define if information from a website like Facebook or Twitter made publically available by its users is public or private? Hudson & Bruckman (2005) suggest that, to date, most work in online ethics has been grounded in a combination of theoretical analysis and experience gained in the course of conducting Internet research.

Despite the significant amount of research that has focused on chat rooms, we still don't know if it is ethical to record conversations from a public chatroom for research purposes (J. Hudson & Bruckman, 2005). To a certain extent, chat rooms are a type of online social network where people interact and share ideas. Regarding chat rooms, some researchers consider that unrestricted membership is the criteria that determines if a space is public or private, and therefore if it can be used for research without its members' consent (J. Hudson & Bruckman, 2005). However, some scholars argue that the ephemerality of some online discussions creates a reasonable expectation that the conversation will not be recorded, even though it is clearly publicly accessible (Bruckman, 2002). Also, a significant number of studies have shown how various psychological properties induced by online environments cause individuals to act as if public spaces were private (Bassett & O'Riordan, 2002; J. Hudson & Bruckman, 2005; J. M. Hudson & Bruckman, 2004). This leaves us with a huge discrepancy between users' perception of privation in online environment and the reality of privacy in such environments. This is the reason why questions of privacy have to deal with the concept "reasonable expectations" and often lead to contradictory conclusions about whether or not consent is necessary, especially that some online environments are clearly intended to be public spaces (J. Hudson & Bruckman, 2005) where people share information with others without any restriction and even without the need to register and provide proper

authentication. When people share information publically on public Internet spaces and that their conversations are publicly archived and accessible, it can be argued that users or members of these spaces should have no reasonable expectations of privacy and that consent issues should be the same as they are for any offline public space (J. Hudson & Bruckman, 2005; Kraut et al., 2004).

Bruckman & Karahalios (2010) ask a range of questions that remain unanswered:

- 1- If a user gives access to his website, timeline of tweets, does this give the researcher the right to access comments to his posts from friends or other people?
- 2- Is it ethical to phish subjects to understand how to design better security protocols?
- 3- When should researchers anonymize and when should they attribute content to their rightful owner, especially when this content is creative and exceptional?
- 4- If someone could identify a subject despite the fact that the researcher did not mention his name expressly, can the study still be conducted?

The ownership of data is another critical issue. When a user publishes a post on an online social network, does it become the online social network's property? Does it become public property? When a user has shared a post or retweeted a tweet, does he become a co-owner of the post? Can he allow the researcher to use the information that was not initially his?

The ownership of the data may also be questionable at a different level: the platform. We consider the problem of big data and the announcement of Twitter promising to release all its data to scientists. Many questions on the subject remain unanswered: will Twitter retain any legal rights to scientific findings? Twitter will deliver billions of tweets over several years, a huge amount of personal data: thoughts, conversations, information, and state of mind of millions of people over several years. Rivers and Lewis (2013; 2014) discuss ethics in a world of big data and show how analyzing Google data in 2009 help estimating influenza activity faster than traditional methods. They mainly focus on the fact that, as Twitter-based research projects multiply, it is extremely important for researches to protect users' privacy. They set six main conditions for ethical research on Twitter:

- 1- Study designs should be transparent and readily available for the public
- 2- The content in which a tweet is sent should be respected
- 3- All data that could help identify a subject should be secured
- 4- Researchers should not look for additional data from other sources
- 5- Studies that require collecting data from a few subjects should go through an institutional Review Board (IRB)
- 6- Privacy settings set by the user should be respected.

Traditionally, research ethics have been analyzed from a theoretical perspective or by working on case studies of research practice. Both approaches, even though providing valuable insight, cannot cover all issues that subjects may have (J Habermas, 1962). Cooper (2014), an economics scholar, is convinced that by default, deception should not be acceptable without providing a strong case to justify its use. He sheds doubt on the justification of Milgram's famous experiment (1963) while, at the same time, agreeing that this experiment was enormously informative. His main argument is that harm was probably caused to the deceived subjects. Yet, his conclusion of the argument, at least regarding the studies he was analyzing, is that "publishing the papers is certainly a justifiable decision". He is also convinced that economic studies based on deception will not influence other researchers and "poison" the reputation of economic researches and studies.

For Saunders & al. (2009), in business research, the avoidance of harm and the way data is used seems to be the main concern of ethical issues in research projects. They consider a list of ethical issues:

- privacy of possible and actual participants;
- voluntary nature of participation and the right to withdraw partially or completely from the process;
- consent and possible deception of participants;
- maintenance of the confidentiality of data provided by individuals or identifiable participants and their anonymity;
- reactions of participants to the way in which you seek to collect data, including embarrassment, stress, discomfort, pain and harm;

For Cooper (2014), four rules provide a reasonable justification for deception:

1. The deception does not harm subjects beyond what is typical for an economic experiment without deception.
2. The study would be prohibitively difficult to conduct without deception.
3. Subjects are adequately debriefed after the fact about the presence of deception.
4. The value of the study is sufficiently high to merit the potential costs associated with the use of deception.

Hey (1998) states that there is a big difference between telling a lie and not telling subjects about one or more elements of the research. For him, withholding information does not necessarily constitute deception. Many scholars share the same vision and argue that deception is mainly misstating facts, sending mixed or misleading messages, or an intentional misrepresentation of facts to a subject. Hertwig and Ortmann (2008), in their paper "Deception in Experiments: Revisiting the Arguments in Its Defense", give a list of scholars who see a major difference between withholding information and deceiving subjects.

Hudson & Bruckman agree that, from a deontological perspective, depriving subjects from their right to be informed and to consent to participate, is not acceptable. Yet, they conclude that, from a teleological perspective, a subject unaware of research cannot feel disrupted or harmed. Therefore, the benefits of the situation (to scientific understanding) outweigh the potential for harm.

Buchanan (1988) suggests that there is a conflict between what is theoretically desirable and what is practically possible. Because of the problems that stand in the way of traditional methods, like delays, waiting for consent, paperwork, etc., he writes that, in this conflict between the desirable and the possible, the possible always wins.

2.5.5 Ethical issues in this research

Deception in online research is not recent subject, nor a novelty. Hudson & Bruckman (2005) discuss their own experience in studying communication in a chat room. They started by announcing to the users of a public chat room that they are scientists and that they will be analyzing communication for a paper for which they announced the subject. They mentioned that no name or identifying information would be divulged in the paper. The reaction of the users was chocking going for rejection to insults. They then tried a different approach asking users to opt-in or opt-out from the research, giving them the choice to remove all reference from their messages from the analysis and results. Based on the feedback of the users, they found that both approaches did not provide the researchers with a viable way to conduct a research. Finally, the Georgia Tech's Institutional Review Board⁷ (IRB) allowed them to conduct the research without informing the users.

Similar experiments to the ones we expose in this thesis have received approval from research ethic boards. For instance, an experiment of social bots aiming at getting a genuine insight into the ecosystem of online attacks at the University of British Columbia received the university's behavioral research ethics board approval (Boshmaf & Muslukhov, 2011). Another experiment involving the creation of a fake Facebook profile, Adrien Leblanc, that would send messages to real women was approved by the ethical committee of the laboratory of Université de Bretagne-Sud (Martin, Jacob, & Guéguen, 2013).

Ott, Cardie and Hancock (2012) state that "relatively little is known about the actual prevalence, or rate, of deception in online review communities, and less still about the factors that influence it." Our experiments try to address what we believe to be a very serious concern. With more than 80 million fake users on Facebook, the usage of Facebook to spread rumors, the usage of fake profile for stalking and understanding the inner workings of maleficence on Facebook to find ways to prevent is an urgency.

Is our approach ethically justifiable? We believe that realistic experiments are the only way to reliably understand how malevolent attacks on Facebook take place and how much harm they can do. These experiments give the research community a genuine systematic insight of the process of creation of an influential fake profile, the attraction of an initial seeding

population and a Facebook attack. This approach seems to be only way to go to analyze this phenomenon and is used and approved by the scholars who have received approval from ethical boards and which we mentioned earlier and others (Bilge, Strufe, Balzarotti, & Kirda, 2009; Jagatic, Johnson, Jakobsson, & Menczer, 2007).

In the process of writing this thesis, our work in progress was reviewed by the university doctoral board and the question of ethics was raised at every meeting. This is why we followed the rules defined by U.S. federal regulations governing research (45 CFR 46.116.d) and the guidelines set by scholars who addressed this problem:

1. We used deception after making sure that the study would be prohibitively difficult to conduct without deception.
2. Our experiment was conceived and executed in a way that it would not harm the subjects;
3. We took every precaution to protect the privacy and anonymity of the subjects;
4. The information we diffused on Facebook was information we reused after making sure it was not hurtful, dangerous, injurious or could cause prejudice to subjects;
5. We did not interact directly with the subjects. Our fake profiles did not reply or send private and personal messages;
6. The deception did not harm subjects beyond what is typical for an economic experiment without deception.
7. We strongly believe the value of this study is sufficiently high to merit the potential costs associated with the use of deception.
8. We designed our experiments in order to reduce any potential risk for the subjects (Bos & Karahalios, 2009);
9. Data will not be used for any purpose other than the experiments conducted in this thesis
10. All data is programmed to be deleted on July 15th, 2015.

In this dissertation, we have used fake profiles in Chapters 3, 4 and 5.

In chapter 3, we used a fake profile to send friend requests. This fake profile did not publish any information, wrong or false. The idea was to build a network of hubs around this profile

and wait until it generates some kind of "network effect", inspiring Facebook users to join his network. Anonymity of the fake profile's friends, the confidentiality of their messages or comments, were preserved. In addition, there was no intent to create harm to those users. Based on Greener (2008), these are two ethical criteria used in higher education business strategies.

In chapter 4, we used two fake profiles to befriend fans from a Facebook page. Again, there was no wrongful or altered information diffused, but information that was previously posted on a company's Facebook page. The company's manager was aware of the experiment and the result was a significant increase in negative WoM. This, effectually had an impact on the company's reputation but this was part of the manager's strategic plan to prepare a "rebound". We explain in Chapter 2 (A Broader Meditation on Research on OSN, page 81), how there is difference between withholding information and telling a lie (Hey, 1998) and how it is sometimes impossible to obtain an unbiased result (J. Hudson & Bruckman, 2005; 2004). More details about the ethical issues can be found in detail at the end of the chapter.

Finally, in chapter 5, we used a mixture of real and fake profile to gather mutual friend's data. The profiles we have used, real or fake, did not interact in any way with the subjects we used for this experiment. The subjects were aware of the experiment and gave us the number of friends they have on Facebook. They were aware that we were trying to uncover a part of their friends list but not about the method we will use. We, nevertheless, promised that they would have access to this research on demand.

3 Using Fake and Real Profiles to Uncover and Rebuild a Fan's Social Graph

3.1 Résumé (Français)

Les personnes agissent sur les espaces publics comme s'ils étaient privés (Bassett & O'Riordan, 2002; J. Hudson & Bruckman, 2005; J. M. Hudson & Bruckman, 2004). Facebook a progressivement permis aux utilisateurs de cacher des informations qui étaient auparavant accessibles au public sur sa plateforme, principalement, l'option de cacher sa liste d'amis et d'extraire son graphe social.

Un des éléments essentiels de contrôle du marketing viral est la structure du réseau qui est ciblé (O Hinz et al., 2011). Or, si une entreprise ne peut pas reconstituer le réseau de ses fans et dessiner leur graphe social, elle ne pourra pas optimiser sa stratégie virale.

Dans ce chapitre, nous utilisons huit profils réels et faux pour dévoiler les amis de dix personnes à la liste cachée en combinant les amis communs. Le résultat varie entre 4 et 28% du graphe social de ces personnes exposé :

Utilisateur Cible	Nombre d'amis	Amis communs avec l'expérimentateur	Amis découverts	Ratio
M.H.	1,168	19	46	3.94%
T.	2,300	61	226	9.83%
V.	290	13	37	12.76%
M.G.	1,041	46	171	16.43%
M.A.	383	18	63	16.45%
C.	401	12	32	7.98%
N.N.	530	77	123	23.21%
R.	1,250	39	56	4.48%
M.N.	700	141	196	28.00%
N.H.	1,069	21	64	5.99%
Average				12.91%

Tableau 1: Découverte de la liste d'amis cachée

L'expérience montre donc que les moyens de protection des informations privées offerts par Facebook ne sont pas efficaces à 100% surtout pour des utilisateurs malintentionnés. Elle montre aussi que les entreprises pourraient éventuellement reconstituer leur réseau de fans grâce à cette méthode ou à des méthodes similaires.

3.2 Introduction

People act as if their interactions on online public spaces as private (Bassett & O'Riordan, 2002; J. Hudson & Bruckman, 2005; J. M. Hudson & Bruckman, 2004) and therefore expect privacy settings offered by the platforms they use to protect their personal information. Unfortunately, on online social networks (OSN), the system should find the right balance between the user requirements regarding privacy, the connections to the user that may or may not have similar needs and the need of the platform, both commercially and technically. In a section on its website entitled "Who can see the Friends section of my profile?", Facebook (2014) clearly explains the dilemma between a user choice and his friends' choices and states that "mutual friends" and other information may be displayed on friends' timeline.

In a perfect world, this would seem a subtle approach to a critical problem. Unfortunately, today's OSN are far from being a perfect and safe place. Literature distinguishes three types of attacks, also known as information warfare, that can occur online: personal information warfare, corporate information warfare and global information warfare (Nitzberg, 1998).

Online life has a strong impact of offline life, sometimes resulting in fights and breakups (Vitak, 2008; Wang et al., 2013). In her thesis, Vitak (2008) discusses several aspects of jealousy in relationships where a jealous partner may scrutinize the friend's list of his partner in search of exes and how this, sometimes, results in fights and breakups. This type of behavior is known as "Facestalking", defined by Young (2011) as the "act of reviewing in detail another person's Facebook page to follow their activity without necessarily engaging in any form of communication with the person".

On a second level, a person or group may use the friends' list of a manager, teacher, star, politician or another type of public figure to discredit it or benefit from his contact list. On online social networks, brands are not in their natural habitat and perceived as uninvited strangers (Fournier & Avery, 2011). They are the target of consumer activism and frustrated employees (Hollenbeck & Zinkhan, 2006). Having access to an employee's or a manager's list of friends may give leverage to the assailant.

On a third level, the 2006 war between Hezbollah (Pro-Iranian party in Lebanon) and Israel introduced a new form of conflict, the "informational warfare" (Gaines-Ross, 2010b). In fact, rumor on online social media to spread discrediting rumors over the Internet has increased significantly since the beginning of the war in Syria. Several online and offline sources try to uncover those rumors. Newspaper websites and rumor checking websites have abundant references to false rumors that spread on the Internet in the last couple of years (Snopes.com, 2013; Nasr, 2014; Lebaneseforces.com, 2014, etc.).

For all these reasons, a Facebook user may choose to keep his friends list private.

However, a brand, a researcher, a marketer, aiming to draw the social graph of a fan, a group or a population, would need to uncover a user's connections (friends) in order to have a glance of the connections in his network and the networks surrounding him and determine his role as a hub, a bridge or a fringe in a larger population of fans.

In this chapter, we investigate this privacy option in Facebook's settings and we question its efficiency. Using a triangulation technique, we attempt to uncover the friends' network of a several Facebook users who chose to hide their friends list. We then contact these users and ask them to reveal to us the number of friends they have. We finally compare the number of friends we have exposed to the real number of friends they have and analyze the results.

3.3 Facebook and Friend's List Privacy Settings

Facebook privacy settings have known several amendments and improvements since the creation of the website. In particular, the "Who can see your friend list?" setting has several settings from the most unprotected, allowing the "Public" to access the list, to the most

limited, letting the only the list owner to have access to the full list of his friends. Between the two options, the user can fine-tune the settings to allow his friends and acquaintances, his friends only, some of his circles or a custom design set of friends to have access to the list.



Figure 7: Facebook Friend List Privacy Setting

We consider the most restrictive setting, allowing the user only to view his friend list. While a user can think that this setting hides his friends list from anyone, the practical aspect of such a setting in an undirected online social network environment like Facebook is not that simple. What happens when you are a friend with someone who chose not to hide his Friends list? His friends will be able to see you are both friends, exposing one person in your list. In its help page titled "who can see the friend section of my profile" dedicated to this privacy setting, Facebook explains the issue writing that, depending on the privacy settings of one's friend, Facebook users may be able to see mutual friends they have with (Facebook, 2014). Yet, even with this inconvenience, a malicious user who is not related to the targeted user in real life and does not share the same social circles may only expose very few of his friends.

In this experiment, we define a method to uncover part of the friends list of a user and analyze its efficiency.

3.4 Methodology

3.4.1 Mutual Friends on Facebook

We target profiles with protected friends list from the Lebanese population. Based on the Facebook advertising system, at the time of this experiment (Nov. 9, 2014), there are 1,940,000 Facebook users living in Lebanon. Our experiments targets users of this population who are friends with Nasri Messarra, the author of this thesis, and who have chosen to hide their friends list completely but setting the privacy level for this option to "only me". We chose personal friends of the author in order to be able to contact this target audience later on and ask them for their friend's count and evaluate the efficiency of this method in uncovering hidden friend lists.

In a "normal" Facebook situation, any person is able to see mutual friends he shares with any Facebook user, friend or not. However, he will not be able to see non-mutual friends of a person who chose to hide its friends list even if he befriends her.

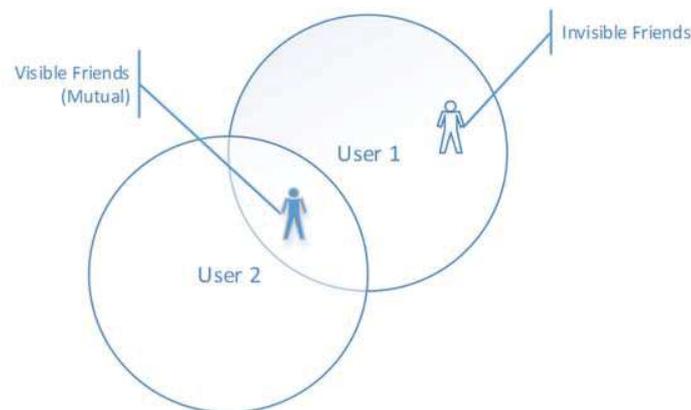


Figure 8: Visible and Invisible Friends of a Facebook User

In a malevolent situation, a jealous companion (Vitak, 2008; Wang et al., 2013), a business competitor (Hollenbeck & Zinkhan, 2006) or a smart mob (Rheingold, 2002, 2010) may be interested in uncovering more friends than allowed by the Facebook system. Using one profile (Figure 8) a malicious user only unravels a small portion of the friends list. We ask ourselves

what happens if the same user attacks using more than one profile, real or fake, or if this is done by a team of users. Each malicious user or profile will be able to see a subgraph, his mutual friends, of the total graph, the list of friends, of the targeted user.

We ask ourselves:

- How efficient is this method using a small number of profiles?
- And, in theory, what would be the number of profiles and friends needed to determine the whole friends list of a Facebook user?

In this experiment, both attackers and target are from the Lebanese Facebook population, a population of 1,900,000 users based on Facebook's ad system on November 9, 2014. Using 4 real profiles and 4 fake profiles totalizing 13,394 users. The Table below (Table 9, p.105) shows our attackers profiles, their number of friends, their type (fake or real) and the density of each network.

The table also shows the total number of unique friends of the combined profiles and the density of the resulting graph.

We notice that the density of the graph is 0.2%, a very low density probably because two of our main real profiles (M.AS. and M.AC.) are the profiles of political figures and that, for our most important fake profile (G.B.), we targeted people randomly. On Facebook, there is a great confusion between strong and weak links and "Facebook friends" are often acquaintances or people that the user met once or twice. Politicians and public figures are no exception and, often, their Facebook friends are supporters they have met occasionally and who don't know one another, which could explain the low density of their graph. Because those profiles and the fake profile have at least 4,000 friends each, the low density of those graphs strongly reflects on the overall density of the graph of the 8 attackers.

Name	Number of Friends	Type	Density
------	-------------------	------	---------

M.AC.	4,985	Real	0.014
S.K.	637	Fake	0.171
Nasri Messarra	567	Real	0.048
A.ME.	89	Real	0.085
A.N.	117	Fake	0.113
G.B.	4,386	Fake	0.006
M.AS.	4,997	Real	0.011
K.C.	208	Fake	0.072
Total (sum)	15,986		
Total (unique)	13,394¹		0.002

Table 9: Attackers Profiles

With the eight profiles to which we have control, we managed to compile a social graph of 13,394 unique users with a graph density of 0.002. We explain the low graph density by the fact of the three most important contributors to our network are politicians and that their networks are mostly built around sparse acquaintances from different social circles, friends, supporters and fans that are not related in real life.

We also believe that the low density may be to our advantage as a sampling method, increasing the probability of uncovering mutual friends.

¹ Excluding mutual friends. This is the total number of unique users.

We select 10 Facebook users:

- M.H., who has 1,168 friends on Facebook and discovered she can hide her friends list less than a year ago and found it interesting because she prefers not to expose her "circle of friends".
- T., with 2,300 friends who chose to hide her friends list to avoid having people who know her contact her friends and send them request. We note that T. is a social activist and a journalist.
- V., with 290 friends. She says the reason she tighten her privacy is to prevent people from writing on her wall. Because the friends list setting is irrelevant with the possibility to write or not on her wall, we believe she just set all her privacy settings to the maximum without exactly knowing what each setting does.
- M.G. has 1,041 friends and she says she likes to set to private whatever she can.
- M.A. has 383 friends and he likes to hide his friends list for business purposes and to keep his personal life private.
- C. has 401 friends and did not know she had this privacy setting on.
- N.N. has 530 friends and likes to keep her list private to avoid privacy invasion and because she wants to avoid accepting people who are not close friends out of embarrassment.
- R. has around 1,250 friends. She likes to keep her personal life private and avoid accepting people out of embarrassment.
- M.N. has 700 accepted friends and more than 100 pending requests. She is very selective in accepting new friends and always tempted to unfriend people from her list.
- N.H. has 1,069 friends and completely forgot she has this privacy setting on. She likesto keep her list private.

The table below shows the list of targets and their friends:

Target	Number of friends
M.H.	1,168
T.	2,300
V.	290
M.G.	1,041

M.A.	383
C.	401
N.N.	530
R.	1,250
M.N.	700
N.H.	1,069

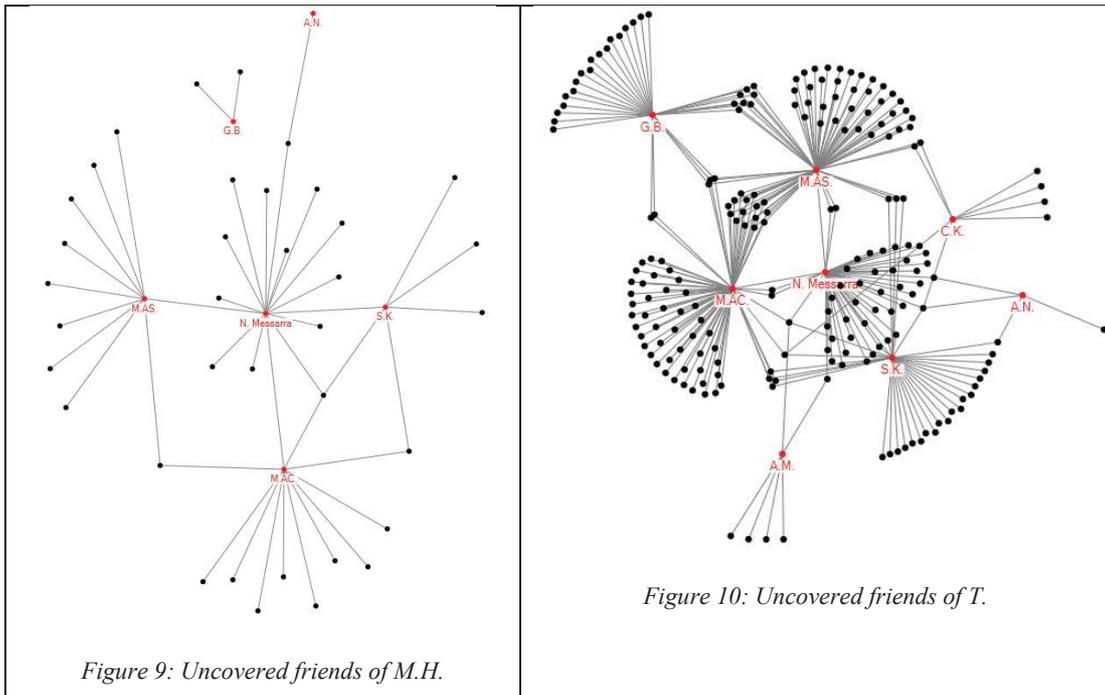
Table 10: Targeted users and friends count

3.4.2 Combination of Mutual Friends

Using Facebook applications like NetVizz (Rieder, 2013) and software like NodeXL (Hansen, Shneiderman, & Smith, 2011) and Gephi (Bastian, Heymann, & Jacomy, 2009) to extract Facebook friends and draw social graphs, we search and compile all the mutual friends of our targeted users.

The procedure is to log in to Facebook with each attacker's profile, search for mutual friends between the attacker and the target, copy them into NodeXL, then repeat the procedure with the second attacker.

The resulting graphs are shown below. The attackers are labeled and displayed in red. For privacy and ethical reasons, the names of mutual friends are not shown on the graphs.



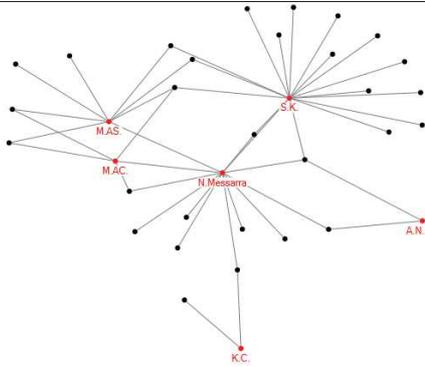


Figure 11: Uncovered friends of V.

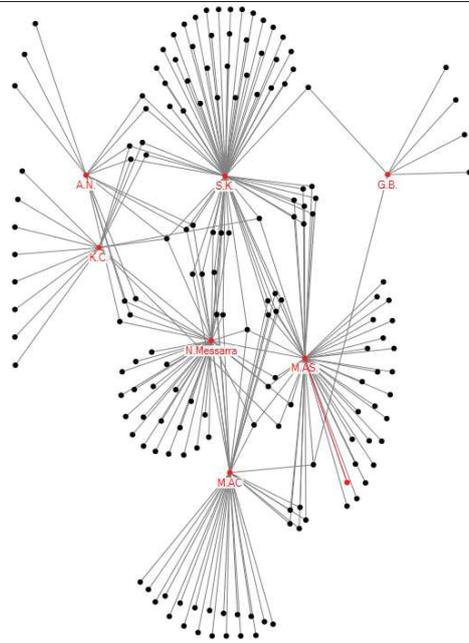


Figure 12: Uncovered friends of M.G.

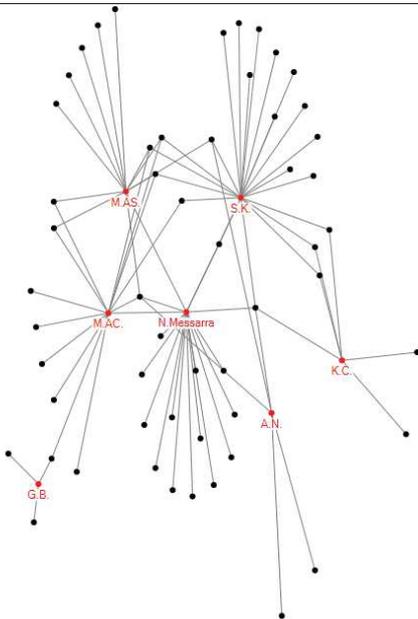


Figure 13: Uncovered friends of M.A.

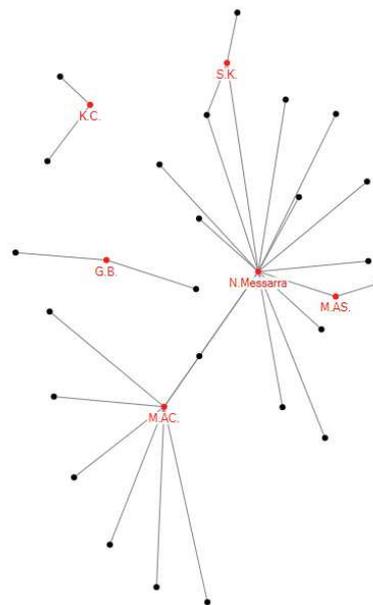


Figure 14: Uncovered friends of C.

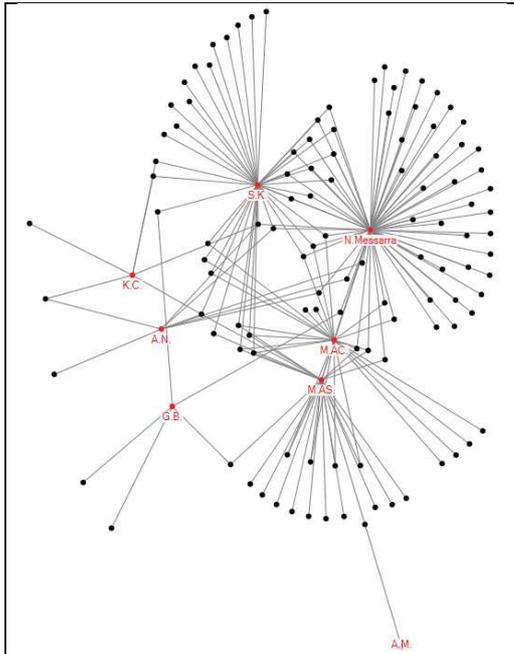


Figure 15: Uncovered friends of N.N.

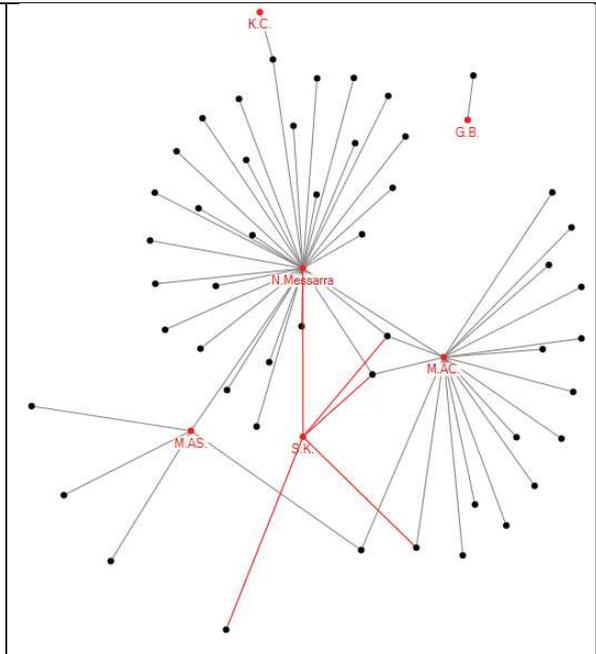


Figure 16: Uncovered friends of R.

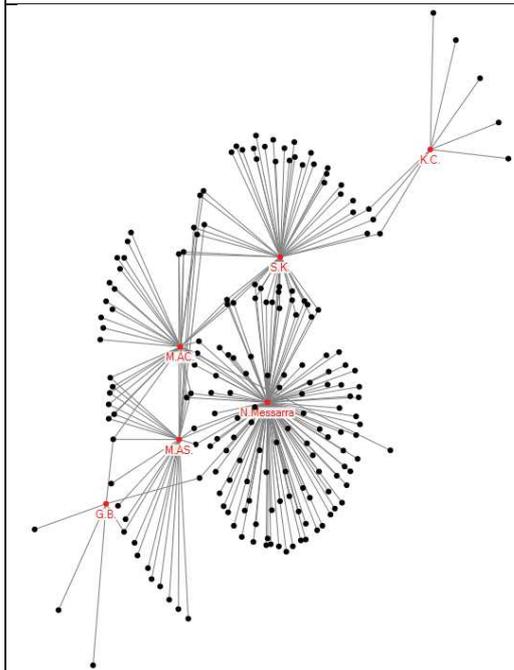


Figure 17: Uncovered friends of M.N.

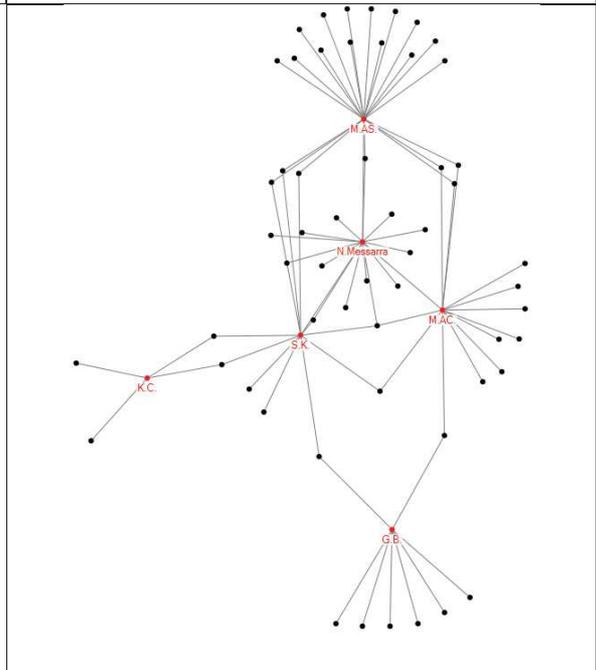


Figure 18: Uncovered friends of N.H.

The following step in this analysis is to compare the real number of friends with the number of uncovered friends. The percentage of uncovered friends for each target varies from 3.9% to 28% with an average of 12.91%.

Target	Number of friends	Mutual Friends with the Experimenter	Uncovered Friends	Ratio
M.H.	1,168	19	46	3.94%
T.	2,300	61	226	9.83%
V.	290	13	37	12.76%
M.G.	1,041	46	171	16.43%
M.A.	383	18	63	16.45%
C.	401	12	32	7.98%
N.N.	530	77	123	23.21%
R.	1,250	39	56	4.48%
M.N.	700	141	196	28.00%
N.H.	1,069	21	64	5.99%
Average				12.91%

3.5 Discussion

In this experiment, a random sample was used for both the target and the attackers even though two variables may have influenced the results:

1- Both the attackers and the targets were selected from population of the same geographical location. Based on recent studies (Backstrom, Sun, & Marlow, 2010), in life and on Facebook, social connections are almost always geographically close. By choosing targets and attackers from Lebanon, the probability of finding mutual friends significantly increases.

2- At least one of the attackers' profiles, the experimenter, is a friend of all targets. Being a member of at least one common circle in real life (alumni, work colleagues, family, etc.) with each target increases the probability of finding mutual friends. This is observable in the table below where we compare the percentage of common friends with the experimenter to the total number of uncovered friends. In some cases, this ratio reached 71.9% of the total while, in other cases, it was only 26.9%. The average number of mutual friends with the experimenter is 43.34%, indicating the significant role of the experimenter's profile even with a small network (567 friends) compared to the other attackers (up to 4,997 friends).

Target	Mutual Friends with the Experimenter	Uncovered Friends	Augmentation
M.H.	19	46	142.11%
T.	61	226	270.49%
V.	13	37	184.62%
M.G.	46	171	271.74%
M.A.	18	63	250.00%
C.	12	32	166.67%
N.N.	77	123	59.74%
R.	39	56	43.59%
M.N.	141	196	39.01%
N.H.	21	64	204.76%
Average			163.27%

Several methods exist to optimize a sample and find the missing edges and vertices in a network (Guo, Yang, & Zhou, 2013; Leskovec et al., 2010; Lu & Zhou, 2010; Mouw & Verdery, 2012; Yan & Gregory, 2013). One of these methods, the Respondent-Driven Sampling or RDS (Wejnert & Heckathorn, 2008) could be used as a technique to select profiles or attract friends from a given population to a fake profile's network of friends in an attempt to completely recreate the network of the attacked person.

3.6 Conclusion

A thin blurry line exist between what is public and what is private on the Internet, and most people expect to have their private life protected even on online social spaces (Bassett & O'Riordan, 2002; Bruckman, 2002; J. Hudson & Bruckman, 2005). By setting their friends list as private, most Facebook users think this information will be protected and hidden from prying eyes.

The "fine print" Facebook displays on the friends list privacy page explaining in very few words that mutual friends will not be hidden but this is not enough to show how fragile their privacy is for someone who is trying voluntarily and malevolently expose their hidden information.

This experiment has shown that a brand, a researcher, or a malevolent Facebook user can, using a random population of real and fake Facebook accounts uncover up to 71% of the

hidden friends list of another user. We believe that, using an optimized sampling technique like RDS, more friends can be exposed.

From an ethical and moral perspective, this experiment has shown that jealous companions (Elphinston & Noller, 2011; Vitak, 2008), smart mobs (Rheingold, 2002, 2010) and malevolent users can expose on online social networks what users believe to be private and protected. Eric Schmidt, Google's CEO, suggested, in 2009, that "if you have something you don't want anyone to know, maybe you shouldn't be doing it in the first place" (Newton Lee, 2012). Maybe this is the only way left for a connected individual to protect his privacy.

From a research and marketing perspective, Facebook barriers to research can be circumvented using this method or similar methods to be able to have access to fans or friends' social network and recreate the structure of a network, an essential element of viral marketing strategies (O Hinz et al., 2011).

4 A web of hubs: the Spartacus experiment

4.1 Résumé (Français)

Chen et al. (2009) suggèrent que les utilisateurs des réseaux sociaux en ligne profitent parfois des fonctions de recherche d'amis communs ou « d'amis que vous connaissez peut-être » pour se connecter à des inconnus qui jouissent d'un statut intéressant et utile pour eux ultérieurement.

Dans cette expérience, nous répondons aux deux questions suivantes :

- Sur Facebook, un faux profil entouré d'un réseau d'amis formé de hubs sociaux (personnes connues, personnes fortement connectées à d'autres amis, etc.) peut-il s'attirer de vrais amis ?
- Ce faux profil peut-il être un vecteur de diffusion d'informations efficient ?

L'expérience que nous avons intitulée Spartacus ou « pot-de-miel inversé », montre qu'en effet, un faux profil avec un réseau de hubs sociaux sur Facebook va s'attirer un nombre d'amis important. Dans notre cas, l'expérience a pris fin en 2012 avec une population de 407 hubs. Or, jusqu'aujourd'hui, le profil s'attire de nouveaux amis (population totale d'amis 675 au 22/9/2015).

A la deuxième question, des statuts à succès affichés sur les fils d'actualités de personnes réelles redistribués par ce profil n'ont reçu aucun engagement (entre 0 et 3 personnes engagées sur vingt statuts).

Ceci nous permet de conclure que, si un faux profil peut s'attirer de vrais amis grâce à un réseau de hubs sociaux, ceci ne signifie pas forcément que ces personnes vont s'engager avec lui et avec ses messages.

4.2 Introduction

Great concern has emerged lately regarding online social networks (OSN) from a marketing perspective. This concern is mostly related to the management of different online social network platforms (Facebook, Twitter, Foursquare, etc.). Companies have already understood the impact of such networks in terms of viral communication, targeted marketing campaign and social CRM (SCRM). In fact, most of them invest today in OSN marketing and for many the criterion of success is the number of followers (Twitter) or fans (Facebook). Yet, fans are not everything and there is a real need to better understand the workings of social media (Hoffman & Novak, 2012).

Indeed, the shape of the network and the connections within the network are the key elements of successful viral campaigns (Delre, Jager, & Janssen, 2006; Liu-Thompkins, 2012; Trusov et al., 2010). Since the seventies, scholars have addressed social networks from a social perspective (M. Granovetter, 1985, 1995, 2000) and tried to investigate the workings of these networks and the behaviors of their members (Krackhardt & Hanson, 1993; Krackhardt, 1995; Lazega, 2007; Wasserman & Faust, 1994). Studies shed light on the role of each member in the network (Lazega, 2007; Wasserman & Faust, 1994) as a node, hub, bridge or fringe using parameters like degree centrality, betweenness, closeness, and eigenvector centrality (Freeman, 1977, 1979; Opsahl, Agneessens, & Skvoretz, 2010) and place the cornerstone for the transmission of information in the network (WOM, e-WOM and virality). Scholars agree that the success of an online campaign is linked to the seeding strategy and specifically the selection of seeds (Delre et al., 2006; Katona et al., 2011; Trusov et al., 2010) in terms of nodes, hubs or fringes. Y. Liu-Thompkins (Liu-Thompkins, 2012), for instance, emphasizes the importance of the first generation of seeders and focuses on the selection on the first seeders, their number, the strength of ties, the level of influence and the interest homogeneity...

Social network theories allow us understanding the workings of a network and the behavior of its members, but they mostly adopt a descriptive and analytical approach, following Granovetter's social approach (M. Granovetter, 1985, 1995, 2000). They act as observers on

already established networks. Here, we intend to explore the building and development of a social network as creators, through a strategic entrepreneurial perspective. This position raises specific questions: what is the role of the online social network creator? What are the strategic actions we can recommend to develop his online social network? Can an online social network reach a critical mass allowing it to sustain itself and increase in size without further intervention?

In order to identify these strategic actions, we have elaborated an original non-automated experiment to build and observe an online social network in a controlled environment. For this, we have created a fake Facebook profile and surgically invited and cumulated enough friends to reach a point where this fake profile began receiving friend requests without any intervention from our end. We observed the diffusion of this network for a year (zero to 427 adherents).

We know that consumers trust net pals who are perceived to have a strong relationship with each other more than those who are perceived to have a weak relationship (Pan & Chiou, 2011). Therefore, we intentionally and meticulously chose social hubs as friends and avoided sending friend requests to less connected people in the network of friends of friends of our fake profile. We tried to analyze the effects of putting a fake profile in the center of a network of social hubs.

By creating spambots, community managers try to lure online social network users in thinking that peer customers, not companies, are diffusing brand related information. The advantages of this system, if it succeeds, are tremendous: they artificially mimic consumer-to-consumer communication using fake profiles, a type of communication known to influence much more than direct business-to-consumer communication. An important literature, like Bronner & al. (2010), Hinz & al. (2011), Liu-Thompkins & al. (2012) and Zhang & al. (2010), confirms how consumer generated content is trusted while companies are perceived as intruders on online social networks (Fournier & Avery, 2011).

Earlier in this thesis, we analyzed the case of Kenza Cullen, one of many fake profiles on Facebook sending marketing messages to give the impression that real users are engaging

with the brand. We noticed that "Kenza Cullen" did not succeed in creating a buzz and very few users engaged with its posts.

Bakshy and al. (2011) suggest that there is no reliable prediction for the success of a WOM marketing strategy and that the best option is to target a large number of potential influencers. In this chapter, we reproduce the Kenza Cullen experiment using a different approach to optimize the social network of our own spambot and try to answer the following theoretical questions:

Q1 – Can we create a network of social hubs around a fake profile?

Q2 – Can a network of social hubs around a fake profile attract real Facebook users?

Q3 – By diffusing information to social hubs, can this fake profile create viral user-generated-content?

4.3 1. The creation ex-nihilo of an attractive online social network

4.3.1 Objectives of the experiment

Our experiment is an attempt to create an *inversed honeypot* online social network for a fake profile. We borrowed the term “honeypot” from the emailing terminology. For mail servers, “honeypot” represents a real email address used to attract spammers in order to expose them. In our experiment, we define “inversed honeypot” in OSN to be a fake profile attracting real people. We consider this experiment to be a success if we can attain a critical mass of friends by sending friend requests and then, have at least one person attracted to the network and sending a friend request to the fake profile without inducement. A second objective is to test the level of influence of our inversed honeypot profile: can it help creating a buzz?

4.3.2 The fake profile and the befriending model

4.3.2.1 *The creation of a fake profile on Facebook*

It was important to create a profile that would be neither attractive nor repulsive. We also wanted no confusion with a real person and gave him a completely heterogeneous name “Spartacus”. He is in his mid-forties, knowing that younger people would be more inclined to maximize their online social capital (Junghyun Kim & Lee, 2011a). He is Lebanese like his five initial friends (involved in the experiment) and graduated from a Lebanese school. He is living abroad (France).

We also picked up three photos from the Internet (for 2 different persons with some resemblance) and published them in the profile’s photo album.

The main issue for starting our experiment was to find a friend’s base on which to build up the network. Our initial friend’s base started with five friends which were informed that “Spartacus”, our fake profile’s name, is not real and used for an experiment: Youssef (Joseph), Maya, Charbel, Tanya and Michele. We are sure that our identity was kept secret during the whole experiment and up until the date of writing this document.

In opposition to an experiment conducted at the University of Columbia (Boshmaf & Muslukhov, 2011) which used bots (automated scripts) to create accounts and send friend requests, we decided to do this manually to be able to control, orient and analyze our social network. The method was to select potential hubs or people with high centrality by selecting Facebook members with the highest number of “mutual friend” at a fixed rate: every 10-15 days, we would target a maximum of 40 people with whom the fake profile has the largest number of mutual friends and wait for their feedback.

4.3.2.2 *Bias prevention*

To minimize the bias in our method, we distanced ourselves as much as possible from the archetype of the fake profile as described by the latest security report from Barracuda

Networks (“Attackers Use Fake Friends to Blend Into Facebook,” 2012); a security company specialized in online security:

- Our fake profile is a male, in opposition to 97% of females in common fake profiles
- Our fake profile is married with three children in opposition to bisexual (60% of fake accounts)
- Our fake profile shows no entertainment interests
- The fake profile does not tag, reply, interact (57% of fake profiles update their Facebook statuses and most fake profiles use 136 tags per four photos)
- The fake profile has a bizarre first name, “Spartacus”, making it very hard to be confused with someone else

The fake profile is 45 years old which also reduces the probability of him getting befriended given the fact that only 19% of users are aged 45 years and above (Source: facebook.com, pingdom.com). Statistics show that people of 40 have an average of 75 friends against 1,000 for people in their twenties (“Facebook,” 2013).

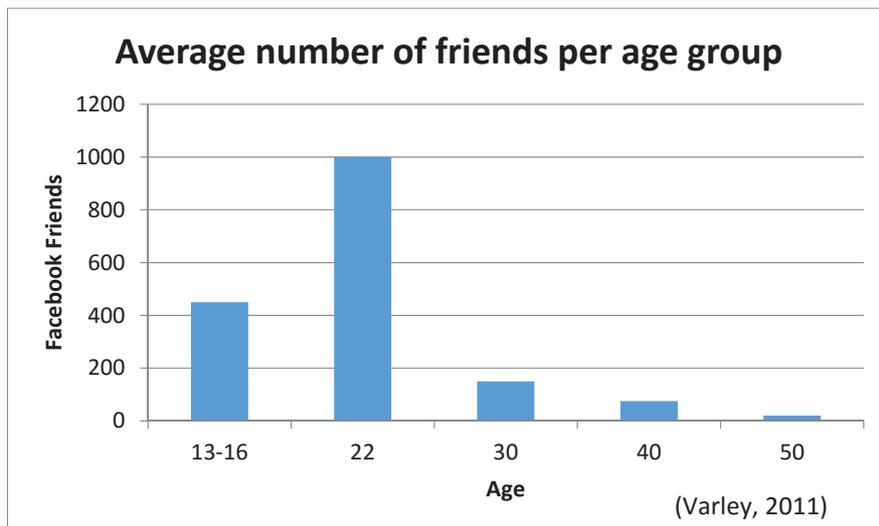


Figure 19: Average number of friends per age group on Facebook

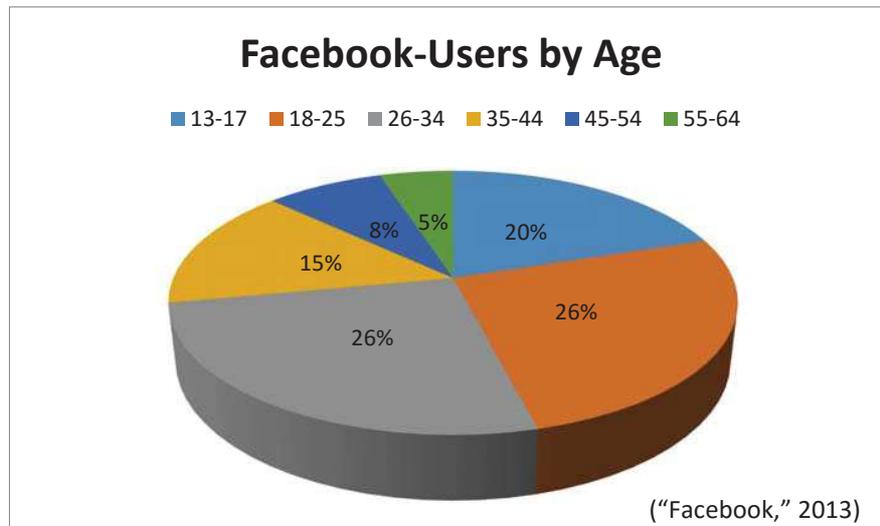


Figure 20: Facebook users by age group

The objective was to reduce the benefit of becoming friend with this person to a minimum. There should be no maximization to one's own profile: by adding an unknown person to your own social network, especially someone that can be hardly be confused with someone else, because of the esoteric first name, you may be infecting your own network with a vicious person. We consider that, even though the number of friends in one's OSN may be associated positively with well-being (Kim & Lee, 2011) and a demonstration of social success, accepting unknown people to one's network may have negative repercussions on his life and his network:

- Someone (you know or not) can use a fake profile to spy on you
- Someone can use a fake profile to publish spam on your wall
- Someone can use a fake profile to harass you with
- This can be an entry point to malware (via posts, apps, link sharing, click-jacking, etc.)
- If your real friends become aware that your own social network is infected, it may lead to having those friends unfriending you.

- Last but not least, having three fake friends (or spammers) in your network may expose your profile to piracy using the “trusted friend feature” (Rashid, 2012). This last issue may have been addressed by Facebook by the time this article is published.

The fact that we have had difficulties increasing the friend base of the fake profile (less than one accepted request for every 6 requests sent at the beginning of the experiment) shows that people are aware of the dangers – or, at least, are cautious - when accepting friend requests.

Finally, it was important not to let the fake profile’s network be infected by other fake users and destroy all the evidence needed to prove our point. This is why we visited all profile pages before accepting or rejecting a friend request. Because the authors of this article are IRL (in real life) friends of the initial friends group, it was easy to investigate discretely the validity of friend requests.

4.3.2.3 The befriending model

Scholarships have studied the development of the social network and examined the acceptance or the rejection decision of entering a network. One of these experiments was conducted by Boshmaf, Muslukhov, Beznosov & Ripeanu (Boshmaf & Muslukhov, 2011) at the University of Columbia and used bots (automated scripts) to create fake Facebook profiles and send friend requests automatically. One of the methods used to target potential friends was to target “mutual friend”. While this method can help create a fake profile with a network of friends in a few hours, we will not be able to guarantee the high centrality we are looking for because hubs, bridges or fringes will be targeted simultaneously and have equal chances of joining the social graph of the fake person.

The objective behind the befriending model is to create a “network of hubs”. We only selected the people with the highest number of friend connections to the inversed honeypot network assuming that, by extrapolation, they would probably have the highest number of connections to other networks of friends. We also avoided sending requests to the people with few connections (small number of “mutual friends”) to the inversed honeypot network

in order to end up with a network exclusively constituted of hubs or friends with high degree centrality.

Using the “people you may know” or “mutual friends” feature in Facebook, we started sending “friend requests” to the people with the most “mutual friends” at a maximum rate of 40 requests sent every 10 to 15 days. Because of the very small number of initial friends (five), it was difficult to find more than two or three mutual friends at the beginning accepting our requests. Also, the initial friend’s base was heterogeneous (only 2 of the initial 5 friends knew each other IRL and online) and worked in different fields and had a different history (school, age, experience, etc.), mutual friends of the first generation would be very popular in order or linked IRL to know both.

The reason for the waiting period is double:

- Avoid being blocked by Facebook or suspected by friends of friends because of the high frequency of requests
- As the inversed honeypot's network grows larger, mutual friends with more connections to the network become available (higher number of mutual friends) and we, thus, would be able to select new friends with a higher number of connections (to a larger number of mutual friends)

We also targeted, from time to time, a few popular people as TV and radio presenters just to increase the number of friends. These people are, by definition, popular.

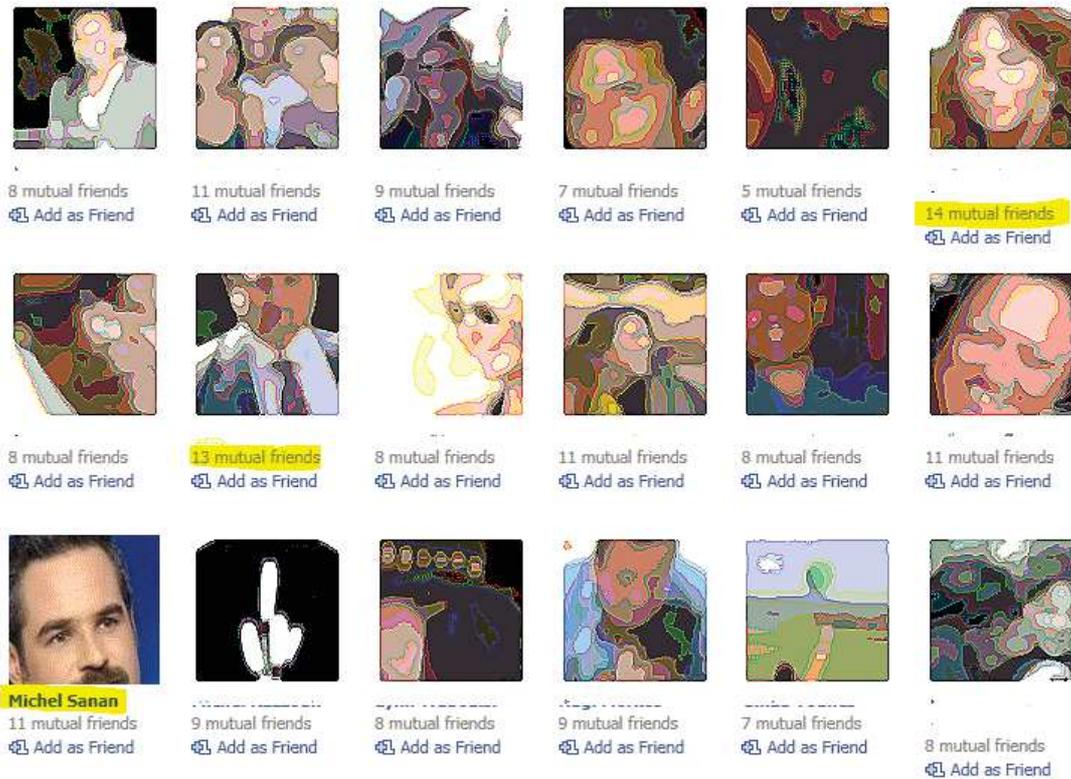


Figure 21: Sending requests based on high number of mutual friends and real-life popularity (some pictures have been blurred for privacy reasons)

Data was extracted from Facebook using several tools and analyzed with NodeXL² and the Social Network Importer plug-in³ for this tool.

² <http://nodexl.codeplex.com/>

³ <http://socialnetimporter.codeplex.com/releases/view/102741>, 2013.

4.4 2. The inversed honeypot social analysis

4.4.1 Social Graph Centrality

Studies suggest different methods to measure the density and activity of social networks as well as the role of the individuals and their centrality within these networks (Krackhardt & Hanson, 1993; Krackhardt, 1995; Lazega, 2007; Wasserman & Faust, 1994).

Several concepts are used to evaluate centrality within a social network:

- Degree centrality is defined by the number of connections incident to a node (Freeman, 1979).
- Closeness centrality is the average node of a node to all other nodes in the network (Newman, 2005; Opsahl et al., 2010; Sabidussi, 1966).
- Betweenness centrality is related to the number of times the node acts as a bridge to other nodes (Brandes, 2001).
- Eigenvector centrality measures influence by assigning relative scores to all the nodes (Borgatti, 2005).
- Page Rank is a variation of the Eigenvector centrality. It is used as a search parameter by Google's search engine (Tanase & Radu, 2009).

We also needed a reference to compare with Spartacus' network. We used the Facebook social network of a person with the same characteristics of Spartacus: in his forties, same graduation school, also married with children, etc. We also took the network of a politician (around five thousand friends, the Facebook limit) as a second network of reference.

4.4.2 The multiplier role: a determinant actor in the network

There are several questions that arise from the outcome of our experiment. One of which is the role of each one of the initial seeds separately: what did each seed bring to the network?

Using the social graph, we compared the resulting nodes for each seed. I was obvious that some seeds, like Maya, brought dozens of friends and friends of friends to the network while none of Joseph’s and Charbel’s friends accepted our request even though the procedure and targeting was the same for the five initial friends of Spartacus (sending invitations to mutual friends) and that these friends had a more or less similar number of friends which was between 300 and 500 friends, except for Tanya who had more than 1,000 friends.

Should we have started the experiment with five people with the same profile of Charbel and Joe, the result would have been a failure because none of their friends accepted our friend request. Knowing that Charbel and Joseph have more than 400 friends each and that they are at the main hub or epicenter of their own networks (everyone in their network is their friend), we have to confirm the findings of several authors suggesting that the online social graph can be different from the real-life social graph and that Facebook friends can be just acquaintances (Tong, Van Der Heide, Langwell, & Walther, 2008a). So, the question that arises is how do we detect a “real” hub or influencer on Facebook? We discuss this issue in the last section of this document.

The table below shows the number of direct mutual friends (direct links) and friends of friends.

It is worth mentioning that IRL, Tanya is very popular and socially involved in several NGOs and activities and has the highest number of Facebook friends (more than 1,000) compared to all other members of the initial group (less than 500). Yet, it is finally Maya who helped attracting the higher number of friends through her network. Many findings corroborate the facts that the online social capital can be very different than traditional offline networks (Tong et al., 2008a).

	Mutual Friends at the end of the experiment	Friend of a Friend
Maya	22	412
Charbel	0	0
Michele	27	265
Tanya	5	51
Joseph	1	0

Table 11: Initial friends group and resulting intra-network links

Another significant value is the ranking of our initial population in terms of degree. Even though Maya is the seed that result in the highest number of friends of Spartacus, it is ranked 390th, following Michele in the 380th position. Asma, the friend of Spartacus with the highest degree is a very popular and active on Facebook. She is a friend of Maya. Ramia, on the other hand, is a friend of Tanya.

	Rank	Degree	Betweenness Centrality	Closeness Centrality	Eigenvector Centrality	PageRank	Clustering Coefficient
Asma	1	260	2924.315	0.002	0.007	3.274	0.221
Ramia	2	252	1788.305	0.002	0.007	3.091	0.265
Elie	3	249	1468.316	0.002	0.007	3.021	0.288
Omar	4	235	2447.816	0.002	0.006	3.019	0.230
Alexandra	5	222	1250.292	0.002	0.007	2.724	0.280
						
Tanya	390	22	1243.585	0.001	0.000	0.949	0.216
						
Michele	380	26	7.662	0.001	0.001	0.448	0.514
						
Maya	390	22	1243.585	0.001	0.000	0.949	0.216
						
Tanya	414	13	1.320	0.001	0.000	0.301	0.603

Table 12: Centrality of some of the members of the engineered network

4.5 3. Diffusion using the inversed honeypot as a vector

This paper was initially written, presented as a poster, and published in the proceedings of the EURAS conference in 2012 (Messarra & Mione, 2012). Three years after the beginning of this experiment, in 2015, our fake profile is still receiving friend requests. Even though we have not sent any new friend's request since June 2012, our fake profile continued receiving friend requests. On July 2015, his friends lists had reached 671 friends. An increase of more than 200 friends since our first writing of this chapter as a paper for the EURAS conference. Our attempted to answer our third theoretical question started two years after the initial question.

To answer this third question, "can this fake profile create viral user-generated-content by diffusing information to social hubs?", we posted 20 statuses with a four days lag time between each status. Statuses were divided into the following categories:

- 1- Advertising: we experienced the result of posting messages about brands and products with a comment that resemble to a consumer to consumer message: "would really like to have this one for my birthday", "Waow! Great idea!", etc.
- 2- Family: we experienced the results of posting photos of children playing with messages like "Julien and friends".
- 3- Social engagement: we experimented the results of posting about social concerns of the moment (campaigns against depression, etc.)
- 4- Political and human concerns: we experimented posting about political issues (situation in Lebanon, support for the Lebanese army) and human concerns like the Alia Bibi case, a Pakistani woman condemned to death for blasphemy.

After the testing period, we noticed that 19 over 20 posts received between 1 and 3 likes only. Only the last post, about the Alia Bibi case was liked twice and shared 3 times.

In the table below, we show the statistics of four of the posts we have published. These posts had a relatively high engagement rate on their creator's pages. Two of these posts were publish on the timeline of two of our profile's friends, while the two other posts were published on timelines outside of his circle of friends:

Date	Post	Engagement on Original Post	Engagement on Fake Profile
April 15, 2015	Nasri Messarra: "Issam Breidy serait-il moins mort?"	62 likes, 12 shares, 9 comments	1 like
December 12, 2014	Dessange: Joyeux Noël (Photo)	18 likes, 1 share, 1 comment	1 like
September 22, 2014	Asma Andraos Yassine: Dessine moi un autre pays...	172 likes, 1 share, 26 comments	0 likes
September 20, 2014	Said Francis: iOS 8.1	103 likes, 8 comments	0 likes

Even with this small testing sample, it is clear that using our fake profile as a successful diffusion vector would be doomed to fail.

4.6 Findings

4.6.1 The inversed honeypot effect

The aim of our experiment was not to have a large number of adherents to the network but, rather, to have at least one person who through network effects is inclined to send a friend request without any inducement.

Other studies were based on the activity of each member to determine his or her importance within the network (Trusov et al., 2010). While the study by Trusov, Bodapati & Bucklin shows and develops a model to determine the influent members of a network, it is mainly based on their contribution to the network (log-in, post, time spent...). For these authors, the more you act, the more you influence other. In our case, this activity is almost non-existent (apart from accepting friend's requests) and the decision to join or not the network is mostly based on the existing network and its members. In the case of an online social "friends", we have shown in this experiment that influence may come simply by the fact that a person is present on a network. For example, having the owner of a famous restaurant or actor in your network may encourage people to join in and become "second-level friends" even if this person does not interact in the network. Many studies have emphasized the well-being linked to the number and quality of friends (Junghyun Kim & Lee, 2011a; Tong et al., 2008a).

Friend requests started coming about five months after the beginning of the experiment. Both males and females sent friend requests. At the end of the experiment, "Spartacus" had 396 friends accumulated through sent requests and 27 friends accepted after receiving their own requests.

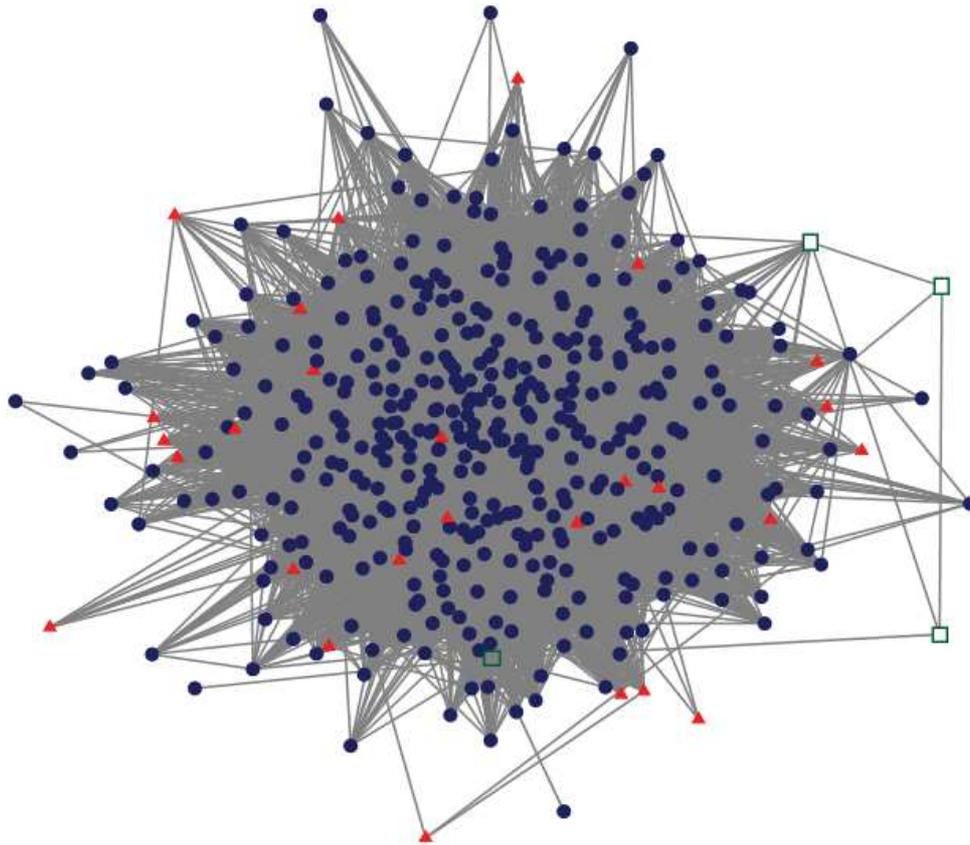


Figure 22: solicited friends (circles) and attracted friends (triangles)

Therefore, the real influence of a person over an online social network may not be related to his activity. In this case, there was almost no activity apart the fact that the fake person was sending friend requests every 10-15 days. In addition, people may be attracted to join a network not because of the attraction or actions of the main node in the network (our fake profile) but because of the centrality of the secondary nodes in other online social networks, mostly their own.

The chart below shows the cumulated number of friend requests accepted over the experiment period (1 year).

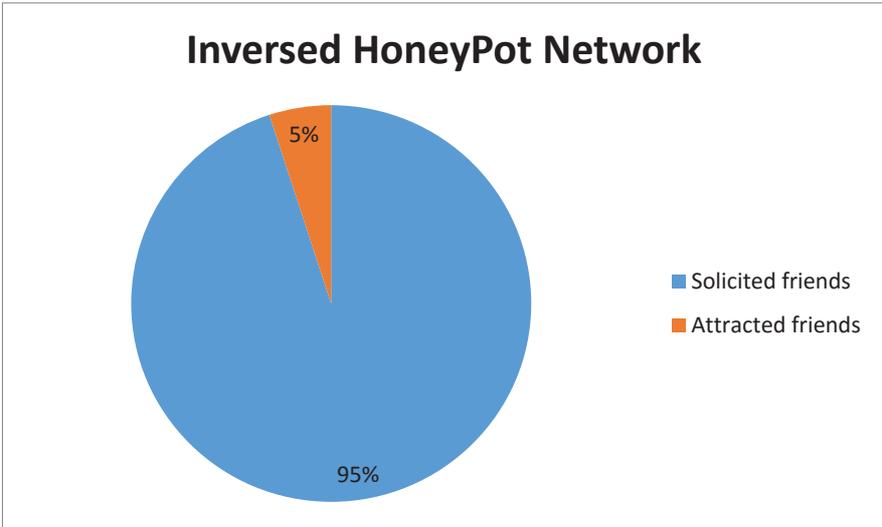


Figure 23: Solicited versus attracted friends

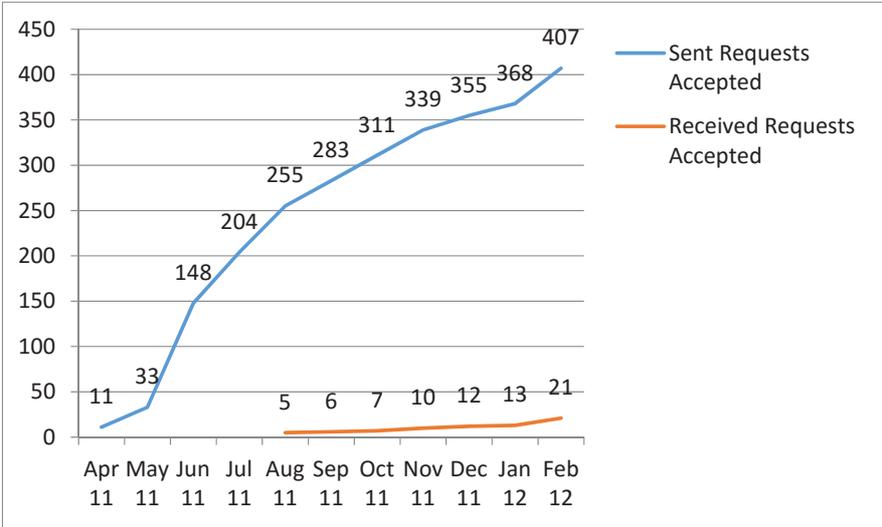


Figure 24: Sent versus accepted requests over time

4.6.2 The inversed honeypot structure

While this experiment showed that mutual friends is an important factor in accepting a friend request, we shown that a less random selection of friends may attract friends of friends to the network regardless of the main, central person of the network, in our case the

fake profile. More importantly, friends will be attracted to the network and we will be cumulating friends without having to send friend requests continuously.

To have a comparison base, we select two social networks. The first one is a social graph for a normal person (NG) with the same age and characteristics of Spartacus (married, three children, almost same number of friends, etc.). The second group (PG) is the social graph of a politician with 4,749 friends on his profile.

In order to get unbiased results, we split Spartacus' graph in two: the inversed honeypot group that is the group of people we have selected to join the network (the group of hubs) and the group that was attracted by the inversed honeypot group.

Groups	Code	Friends count	Average Degree	Between-ness Centrality	Closeness Centrality	Eigen-vector Centralit y	Page Rank	Clustering Coefficient
Inversed HoneyPot Group	HG	396	76.23	191.86	0.0012	0.0024	1.03	0.38
Attracted Group	A	27	43.11	73.65	0.0018	0.0014	0.64	0.38
Real Network of friends (Normal group)	NG	455	23	395	0.0027	0.0022	0.984	0.409
Very Large Friend's Network (public figure group)	PG	4749	69.21	3608	0.0005	0.0002	0.993	0.3019

Table 13: Comparison of the inversed honeypot network to other real networks

We notice that for all centrality measures $PG < NG < HG$ showing that, even though the inversed honeypot network is built around a fake person, the people in the network are very

strongly connected to each other even when compared to the profile of a real person with real friends!

Pagerank is higher for the inversed honeypot showing that there are more direct neighbors in the inversed honeypot than in the regular Facebook profiles we compared it to.

The clustering coefficient is $PG \ll HG < NG$. This is probably due to the fact that the HG was initially based on 5 different people with little or no relations and friends amongst each other's. Yet, the result is a clustering coefficient very close to the coefficient of a real person's profile.

We think that the most significant values are the average degree and the average betweenness centrality showing the high connectivity amongst the network. The values are two times larger than those of a normal network built in a standard manner around a real person.

Our experiment resulted in creating a highly centralized network with higher centrality scores than a regular person. This network, in turn, generated an inversed honeypot effect, attracting more friends to join the network.

It is important to mention that, one year following the experiment, our fake profile is still receiving friend requests from real people and has now reached a total number of 567 friends.

4.6.3 Diffusion to the Inversed Honeypot's friends

Using our fake profile as a diffusion vector did not give positive results. Nineteen out of the twenty statuses posted by our fake profile were liked by 1 person or even none. The 20th one was liked by 3 (maximum). We assume that this is mainly due to the fact that people will become friends with people they don't know through the mutual friends feature in order to maximize their social graph (Chen et al., 2009) but that perceived social support is directly linked to honest self-presentation (Junghyun Kim & Lee, 2011a). In other words, our fake profile only plays the role of a social bridge, not as an influencer or even as someone with whom Facebook users would like to engage.

This also supports recent literature regarding the similarity of perception of people on online social networks and in real life.

Despite the fact that we chose trending subjects as statuses, friends of Spartacus did not engage with him. We assume this is because, in real life, our fake profile does not have a strong connection to his friends. Zywica & Danowski (2008) find a discrepancy between off-line popularity and Facebook popularity. Without additional data, we assume that our fake profile is perceived as a person that is popular in real-life but not on Facebook. Another study shows how an abundance of friends can raise doubts about a user popularity (Tong et al., 2008a). Whatever the case, it is safe to assume that, without building a Facebook reputation, a fake profile will not be able to act as an information diffusion vector.

These findings also support the importance and role of the messenger in the diffusion of information (Valente & Myers, 2010).

Watts & Dodds (2007) believe that influence and diffusion success is not about targeting hubs but rather about targeting a small group of people who can be easily influenced. Another theoretical question for further research would be reproducing the same experiment with influential people, not hubs or influencers, and compare the results.

4.6.4 Implications for marketers

One of the major findings of our experiment is that, if instead of targeting friends or fans randomly, an entrepreneur carefully chooses his initial fans population by excluding people with low centrality and targeting people with high centrality, the resulting network will have high centrality and attract fans independently from the product itself and at no additional cost.

The second important finding is that the strategies currently used by new media companies (c.f. Kenza Cullen) are not efficient. This experiment has shown that a fake profile will not help in diffusion or generate WoM, at least without a buildup of Facebook popularity.

4.7 Discussion

This experiment draws different nature of questions. We propose to discuss the methodological limits and contribution of this paper first. We, then, will question theoretically the contribution of this experiment on the network externality concept. We will finally consider the managerial dimension of this fake profile.

4.7.1 Ethical issues

The use of a fake profile for our experiment may raise some ethical issues. Yet, this experiment would have been biased if we used a real person for our experiment, mainly because some people would have befriended our profile not because of the highly centralized network but because they would have known our profile in real life. The point was to show that an online social network could be intrinsically attractive independently of the person who is at its center.

It is also important to mention that the fake profile was uniquely used as an experimentation technique and that we strongly discourage entrepreneurs to use fake profiles for ethical and cost-related reasons:

- The use of fake profiles within a population of fans may be badly perceived by fans and affect the feel of belonging to the network.
- Because Facebook distributes information (posts) to only a percentage of the fans (organic reach), this information may be totally or partially distributed to fake persons and the company will need to pay more (paid reach) to reach the people he would have organically (freely) reached.

4.7.2 Methodological questions

We tried to make our fake profile as unattractive as possible. Yet, we can't certify this is completely true. Some people may, indeed, be interested in a 40 years old man, married with

children. Others may have confused our profile with someone else, based on the fake photo or the family name, or they may have known someone who used the nickname “Spartacus”, etc.

On the other hand, it is unfortunately impossible to extract all the actions and interactions resulting from information sharing within the network. It is important to know, for instance, if some of Spartacus’ friends were trying to maximize their own network in the same way that Spartacus befriended them, through the “mutual friends” system in Facebook.

Finally, we question the relativity of the network. In the case of our experiment, we could count at least four different social networks:

- The Facebook social network
- Our fake profile social network
- Any potential friend’s social network
- The social network created by mutual friends of the fake profile and the potential friend

The main consideration in this case is that it is important to know if, by accepting our fake profile as a friend, the person who’s accepting the request is not trying to maximize his or her own network. This is why we think that mutual friends with the fake profile are a source of trust and confidence generated by this common network that, in turn, is part of the fake profile’s network.

We could ask ourselves if our fake profile was the inversed honeypot or if one of the other networks is. To confirm the results of our experiment with certainty, we need to reproduce the experiment several times and with different populations and cultures.

4.7.3 The existence of network externalities?

This observation concerning the level in the network draws other questions: can we consider the attraction to the network the result of network externalities as described by Katz and Shapiro (Katz & Shapiro, 1985)? Can this concept be applied to a social online network through the network generated utility? To which point does the utility depend on the network? Precisely in our case, who is the creator of the network? Is it the entrepreneur who launched this fake profile? Is it Spartacus? Is it Facebook? We can anticipate that the revelation of the fake profile scam will transform the expected benefit of this network. Nevertheless, the network externality value should not be transformed as the friends of friends are real persons. However, we can expect that a change at the origin of the network should have an impact on the network persistence. This is another question that needs to be explored.

Also, focusing on the externality network benefit enabled us to identify the tipping point after which there was no need for an intervention of Spartacus to see the development of the network. A supplementary step could be the interview the adherents on the reasons that led them to enter the network. Numerous opportunities exist to make more substance of this fake network.

4.7.4 Time and direction of vertices

Another limitation of our experiment is the fact that we did not take *time* as an element in our analysis. By adding the time factor to our analysis, we could trace the links between members according to time which could help us determine the precedence of the links (if A influenced B, B influenced A or C influenced A and B, etc.).

Moreover, and this could be an incredible addition to Facebook for analysts and strategists, is the addition of the direction dimension to vertices. It would be very valuable for us to know if A befriended B or if it's the other way around. Direction could be a significant lead in understanding influences and attractions within the Facebook network and, on a smaller scale, understand who, within a personal network, is drawing other friends to join.

4.7.5 A real network paradoxically based on a fake profile

Our third observation is that the network nowadays exists and links real people even though it has been built around a fake profile. In other words, 396 persons believe that our fake person exists and that they know him directly or indirectly. This pinpoints the discrepancies between real and digital worlds and shows the importance of analyzing and studying these networks from a marketing and managerial perspective, especially that these networks act as a double-edged sword and companies that are unaware of this reality may not be able to recover from a pitfall on these networks.

It was important to draw the connections within the network in order to understand who are the main “players” in the network. On a very shallow level, Spartacus, our fake profile, is in the center of the network with 431 friends but, IRL and even online, Spartacus does not connect anybody, so it’s either the impression that Spartacus can be a link to other popular (hub) people or the popular people themselves. In both cases, the attraction lies around “Spartacus”, not on him.

Many scholars have tested seeding strategies at different levels of a network (Delre et al., 2006; Goldenberg, 2009; Liu-Thompkins, 2012). Yet, we can’t find in the figures a distinct parameter that determines the multipliers. It is obvious, based on the number of mutual friends and mutual friends of friends that the role of Maya was decisive in the creation and growth of the network, yet, Maya does not have a significant degree (ranked 485/514 in terms of degree as of April 10, 2013) or Eigenvector Centrality (494th), nor the largest betweenness centrality (rated 10th) or the largest pagerank (293rd) or a clustering coefficient (419th). We used in this study an empirical method to determine the multipliers when building an online social network from scratch but the question about how to determine multipliers on an already existing network remains to be answered.

Therefore, a fake person can create a real link between two real people and increase the size of other networks. For an entrepreneur, this can be beneficial or dangerous, depending on the interactions outside the network. Yet, in an environment where he has little control like Facebook, Twitter or similar social network platforms, taking control over the communication

outside the network will probably be very complex or even impossible. That is a dimension we would like to investigate at a later stage.

4.8 Conclusion

We have managed to create an online social network around a non-existing person and, by carefully selecting his friends, we have created a network with high centrality values that resulted in attracting real people to become his friends without any action or reaction from his end.

This experiment also showed that an entrepreneur can have better control over his OSN. We have demonstrated that this network has strong and weak nodes and how some of the users can have positive repercussions, in terms of growth, on the whole network. This is the first experiment that has focused on selecting each member alone and not used an automated method to add friends through spamming. It is also, to our knowledge, the first observed experiment where real people asked to become friend with a fake person.

Finally, we found that, even with an optimized population of hubs as friends, and an "attractive" profile in terms of network quality, "friends" will not engage with his posts. We assume that people are only interested by this person as a bridge overlapping a structural hole to potentially "important" people.

In this experiment, the nature and role of the entrepreneur in selecting the first adopters of his network are examined. The usage of this network as an initial seeding population was not successful. From a strategic marketing perspective, it shows that using fake profiles as a vector for information diffusion is not an efficient marketing strategy. A lot remains to be analyzed and automation should be investigated. This experiment does not answer all the questions asked but opens a door for a more thorough analysis.

5 Negative WoM and its transmission on OSN : the determining role of the seeding population

5.1 Résumé (Français)

Nous prenons le cas réel d'un groupe de consommateurs qui publie des messages négatifs sur la page Facebook d'une entreprise. Notre questionnement théorique se situe au niveau de la diffusion du BaO négatif dans le cas d'une population initiale de diffusion optimisée.

L'expérience agit tout d'abord au niveau du support : dans le cas des pages Facebook, la diffusion des messages des « fans » est réduite de par le système lui-même (Miller, 2013a). Nous utilisons donc comme support les pages personnelles Facebook où la diffusion des messages atteint près de 61% des amis chaque mois (Bernstein, Bakshy, Burke, & Karrer, 2013a). Nous pensons que cette approche a aussi un effet sur la perception du message qui est maintenant un « ami ». De surcroît l'environnement est modifié (Heath & Heath, 2010b) par le passage d'une page d'entreprise à un flux d'actualité d'amis.

Nous agissons aussi sur la population initiale de diffusion en choisissant les personnes qui ont publié des messages négatifs sur la page Facebook de l'entreprise et en les attirant vers deux faux profils qui seront responsables de diffuser les mêmes messages négatifs qui avaient été auparavant publiés sur la page sans aucune modification.

Avec la rediffusion sur les flux d'actualité des deux faux profils de 6 messages initialement publiés par des clients non satisfaits sur la page de l'entreprise, l'expérience montre une augmentation très sensible (plus de 400%) de l'engagement des utilisateurs Facebook.

	Messages négatifs publiés sur la page de l'entreprise	Les mêmes messages publiés sur la page personnelle de deux faux profils avec une population initiale de diffusion optimisée	Différence
Fans engagés	11	37	+236%
Engagement (likes, commentaires)	15	77	+413%
Reciprocation (communication d'utilisateur à utilisateur)	0%	14.8%	+14.8%

Table 14: Comparaison des résultats de la diffusion de messages négatifs initialement publiés sur une page Facebook d'entreprise, republiés sur les pages de faux profils avec une population initiale de diffusion optimisée

5.2 Highlights

- We analyze the role of the seeding population in NWoM diffusion on an Online Social Network
- We develop a method to define an optimized seeding population and measure the diffusion of NWoM through this optimized seeding population as compared to a random distribution on the general population
- We contribute to WoM diffusion theory in considering the carrier as a critical factor of the virality of the message

5.3 Abstract

This paper is a contribution to the knowledge of WoM transmission on OSN. We specifically analyze the role of the seeding population diffusion of negative WoM. The method is based on an experiment on the Facebook fan base of an existing company. We manage to control the four elements of a successful WoM communication: the message, the social structure of

the network, the characteristics of the individuals in the network, and the seeding population. We develop an original method to dissociate a seeding population from the general population and compare the diffusion of a set of negative messages distributed to both the original population and the artificially targeted subset. Results show the impact of the seeding population's characteristics on the diffusion of consumers' negative messages. We specifically show the impact of the carrier on the virality of the message.

5.4 Introduction

More and more companies see online social networks (OSN) as a necessary tool and are including these networks in their marketing strategy and management practices (Barnes, Lescault, & Wright, 2013; Li & Bernoff, 2011). Yet, because they offer untampered communication, OSN can be a double-edged sword. This shift in control from companies and governments to end users of technology or "technology enabled collective action" or "smart mobs" was already announced by Howard Rheingold in 2002 (Rheingold, 2002). Brands have involuntarily relinquished control to online communities which are now targeting brands instead of brands targeting them (Fournier & Avery, 2011). Pampers, Nestlé and other brands have already paid the heavy price of unsatisfied Facebook communities (Champoux, Durgee, & McGlynn, 2012; Paul Gillin, 2012; Steel, 2010)..

Negative WoM transmitted by dissatisfied consumers has been studied largely in marketing before the development of OSN, mainly relatively to the preoccupation on satisfaction around the 1970s. Lazarsfeld (1955) had identified the role of leaders in disseminating information. Later, Rishing (1983) examined negative WoM of dissatisfied consumers and Singh offered a model based on Hirshman's framework for Exit, Voice and Loyalty (1990). The development of the Internet and then OSN gave another dimension to e-word of mouth with the preoccupation of e-reputation (Reinhgold, 1990). EWoM can now be considered as a marketing signal which is defined as an activity that provides information regarding unobservable aspects of a product (Herbig and Milewicz, 1993). Reputation of a brand or product is established through these marketing signals (Herbig and Milewicz, 1993) that can be used as a strategic influence to convey or attack the reputation of a brand or product.

In this paper, we specifically explore the negative e-reputation WoM on Facebook. We republish negative messages from a brand's Facebook page on the timeline of fake profiles that have befriended engaged fans (likers and commenters) of the brand's page. We analyze the results of the diffusion of messages to this subset of the larger community on Facebook timelines and compare the results with the diffusion of the same messages on the brand's page.

The first part presents a review of literature on WoM and its transmission. We specify some elements on negative WoM. The second part exposes the method. Then we present the result and discuss them before concluding the paper.

5.5 Negative WoM and its transmission

Negative WoM is a preoccupation for marketers in charge of the e-reputation. Firms and companies are now training people and using tools to monitor bad e-reputation messages (Cuvelier & Aufaure, 2011). Studies show that the organization of negative communication has a direct effect on brand evaluations (Laczniak, DeCarlo, & Ramaswami, 2001). On social networks, positive WoM occurs more frequently than negative WoM in different proportions depending on business category and market share (East, Hammond, & Wright, 2007). East & al. estimate the ratio of positive WoM over negative WoM to be 3:1. However, negative WoM has a stronger influence on customers' brand evaluations than positive WOM Communication (Arndt, 1967) due to negative information being considered more indicative of actual performance (Kamins, Folkes, & Perner, 1997). Naylor & al. (2000) found that customers are more likely to diffuse negative WoM faster than positive WoM even if positive WoM occurs more frequently, showing that negative WoM is diffused more largely. Their findings came to support previous findings of Silverman (1997).

This negative WoM may indicate maneuvers of influence strategies led by competitors with malevolent intentions. In this perspective, the Internet is a "magma of influence" where every social node or organization is trying to influence others (Heiderich, 2009b; Vaille, 2010). The advantages of online social networks in playing an influential role are numerous: communication speed, shorter social paths, targeted and direct one-to-one communication, etc. For instance, thanks to Facebook, the small-world effect and six degrees of separation

dropped from 6 in the USA to 4.7 worldwide, significantly shortening the distance, in term of links between two random persons (Ugander, Karrer, Backstrom, & Marlow, 2011). People and organizations are taking advantage of this situation, increasing power and control of end users and communities (Fournier & Avery, 2011; Rheingold, 2002). Unlike traditional marketing, communication can now easily move both ways, top to bottom and bottom to top, and also create lateral channels between customers or groups of customers outside the control of the brand. Customers can reach and attack a company and force it to take action instantly (Champoux et al., 2012) even using false accusations, as most readers, today, do not verify the authenticity of the information provided and often follow their instinct rather than minds (Dunn & Allen, 2005). The case of the Pampers attack is a significant example: without any scientific evidence, a group of unhappy customers declared war on Pampers on a Facebook page that quickly reached 11,000 dissatisfied customers. It took P&G more than a year to restore its lost trust. Dunn & al. (2005) confirm that consumers are being influenced by WOM more than by any other source of information including peer reports, and that users transmit rumors frantically and cause significant damage to companies, especially when they use computer mediated communication.

It, therefore, becomes essential for marketers and communication strategists to understand the process of WoM diffusion. Hinz et al (2011) have identified four critical success factors behind viral marketing success: the content of a message, the social structure of the network, the behavioral characteristic of the recipients and the seeding strategy. Concerning these four factors, we observe the following elements:

1. The content of the message has been considered as a determining element in the success of its diffusion. Online communities rely massively on it as the main key of their WoM communication strategy (JA Berger & Milkman, 2009; Valos et al., 2007). Studies have analyzed the content through two dimensions, its attractiveness level and how memorable it can be (JA Berger & Milkman, 2009). This focus on the content of the message is however criticized by Hinz & al (2011) and Valente & Myers (2010) who observe that the other elements that drive viral marketing have often been neglected.
2. The structure of the social network is also identified as an important factor in the diffusion of a message. Bampo & al. (2008) consider three different network structures, random, small world and scale free. Using simulations, they show that the

spreading scheme is different depending on the size and connections of a social network.

3. The behavioral characteristics of the recipients and their incentives for sharing the message play an important part as well in the diffusion of the message (Kamins et al., 1997): From a social perspective, diffusion is strongly correlated to the behavioral characteristics of the recipients. While some scholars recommend targeting hubs to increase WOM (O Hinz et al., 2011), others recommend focusing on the individual characteristics of each node as an opinion leader (Valente, 2012) or as an easily influenced person (Watts & Dodds, 2007). Booth and Matic (2011) describe individuals in the network as “somebodies” and “nobodies” finding that it is the influencers who bring change. Watts and Dodds (2007) alternatively suggest that it is a critical mass of easily influenced individuals who is the key to the formation of public opinion. Ardnt (1967) shows that the WOM pressure affects and is shared differently between high and low-risk perceivers, while Liu-Thompkins (2012) finds that people with strong ties to the company are more likely to share WOM. Even if some research results may appear contradictory (should we target influencers, easily influenced people, hubs or strong ties?), it is clear that the behavioral characteristics of the recipients (will they share, comment, like or avoid interactions), have an important role in the diffusion of WOM.
4. Finally, scholars agree that the initial seeding population is the key to an efficient viral marketing campaign (O Hinz et al., 2011; Liu-Thompkins, 2012). The seeding strategy determines the initial set of target consumers chosen by the initiator of the campaign (Bampo et al., 2008; Liu-Thompkins, 2012). Recent studies suggest that the choice of seeds is more important than the size of the population and that, by targeting the right seeds rather than the whole population, better results are achieved (Liu-Thompkins, 2012; Scarpi, 2010). Watts and Dodds (2007) support this finding and state that influence is driven by a small group of easily influenced people and not by influential people. Again, Valente and Myers (2010) suggest that influence is more about the messenger than the message itself). All of these studies seem to point to the fact that change is driven by the individuals or the small groups of individuals who carry the message, not by mass distribution of the information. Bampo and al. (2008) write that the marketing challenge should be to target enough seeds with a high enough “epidemic threshold” to achieve campaign objectives without the unnecessary expense and possibly negative impact of flooding the target population with mass marketing.

On online social networks, marketers and researcher have no control over all four elements of viral marketing. While the marketer can control the content of his message, he is not in control, nor has the necessary data about the recipients of the message, their characteristics

and the structure of the network. For example, on a Facebook page, based on a "secret" algorithm, only an undetermined part of the fans will see the message. Empirical experiments estimate this number to vary between 1% and 33% depending on the number of fans of the page amongst other factors (Agorapulse, 2015; Constine, 2014; Loomer, 2015; Miller, 2013b). Those targeted fans are not necessarily hubs, influencers, or have any other special position in the network or characteristics as individuals. This is why posting on a Facebook page, even if distribution (post boost) can be fine-tuned to target fans of a specific gender, age group, etc., can be considered a distribution to a relatively random subset of a larger population. Because the marketer has no control over the seeding population, the structure of the network and the behavior characteristics of the recipients, the virality of the message is, to some extents, scientifically unpredictable.

Studies show that engaging in negative WOM is not a function of the amount of WOM activity (Naylor & Kleiser, 2000). In other words, in a defamatory campaign, the number of negative messages, posts or tweets, with analogous content to the same group, should not generate more NWoM. Studies also show that a well-organized negative communication has a direct effect on brand evaluations (Laczniak et al., 2001). This implies that control and tweaking of the elements of viral marketing can increase the amount of negative communication generated through WoM compared to a non-optimized distribution of the same negative messages. Therefore, we decide to use the fans who interact frequently with the posts of the brand's Facebook page as the initial seeding population. We also use Facebook timelines instead of the brand's Facebook page to maximize distribution and control all the elements of viral communication. We re-post the same negative messages that were previously posted by dissatisfied fans on the Facebook brand's page without any modification. Finally, we compare the reach of the set of negative messages originally published on the brand's Facebook page to the reach of the same messages diffused through Facebook personal timelines to a meticulously selected seeding population.

For this experiment, we create and use two fake profiles (control over the messengers). Those fake profiles will befriend people who have co-commented or co-liked negative posts (control over the network structure). Because they have already engaged with negative messages, we presume that they will comment again on these messages if they are posted again (control

over behavioral characteristics). After building our new network of engaged fans of the brand around our two fake profiles, we post negative messages to this seeding population (control over the sharing strategy).

In order to achieve this experiment, we contacted a company's manager who agreed, without the knowledge of any other staff member or consumer, to allow us to reuse the posts of fans on his company's Facebook page in order to test the reactions of his customer service department and social media manager. The use of an existing brand adds realism to the experiment and help us experiment a real-life situation.

5.6 Methods

Our experiment uses the Facebook page and posts of a small European company that has around 1,500 fans. An analysis of the data insights provided by Facebook shows that between one and two new posts are published every week with an organic reach varying between 2 and 60% of the total fan population. On average, each post reaches 31% of fans. Facebook's defines engagement as the fact of clicking, liking, sharing or commenting on a Facebook message. Because we do not have access to the names or Facebook IDs of people who click on a message, in this experiment, we consider engagement as the fact of liking, commenting or sharing a message. User engagement by post varies between 0 and 130 fans engaging with likes, comments or shares. An analysis over the past year (2013) shows that thirty fans engage, in average, with each post.

We extract all 500 posts published on the company's page and find that 72 unique fans are engaged in co-comments. This number is equal to 4.8% of the total number of fans (1,500) of the page. 711 unique fans are engaged in co-likes, evidencing that more than 47% of the total fan base interacts with posts on this Facebook page.

The density of the co-commenters graph is equal to 33%. In figure 1, we used NodeXL (Hansen et al., 2011) to draw the social graph of co-commenters and group them by clusters (fans who comment on the same posts). We detect twelve clusters amongst which nine clusters, A, B, C, D, F and G, who are connected by bridges (fans who have joined the conversations of several clusters). For instance, fan "x" at the center of cluster B, has joined the conversations

of fans in clusters A, C, F, D and G. We also notice three small completely independent clusters, E, H and I, representing 10.4% of the population, engaged in parallel discussions (could be posts related to specialty products, or discussions that are not of common interest). The density value and the bridges clearly illustrate high interaction between engaged fans.

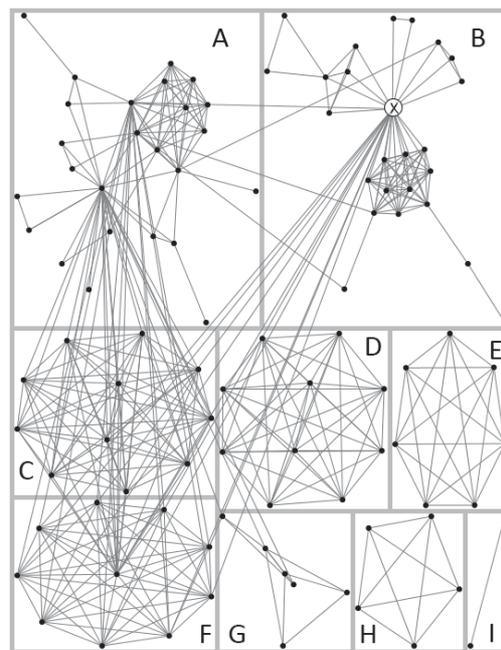


Figure 25: Clusters of communication

Using the Facebook page of the brand to diffuse positive or negative WoM has four major drawbacks:

- 1) it makes it impossible to target engaging fans only or a subset of chosen individuals,
- 2) our posts can be deleted by the page's admins and our "users" banned,
- 3) our messenger will not be a "friend" or "acquaintance", rather "another consumer", and
- 4) based on empiric tests, the organic reach (Facebook free distribution of posts) on Facebook personal timelines (Bernstein, Bakshy, Burke, & Karrer, 2013b) is much higher than the organic distribution on Facebook pages (Agorapulse, 2015).

We would like to demonstrate that, by creating a seeding population of engaged fans only and controlling the behavior characteristics of the members of the network (people who have already engaged in posts for this brand), we could increase the diffusion of NWoM. For this

purpose, we create two fake Facebook profiles to infiltrate the network of engaged fans, enticing them to accept friendship. We use two fake profiles, the first one with the characteristics compiled by Barracuda Labs social networking analysis (Krombholz, Merkl, & Weippl, 2012; Rashid, 2012). This research shows that 97% of fake profiles are young women, interested in both sexes, living in big cities, etc. Our first profile follows these "guidelines". The second one has opposite characteristics: mature man in his sixties, married with children, etc. Both profiles have just a couple of photos published on their profile, and no posts or comments that could influence the decision to accept their friends' requests. Their physical appearance and the fake names used may be considered as factors influencing the acceptance of friendship. Yet, our question is not in the reasons why our brand's fans will accept to befriend those profiles but in their reactions once their new fake friends will start posting negative messages about the brand.

Both profiles were created from scratch without any friend at the beginning. In order not to influence fans in engaging with their comments, our fake profiles have not interacted in any way with the fans of the brand's page throughout the experiment. We decide to send only standard friend request messages (no personal messages even as replies when private messages are sent to the fake profiles). We extract the names of all the fans who have engaged with the brand by commenting, liking or sharing posts on the brand's Facebook page. Those fans are extracted using NodeXL's social network importer (Social Media Research Foundation, 2015). We send friend requests to the 700 engaged fan extracted. To avoid suspicion, we do not send a friend request to the same person from both profiles simultaneously but, rather, do this almost randomly, deciding to send the request from the first or the second fake profile in no particular order and for no particular reason. We manage to befriend 187 engaged fans of the brand on the first profile (young woman) and 113 on the second profile (mature man).

The graph below (figure 2) shows requests sent vs requests accepted on the second profile.

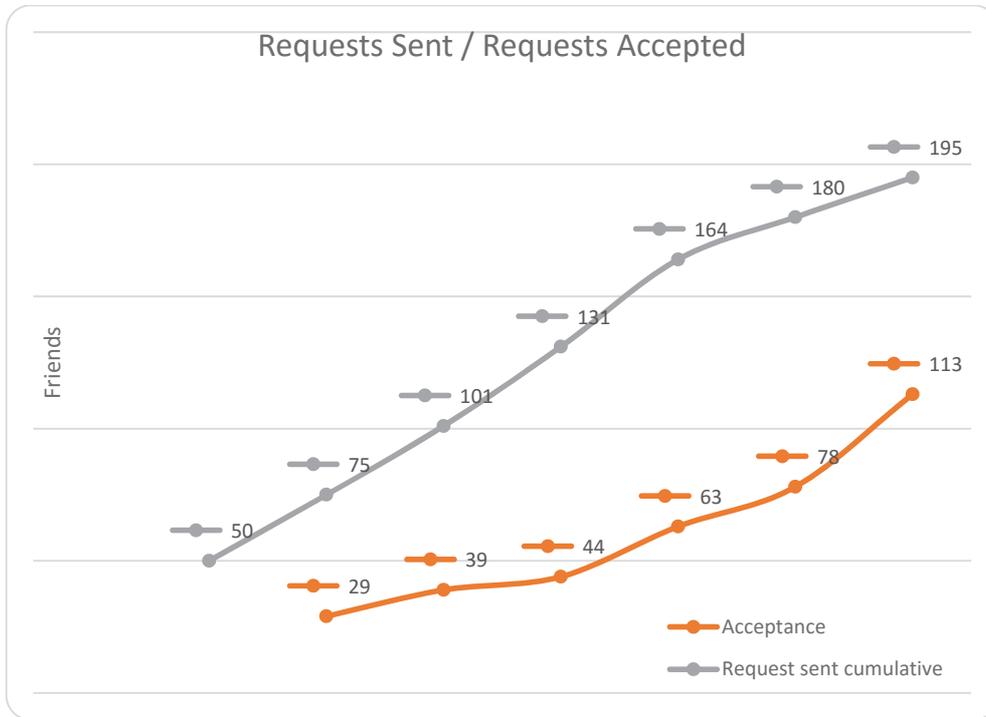


Figure 26: Requests sent and requests accepted

5.6.1 The resulting global network

Using both profiles, we managed to befriend 300 engaged fans (commenters, likers, sharers) of the brand. The social graph below shows the networks of both profiles combined. Friends of the first profile are colored in dark blue and friends of the second profile in light blue. At the center, 30 dots represent mutual friends of both profiles.

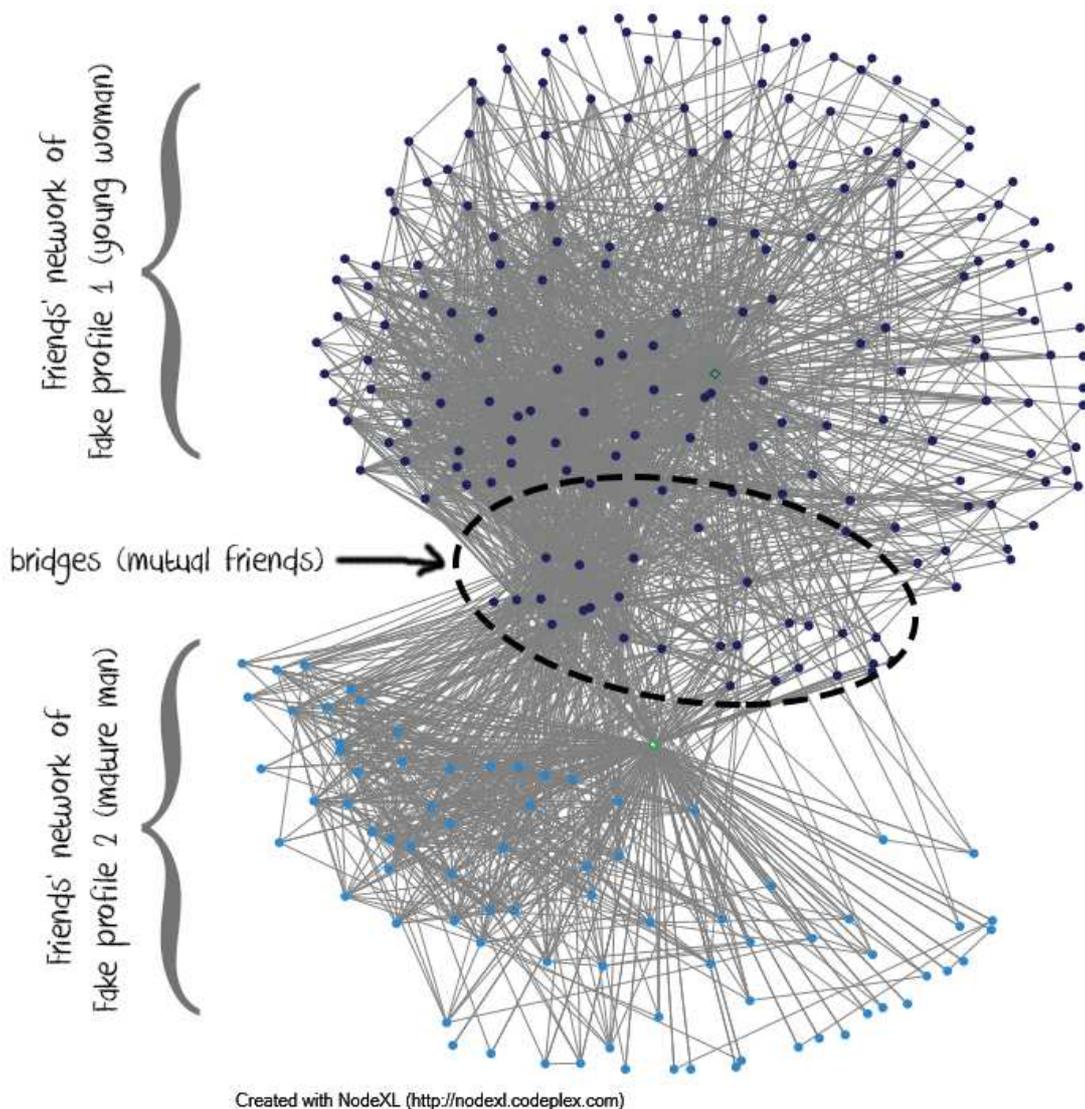


Figure 27: Resulting network

5.6.2 Redistributing the messages to the seeding population

We reuse the last six negative customers' complaints from the brand's page and post them on our fake profiles timelines. We use the last six posts because of their recentness. We choose negative comments because negative WOM communication has a stronger influence on customers' brand evaluations than positive WOM Communication (Arndt, 1967) due to negative information being considered more indicative of actual performance (Kamins et al.,

1997). If this experiment succeeds, the strategy should show a significant increase in NWOM. On the brand's page, these posts never received more than five likes each. We publish each post only once, as research has shown that engagement with negative WOM is not a function of the amount of WOM activity (Naylor & Kleiser, 2000) and, just a few posts, published once, should be indicative of the outcomes of the method.

At this point of the experiment, we have control over the four elements essential for viral marketing strategy success:

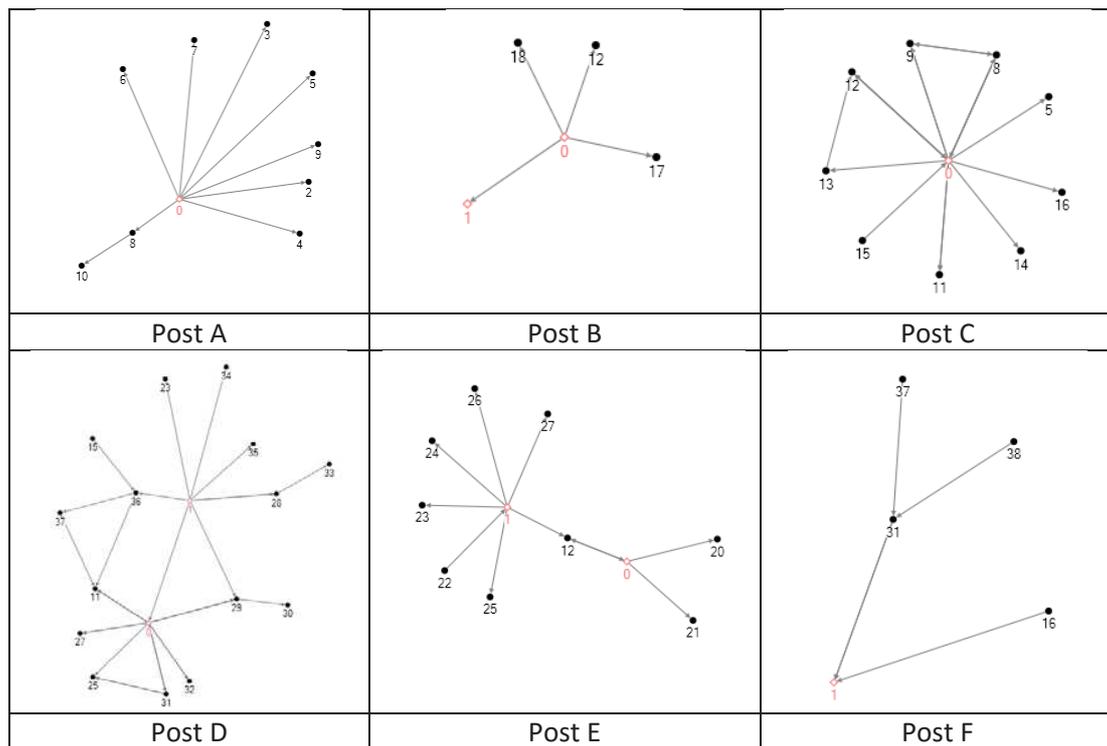
1. The content: The purpose of the experiment is to compare negative WoM diffusion from a Facebook page to a personal timeline within a community of fans. Our intention is not to evaluate the content itself and we are not trying to evaluate the diffusion according to the attractiveness or memorable features of the messages. We rather intend to be close to reality and use existing messages rather than creating new ones. That is why we republish old messages from the Facebook brand's page to the fake profiles' timelines. This should allow us to compare the diffusion of the same messages on the Facebook page with a random population, and on Facebook timelines with an elected set of friends as a seeding population.
2. The social structure of the network: Using Facebook personal timelines (profiles) instead of Facebook pages allow us to determine the edges between the vertices of the network (A is friend with B), something constrained by Facebook when using the data extracted from a Facebook page. Our network has a short geodesic distance and strong ties (16 ties in average). Hinz et al. (2011) assume that seeding to well-connected individuals is the most successful approach because these attractive seeding points are more likely to participate in viral marketing campaigns. Getting the brand's fans to become "friends" changes the structure of the network and the nature of the communication from consumer-to-consumer to friend-to-friend. Moving fans to Facebook timelines unlocks access to the social structure of the network.
3. The behavior characteristics of the recipients: We have only selected fans that already interacted with the messages we are resending. Those recipients have all liked or commented on those posts on the brand's page. We expect this group to interact again because pairs of individuals who interacted previously have greater opportunity to influence one another and have more aligned interests, which increases the chances of contagion (Bakshy, Rosenn, Marlow, & Adamic, 2012; Brown & Reingen, 1987; S. Hill, Provost, & Volinsky, 2006). Because of earlier interventions amongst its

members, this group is a seeding population with an "epidemic threshold" (Bampo et al., 2008; Liu-Thompkins, 2012; Scarpi, 2010).

4. The seeding strategy: based on a study by Bernstein & al. (2013b), each published post on a Facebook timeline reaches around 24% of the friends of the profile. We therefore expect our posts to reach 24% of the friend of each of our fake profiles. Moreover, seeding the same messages on a personal profile (a group of friends) rather than the brand's page (a group of consumers of the same product or lovers of the same brand) may be perceived as a "tweak to the environment" which is one of the elements that facilitates change (Heath & Heath, 2010a). Indeed, Heath and Heath suggest that by changing the environment to make tasks easier to perform may encourage those who are still hesitant to take action. In our case, by switching from a Facebook page where fans' comments are hard to find and are not displayed directly on their friends' newsfeed, to Facebook timelines where messages are directly posted to friends' newsfeed and can be liked or commented directly, we have shaped the environment to our advantage. Also, this environment change can be perceived by Facebook users as a change from a public environment (a Facebook brand's page) to a private place (the fake profiles' timelines). This is because users act as if their personal spaces on online social networks (newsfeed, timelines) are private (Bassett & O'Riordan, 2002). By seeding to a selected set of engaged fans through Facebook timelines instead of a distribution on Facebook pages, we have optimized our seeding strategy on Facebook.

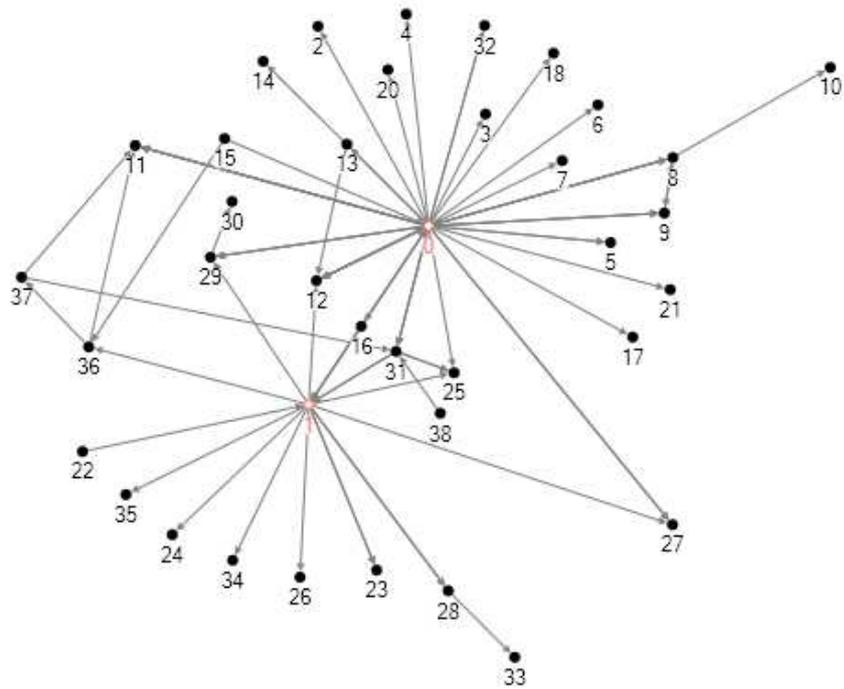
5.7 Results

On our profiles' timelines, forty people rapidly engaged with the six published posts by liking or commenting on them. In the graphs below, we label our profiles "0" and "1" and the likers/commenters with numbers 2 to 40 and draw the social graph for each published post. We label our posts A to F. For Three of the statuses (B, D & E), each one of our profiles automatically likes or comments on the post of the other profile acting as a bridge between both social networks (his friends and the other profile's friends). These graphs show the engagement on each post of our profiles' friends, who represent our initial seeding population and are fans of the brand's page. We notice that some posts create more engagement than others, mainly C, D & E. In these posts, friends (or brand's fans) not only engage with our created profiles but also with each other. For instance, in post D, friends 11, 36, 37 and 15 engage with each other in a discussion creating a connection between the friends of profile "0" and the friends profile "1" and opening a new channel of discussion.

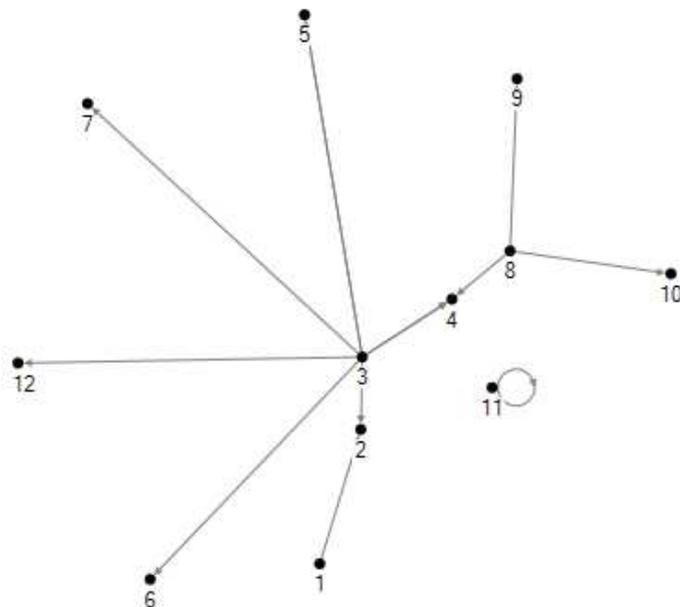


We evaluate the success of our method by combining the communications of all six posts on our fake profiles' timelines in one graph and determine the metrics of the resulting graph using NodeXL (Hansen et al., 2011):

- There is one connected component meaning that both profiles generated one larger network of communication and influence or – as the graph shows – involved both networks in the same communication and acted as bridges between two sub-networks who react differently (we mentioned that our profiles have only 30 friends in common (around 10% of the total population of attracted fans). A deeper analysis showed that 33 engagement actions (comments/like) were made on the statuses or comments posted by one of our profiles and 44 engagement actions were made on the statuses or comments made by the other profile.
- 14.8% of edges (connections) are reciprocated showing that communication went back and forth between brand-engaged fans.



In comparison, the same 6 posts on the company's page had significantly less interactions:



The following table shows the difference between the two strategies:

	Negative posts published on the brand's Facebook page	Same negative posts published on fake profiles timelines using an optimized seeding strategy	Difference
Fans engaged	11	37 ⁴	+236%
Engagement actions (likes, comments)	15	77	+413%
Reciprocation (back and forth communication and consumer to consumer communication)	0%	14.8%	+14.8%

Table 15: Comparison of Facebook engagement using posts on the brand's Facebook page and using a seeding population on Facebook timelines

The experiment showed that it is possible to attain higher engagement by targeting a small group of highly interacting fans on one or more Facebook personal profile rather than targeting the whole population of fans on the Facebook page of the brand. Using this technique, we were able to engage 236% more fans and generate 413% more WOM actions. This confirms the potential of this technique as an efficient NWoM marketing and e-reputation tool.

⁴ Not including our profiles.

5.8 Implications for WOM

From a theoretical perspective, our experiment is consistent with the findings of Watts and Dodds (2007) that large cascades of influence are driven by a critical mass of easily influenced people. We also contributed to the knowledge of the role of the initial seeding population. Indeed, a determinant factor in diffusing information on online social networks is the choice of the initial seeding population (Liu-Thompkins, 2012) especially with Facebook gradually decreasing the organic reach (free distribution) of brand's statuses and posts. These findings confirm that using an optimal seeding population as a seeding strategy results in higher WOM and influence (Bampo et al., 2008; Liu-Thompkins, 2012).

Most importantly, we mentioned earlier in this paper that scholar suggest four critical viral marketing success factors: Content, structure of the social network, behavioral characteristics of the recipients and their incentive, and the seeding strategy (Hinz et al., 2011). At the end of this experiment, we suggest to add a fifth factor to the Hinz et al (2011)'s list: the carrier. We know that consumers actively avoid traditional marketing methods and engage with peer and user-generated content (Hann, Hui, Lee, & Png, 2008; Oliver Hinz et al., 2011). These findings are confirmed by Sprague and Wells (2010) who have observed a deeper impact of communication when the consumer perceives the source of the information as not being a marketer. In this experiment, the messengers have been be direct "friends" or "friends of friends".

The role of the messenger has previously been identified as a key to WoM success (Liu-Thompkins, 2012; Valente & Myers, 2010). Valente & al. (2010) consider that "the messenger is the message", suggesting that the message carrier's role in the diffusion may be even more important than the content of the message itself. Lacznik & al. (2001) also suggests that receivers' attributions depend on the manner in which negative WoM is conveyed and that the source of information impacts the level of influence. Sprague & Wells (2010) also found that customer-to-customer messages generate more trust, interactions and WoM.

Finally, our experiment suggested an innovative method that can be used on Facebook to control all five essential elements for a successful communication that would significantly increase negative WOM. This method can be reused by marketers and researchers to have a

deeper understanding of the inner workings of negative WOM on Facebook. Malevolent attackers could use this method to circumvent standard prevention methods, like banning fans from a page or locking the brand's page for comments and posts. The usage of this type of information vector should be investigated more closely as a model of diffusion but also as a dangerous diffusion model to be aware of in case of e-reputation attacks.

We believe that this strategic approach that has, to the best of our knowledge, never been studied from a marketing perspective could define new methods and techniques to efficiently target and influence communities, control the flow of information to different subset of the community at different times. For example, a marketer could target satisfied customers with a message and unsatisfied customers with another. He could also choose to target a specified number of users at a given time and then wait before sending the same group a second message. He could also use the same technique to benchmark the effect of a message on different communities.

5.9 Limitations and Future Research Directions

This experiment showed that grouping engaged users and diffusing information organically to an optimized seeding population results in higher interaction and engagement.

Our approach and its methods may raise two ethical questions: we have performed a malevolent attack against a company (1) and the subjects were not aware of the experiment (2). Regarding the first point, the General Manager of the company knew about the experiment and was its sponsor. He also followed the whole process closely.

Regarding the second point, we mainly republish existing messages to a subset of the population that was initially targeted by those messages. We have just enhanced the distribution and WoM of existing messages without modifying their content. In this matter, Hey (1998) states that there is a big difference between telling a lie and not telling subjects about one or more elements of the research. For him, withholding information does not necessarily constitute deception.

On another hand, the main element we concealed was the fact that our profiles were fake. Such practices are not uncommon on Facebook and, even Facebook itself is performing sociological experiments on its users to test their reactions (Bakshy et al., 2012; Nicole Lee, 2014). Different tests conducted on blog members' participation by Hudson & Bruckman (2005) showed that people are much less likely to act naturally if they are aware of the experiment. They also discuss the bystander effect in such cases, meaning that people would rather wait for others to help (J. M. Hudson & Bruckman, 2004). By disclosing the nature of our fake profiles, we would have discouraged people from befriending them or engaging with their posts. We believe that information diffusion on online social networks will evolve with time and that companies, brands, and public figures should understand the methods that may be employed and use them to their advantage, or protect themselves from malevolent attacks. This experiment provides scholars a framework for understanding how firms can be discredited on Facebook using this technique and enables them to understand, use and, eventually, imagine ways to counteract this special type of communication vectors.

This experiment draws methodological and theoretical lessons that can also be discussed. While most experiments on Facebook revolve around the idea of a network of friends or acquaintances, we have transformed engaged users into friends. In our approach, we look at a Facebook profile not only socially but also strategically. Our fake profiles attracted an initial seeding population of engaged fans, initiated a reaction by diffusing information and worked as a vector in the network to increase the rate of fans' actions.

This experiment also draws some legitimate questions: knowing that the described method increases negative WoM, how does it really affect sales or trust in the brand? Also, with negative WoM being 14 times less influential when it comes to purchase probability (Vázquez-Casielles, Suárez-Álvarez, & del Río-Lanza, 2013), can this method be used with positive WoM as a marketing or advertising strategy? These questions are left for future research or experiments.

5.10 Conclusion

Information diffusion on Facebook can be hazardous, uncertain and cause unexpected results especially if marketers focus on the message only. Diffusion success and virality depend on

four other important elements: the social structure of the network (Bampo et al., 2008), the behavior characteristics of the recipients and their incentives for sharing or receiving the message (Arndt, 1967; Liu-Thompkins, 2012), and the seeding strategy which determines the initially targeted population (Bampo et al., 2008; Liu-Thompkins, 2012). To these four elements, we have added the messenger himself (Valente & Myers, 2010) as an element of viral marketing success. Many scholars agree that the key to success in information diffusion is influencing the influencer (Galeotti & Goyal, 2009; Oliver Hinz et al., 2011) or even influencing a critical mass of easily influenced individuals (Watts & Dodds, 2007) and using strategy to target an optimized initial seeding population (Liu-Thompkins, 2012). Also, the information of peers tends to be more contagious than the information diffused by brands or similar source (Valente & Myers, 2010; Watts & Dodds, 2007) and diffusing negative information to an optimized seeding population of consumers on a profile page results in a much higher negative WoM than diffusing the same information on the brand's page.

This paper exposed a technique that malevolent attackers could use to control the elements of viral marketing on Facebook and use them to increase diffusion of negative WoM. Companies, governments and people should worry about such strategies that could be used on online social networks, in this case, Facebook, to increase negative WoM generated by fans and hurt their online reputation.

6 Finding Bridges for Political Influence

6.1 Résumé (Français)

Burt (2004) souligne l'importance des ponts surplombant les trous structurels dans les réseaux sociaux pour diffuser de nouvelles idées et pour ne pas être immédiatement rejetés par les groupes qu'ils relient.

Le Liban connaît depuis quelque temps une rupture politique grave entre les deux courants politiques principaux qui bloque complètement l'activité politique (le Liban est actuellement sans président de la république faute de quorum). Cette division est d'autant plus palpable sur le réseau Twitter où les deux groupes opposés se présentent comme des « groupes polarisés », c'est-à-dire des groupes qui s'ignorent mutuellement même dans le cas de sujets critiques qui les intéressent à tous les deux (M. Smith et al., 2014).

Notre question est de savoir s'il serait possible de trouver sur Facebook des ponts, c'est-à-dire des personnes qui auraient des amis dans l'un et l'autre groupe politique, entre ces deux groupes politiques rivaux. Ces ponts seraient, en théorie du moins, une société initiale de diffusion pour de nouvelles idées émanant de groupes politiques moins importants ou une société initiale de diffusion qui pourrait véhiculer les idées d'un groupe vers l'autre sans être automatiquement rejetée.

Notre méthode consiste à prendre le profil d'un politicien du 8 mars (premier courant politique), d'un politicien du 14 mars (2^{ème} courant politique) et d'un politicien indépendant, et de constituer le graphe social de toute cette population collectée. Le résultat est un réseau de 15,344 nœuds et 341,345 liens. Les nœuds sont marqués soit 8 (couleur orange), soit 14 (couleur bleue), soit indépendants (couleur verte). Les nœuds qui font partie de deux groupes sont marqués par les numéros 110, 101 ou 011 selon les groupes auxquels ils sont connectés. S'ils sont connectés aux trois groupes et, donc servent de pont entre les deux groupes antagonistes en passant par le groupe des indépendants, ils sont marqués 111.

La méthode nous permet de déceler 1041 ponts entre les deux groupes.

6.2 Introduction

An impressive literature exist about political campaigns on online social networks (Berinsky, 2012; Carpini & Williams, 2001; Finke & Harris, 2012; Huang, 2013; Mercanti-Guerin, 2010; Ratkiewicz et al., 2011). This literature addresses questions related to the diffusion of information, the spreading of rumors, political marketing and political influence. Yet, marketing on social networks and WoM marketing is often about specific people to target and several theories focus on the role of people in the network as weak links (M. Granovetter, 1983), easily influenced people (Watts & Dodds, 2007), influential people (Liu-Thompkins, 2012), etc.

While politicians, on online social networks, seem to focus on the number of fans to the point that some of them buy fake ones (Julian, 2013a, 2013b), and the diffusion of messages and rumors via WoM.

On Facebook pages, Facebook obfuscates vital elements for a strategic approach, like the names of the fans beyond a few hundred of them, their relation to one another (are they friends?), important action and information (who is reading the message?), etc.

We ask ourselves if we can use Facebook to find bridges between several political groups, draw and understand the social connections between the members of these political groups.

6.3 Political Landscape in Lebanon

Since its regained freedom after the withdrawal of the Israeli (2000) and Syrian armies (2005), Lebanon's politics has shifted from Muslims against Christians to two new political movements produced by the Sunni vs Shia, USA vs Iran and USA involvement in the region.

The first movement is called "March 14". It mostly supports the USA and Saudi Arabia policy in the region. The other movement is called "March 8" and it supports the Iranian policy.

Between these two major movements, a few politicians try to break through with moderated ideas.

In Lebanon, politicians are often perceived as a father or a grandfather, a prophet, a simple man who rose to become a hero, a model, etc. (Mermier & Mervin, 2012). An interview with Mr. Makram Ouais, chair at the Department of Social Sciences of the Lebanese American University and Mr. Rabih Haber, CEO, Managing Director at Statistics Lebanon Ltd., allowed us to draw the following remarks:

- Even in the tense political periods of Lebanon's history, almost 50% of the Lebanese people did not vote. This percentage of the population will probably never engage politically and never vote.
- It is extremely hard to make people switch from one side to the other. Supporters can drift away from their political engagement but will never get to the point where they vote for the antagonistic group.
- The commonly used strategy for political movements in Lebanon is produce or use a political or security event in the last couple of months before the elections to revive tensions (and often hatred) between political groups and encourage supporters to vote.
- In the current context of events, independent movements cannot break through. Independent politicians running for deputies elections can make a point by showing that not all people are "black or white" or, if they want to win an election, are forced to ally with one of both sides.

6.4 Facebook Restrictions and their Impact on Social Political Strategies

One of the most absurd limitations of Facebook is preventing a user, in our case, a politician, to retrieve the complete list of names of his own fans. Actually, Facebook only allows the retrieval of a very small portion of the fans (less than 500 even for pages with millions of fans) and it has been avoiding the question even with users presenting strong arguments in favor or removing this unjustified ban:

- *"I have been able to see the Likes on my business pages since I started it in 2011. Just this week - I have 9 new Likes - can only see 1. This doesn't even make sense! How can my business interact with them - or use them as leads? Isn't that the point of a business page?" by Victoria Petersen in <https://www.facebook.com/help/community/question/?id=10152264783244409>*
- *"This is totally unacceptable Facebook. A lot of us pay a lot of money for ads and we should be able to get a real time list of who likes our page. Having to create and update a spreadsheet of our likes is not acceptable IMO. Like other business I have a drawing for the people following my business. I want to draw the winner from a current list of likes. If somebody no longer follows me they should not be in my next drawing. Also the list should have a links to the like so I can notify the Winner. As it goes right now I think Facebook is not giving us this information because they want business owners who are paying for ads to feel they are getting their monies worth when actually I feel I am being snowed." by Michael Briggs in <https://www.facebook.com/help/community/question/?id=10152948879270451>*

This drastically limits the use of Facebook pages for social marketing. Pages can still be used for traditional marketing which focuses on targeting a specific type of customers (sex, residence, language, etc.) or people who engage with the page or the applications created by the administrators of the page. From a purely marketing perspective this may sound like a lot of possibilities, but, from a social marketing perspective, the strategist cannot draw the connections between the fans, their position in the entire population (fans and non-fans), their position inside the network and with other network as hubs, bridges or fringes, etc.

This is still possible – to a certain extent – on personal timelines. Personal timelines of Facebook users are not necessarily built around "real-life" friends. Facebook friends can be former high school friends, distant relatives, colleagues and any type of weak ties (Enli & Thumim, 2012). There is also the fact that, over time, connections can go stronger or weaker (Viswanath, Mislove, Cha, & Gummadi, 2009). For politicians, acquaintances, friends or supporters, regardless of the strength of their links with the politician, send him friend requests. In the case of M, it took us only 7 months to acquire 4,458 friends on one of his

personal timelines and, at the time of the article, many requests were still pending acceptance.

The weaknesses and strength of pages versus personal timeline are shown in the following table:

	Facebook Personal Timeline	Facebook Page
Number of connections (Limit)	5,000 friends	Unlimited number of fans
Identity of connections	ALL	Extremely Limited (less than 500)
Edges between connections	Yes	No
Interactions between connections (engagement to posts)	Third party tools	Third party tools
Social Marketing Strategies	Yes	Limited
Marketing Strategies / Advertising	No	Yes

Table 16: Personal Timelines versus Pages for Social Marketing

6.5 The Political Subject of this Experiment

For this experiment, we use the political list of Facebook friends of a politician with more than 40 years of involvement in Lebanese politics. For privacy reasons, we will use the letter "M" to define this politician throughout this chapter. M is an independent politician with ideas very close to those of the March 14 movement. He has a significant base of Christian

supporters in his district. During the Syrian occupation, he managed to obtain the highest number of Christian votes in this district. M has always been very much involved in social activities in his community. In the new political landscape created after the withdrawal of the Syrian army and the involvement of the Iranian regime in Lebanese politics through the Hezbollah (Islamic resistance in Lebanon), and the mutation of the Christian-Muslim political division to a March 8 (pro-Iranian) – March 14 (pro-Occident, pro-Saudi Arabia) movements, M chose to ally with March 8 but his ideas for a new Lebanon are mitigated between those of 14 and 8 March.

To override Facebook's limitations to 5,000 friends per user, M's team created two Facebook profiles for M. This is already a noncompliance to Facebook's rule. Yet, this strategy is far from being uncommon, especially in the Facebook Lebanese social network of politicians and artists. The reason for this strategy, based on M's communication team, is that personal timelines attract more Facebook users than Facebook pages. In addition, the fact that connections are not concealed allow the team to understand supporters' reaction and, eventually, use strong and weak connections to connect, influence or help through mutual connections.

M's personal timelines have 9,458 friends (5,000 friends on the first profile and 4,458 on the second profile). Removing duplicates from both profiles leaves 8,440 unique friends with 275,607 connections (edges) amongst them.

6.6 The Cover Experiment

For the purpose of this experiment, we created two fake Facebook users using a technique we called the "cover experiment". We presented this technique at the International Network for Social Network Analysis Sunbelt 2014 conference in Tampa, Florida.

Social bots and fake profiles have one objective: maximizing the number of friends and then, studying the resulting network or initiating and attack (Bilge et al., 2009; Boshmaf & Muslukhov, 2011; Elishar, Fire, Kagan, & Elovici, 2012; Irani, Balduzzi, Balzarotti, Kirda, & Pu, 2010). They are in majority based on sexual attraction and targeting mutual friends. Barracuda, the security company, found that more than 97% of Facebook profiles are sexy

bisexual women (Rashid, 2012). "Friends" are targeted either randomly or by targeting mutual friends of the fake profile and his attracted "friends" (Boshmaf & Muslukhov, 2011).

Our cover experiment attracts users that are interested by the same topic or share a common interest for a cause or subject. They may not be Facebook friends but they are both fans of the same Facebook page or pages.

The procedure starts by creating a fake Facebook profile and creating a cover in relation with population we are targeting. For the purpose of this experiment, we created two profiles, the first one with a cover photo taken during the 14 March demonstrations (almost 1.5 million Lebanese citizen) and another one with the orange symbol of the Tayyar party (major Christian party of the March 8 movement).

As a second step, we looked for supporting pages for the Tayyar party (Christian pro-March 8 party) and the Lebanese Forces (pro-March 14 party) and sent friend requests to Facebook users who have commented or liked posts from these pages (users engaged on Facebook – and probably in real life – with those parties).

Using this method, we managed to acquire 994 users from March 14 and 4889 from March 8. Resulting networks have 6,278 edges (14 March) and 59,570 edges (8 March). The reason for the discrepancy between the number of friends is due to the fact that the 14 March account was locked by Facebook a little more than 1 month after its creation. We were able, nevertheless, to back up the graph data before its locking.

6.7 M's network

To extract M's friend lists from his two profiles, we use NetVizz (Rieder, 2013) to retrieve the data from Facebook and NetVizz2NodeXL (Messarra, 2014), a program we personally developed to convert the data from the GDF format to GRAPHML format. We use both NodeXL (Hansen et al., 2011) and Gephi (Bastian et al., 2009) to analyze and draw the social graphs.

After combining the two profiles of M., the resulting network is made up of 8,440 unique edges (users) and 275,607 edges. The density of the graph is equal to 0.008, a very low value that can be explained by the fact that a politician usually knows many people from different communities that could not be friends or even connected in real life. The average degree of the 8,440 users is 65.31.

The graph below represents M's friends / supporters on Facebook. Larger circles mean higher edges. The graph was generated by Gephi with the following settings:

- Node size based on degree: min 20, max 100
- Hidden edges (to improve visibility)
- No filters
- No Layout

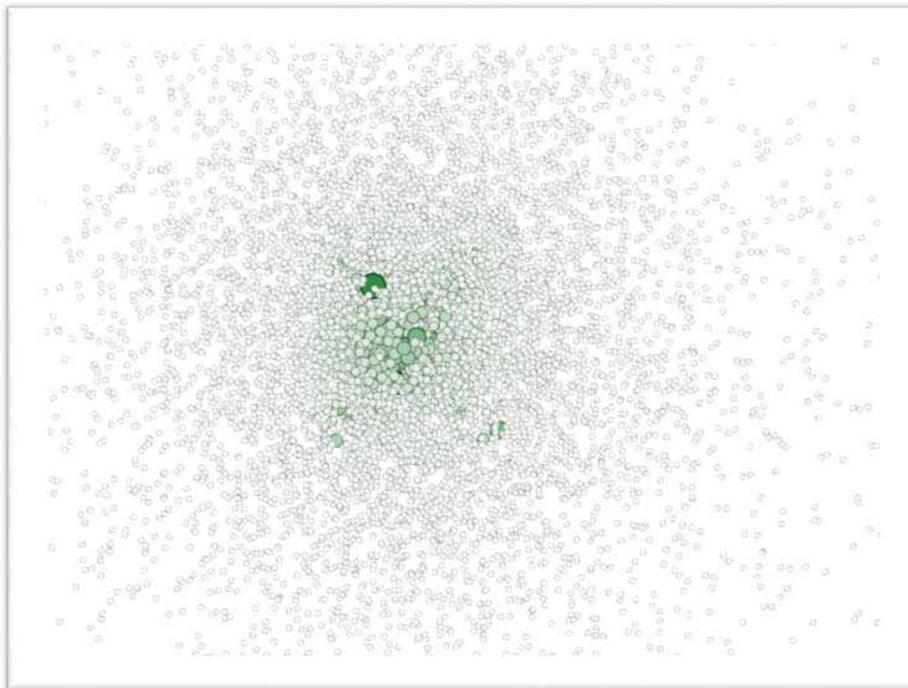


Figure 28: M.'s network of friends on Facebook

Social graphs of this size are hard to read visually. To improve visibility, we add a filter to the population of friends to show the hubs (higher number of connections) of M.'s network:

- Degree between 500 and 1,385 (maximum degree on M.'s network)

The graph is displayed using the Fruchterman Reingold algorithm with an area of 10,000 and a gravity of 2. Edge count is displayed on the nodes. For privacy reasons, names are not displayed.

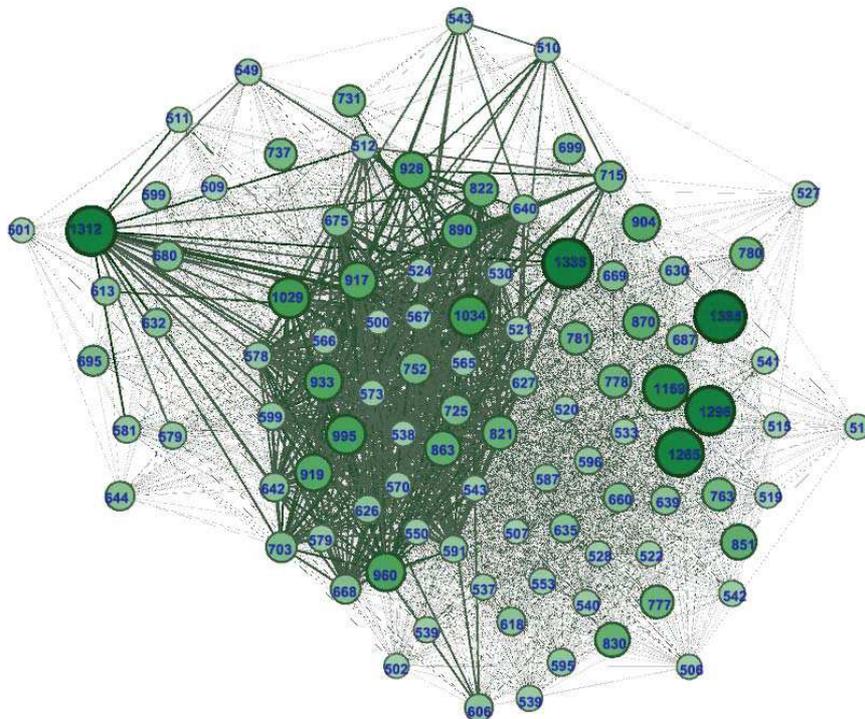


Figure 29: Hubs in M.'s network on Facebook

The resulting network (edges between 500 and the maximum of 1,385) contains 100 nodes (1.18% of the total number of friends of M.) and 3,025 edges (1.1% of all the edges in the network).

6.8 Finding 1: A social marketing advantage for multiple profiles

We have previously mentioned Facebook's restrictions to access to one's own data and the subsequent limitations to using efficient social marketing strategies on this platform. In short, if a politician uses a Facebook page, he only has access to his last 500 fans and cannot recreate a friend's network from this data. On the other hand, if he uses a personal profile, he is limited to 5,000 friends only.

The strategy of using multiple profile – despite Facebook's prohibition – allowed us to redraw a larger social graph of M.'s supporters and friends. The benefit of such a method is that it would be possible to redraw M.'s "big data" from bottom to top, one Facebook timeline at a time.

The second advantage from a social marketing perspective is the capability of drawing paths between nodes from different profiles and finding connections between people.

In the example below, we use the "shortest path" tool in Gephi to find the connections between two nodes: A and B.

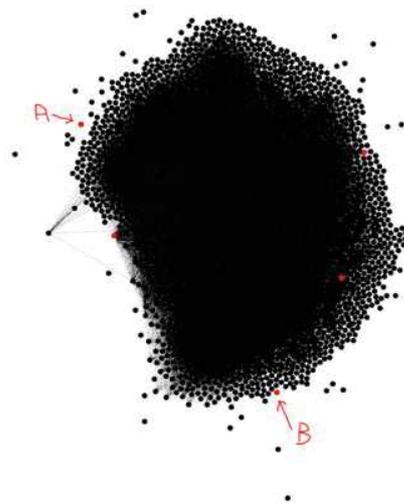


Figure 30: Finding connections throughout Facebook profiles

We can then extract the nodes from Figure 30 to a different workspace for better readability. The screen clip in Figure 31 shows the nodes A (Amal), B (Maurice) and the connections leading from A to B throughout both M.'s profile. Last names have been stroked for privacy reasons.

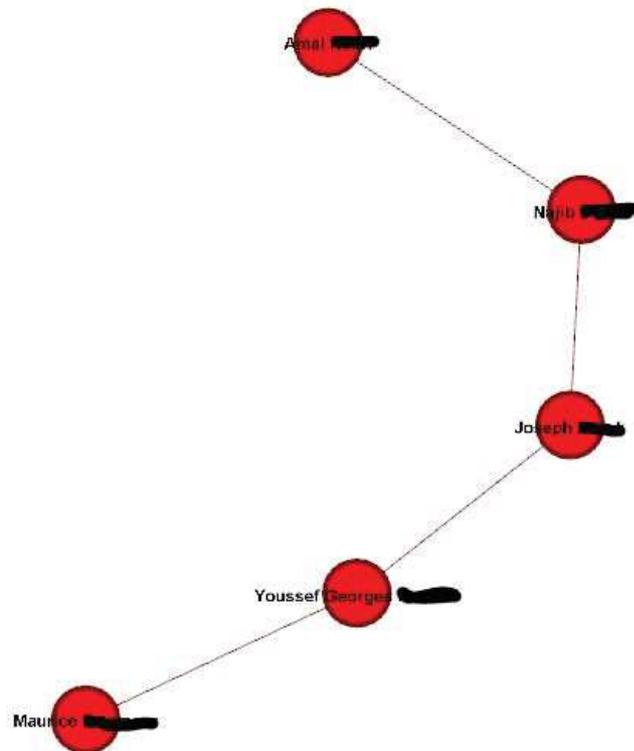


Figure 31: Shortests path from Amal to Maurice throughout both M.'s profiles

6.9 The big picture: mixing political networks

The main purpose of this experiment is to find social bridges amongst multiple political networks. We mix the two profiles of M.'s with the two fake profiles of March 8 and March 14 political movements. The resulting data contains 15,344 nodes and 341,345 edges. This size of data is extremely hard to visualize. It is also very hard to analyze. This is why we have to NodeXL for its ease of use in order to retrieve the bridges between the three different political networks, and Gephi for its performance in order to visualize the results.

We go through the following steps in order to extract and analyze relevant data to bridges amongst the three networks:

1. We extract all the data for the four profiles (two profiles for M, one March 8 profile and one March 14 profile) using the social media importer for NodeXL and combine all the data into a single NodeXL file.
2. We add a new column to the NodeXL file and call it "Political Group". For each node, this column will hold a "B" (Blue) for the March 14 profile, "O" for the March 8 profile and "M" for M's profiles. If a node is found in more than one network, it will keep the value of the first network it was found in.
3. We also create a second column, "Bridge". This column will contain one of the following values:

	M	O	B
Bridge Between M and O	1	1	0
Bridge Between M and B	1	0	1
Bridge Between O and B	0	1	1
Bridge Between M, B and O	1	1	1
Not a bridge	100 (M only), 10 (O only) or 1 (B only)		

4. In the edges sheet, we create a new column "Bridge" with a formula which returns 1 if one of the nodes of the edge is a bridge, otherwise 0. We use this column to remove all friends of M who are not directly connected to a bridge. Our objective being the detection of bridges between political networks, this procedure will help us remove unnecessary nodes from the graph.
5. We finally delete all edges who have a "bridge" value of 0 and copy the data to Gephi.

6.10 Finding 2: Bridges between Lebanon political groups

The data imported to Gephi is converted to a graph that shows the bridges in orange (March 8) and blue (March 14). Green dots represent M's connections who are directly connected to an orange or blue bridge. A larger node means a higher degree.

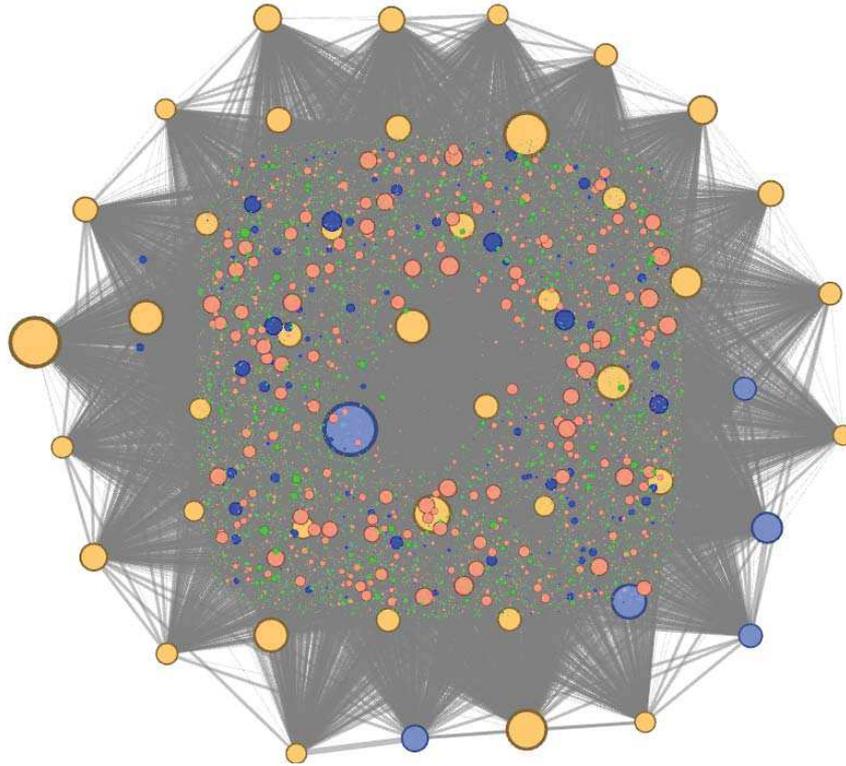


Figure 32: Bridges between political groups in Lebanon

We find 3,839 nodes belonging to more than one network and serving as bridges between the competing political groups in Lebanon.

For visibility and aesthetics, we filter the nodes showing only those who have a degree between 520 and 1,385. The graph below shows the most important bridges between M.'s network and a network of March 8 supporters (orange) and a network of March 14 supporters. Each node is labeled by its degree value.

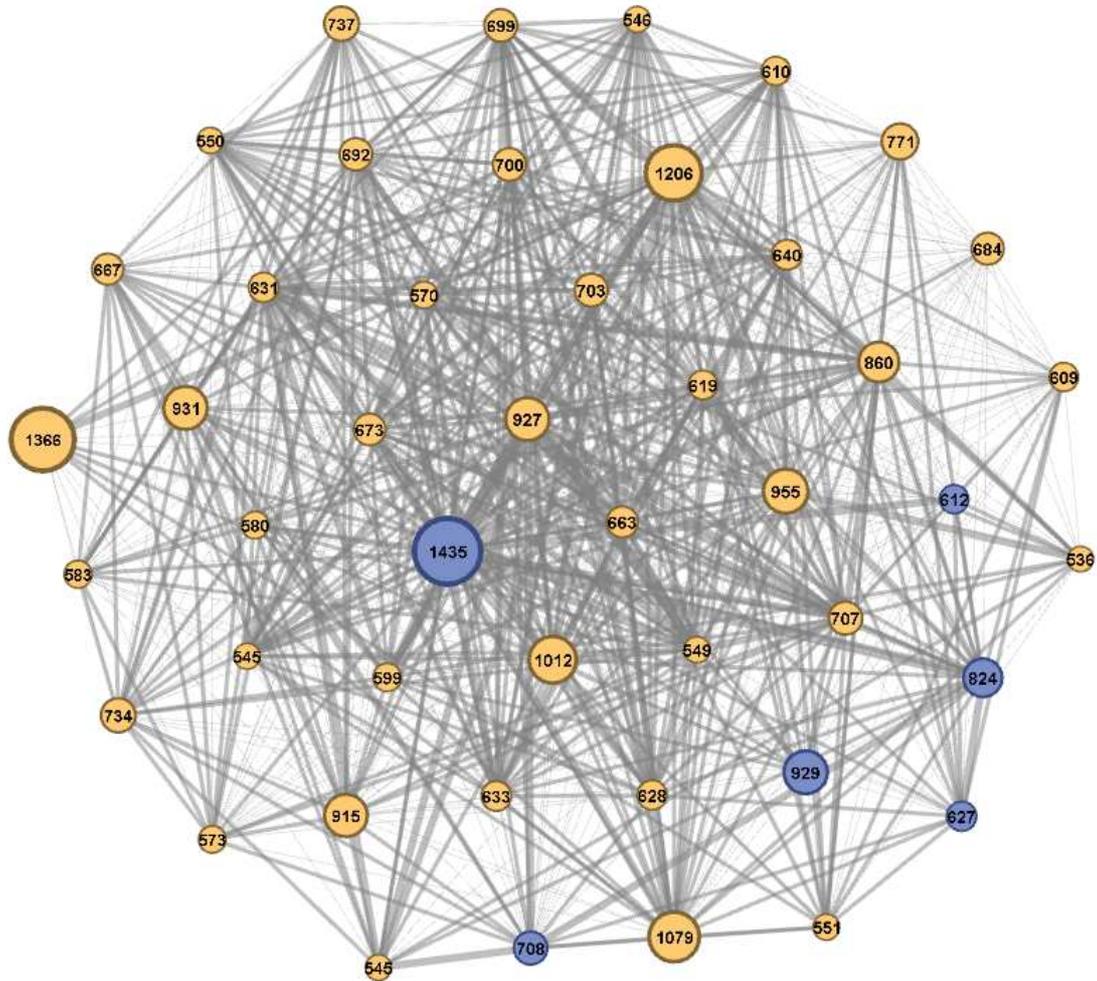


Figure 33: Bridges between several Lebanese political groups

6.11 Real life evaluation of the results

To evaluate the efficiency of our method, we delivered a list of the 1,041 names that were found to be bridges using the method described in this paper to M's team who investigated the first 100 names (sorted by number of connections). It appeared that these people were well-known journalists, lawyers, businessmen, etc., who were considered as politically "neutral" or "moderated" by the general public. M's team confirmed that with very good

social connections and with their non-aligned political position, these persons could, indeed, play a role as bridges between M's network and other political networks.

6.12 Conclusion

Facebook limitations force marketers to use traditional marketing on social networks instead of using social marketing. Using two profiles of a moderate Lebanese politician, "M", we draw a social network of supporters and acquaintances of this politician. We then create two fake profiles each with a simple cover photo supporting one of both major political movements. We then send requests to Facebook page fans of each political movement, encouraging supporters to become friends with those profiles.

The resulting network of more than 15,000 nodes and 300,000 connections is then analyzed for nodes belonging to more than one group.

The same procedure can be applied to competing brands, or even people.

This procedure allowed us to have a social view of the Lebanese political landscape of more than 15,000 people and their connections, not only as political affiliations, but also to other members of the society.

This approach reverts Facebook to its initial purpose, a social network, and allows the marketing strategist to target and influence social nodes who can transmit information from one group of supporters to the other. It also unveils new marketing perspectives to communication and social marketing companies who are using traditional marketing (classic advertising) instead of social marketing on social networks.

7 Rethinking Marketing on Facebook

7.1 Résumé (Français)

Les recherches et les expérimentations au niveau du marketing sur les réseaux sociaux semblent s'axer principalement sur le marketing viral et le BaO négatif ou positif.

Seulement, qu'en est-il d'autres formes de marketing : marketing de masse, marketing de niche, marketing relationnel et marketing viral. Aussi, sur Facebook, plusieurs supports permettent d'agir différemment et d'exister différemment sur cette plateforme : les pages personnelles ou fils d'actualité, les groupes et les pages d'entreprise.

Nous avons montré dans les parties précédentes, qu'en théorie, c'est sur les fils d'actualité (les profils personnels) que le chercheur ou le stratège marketing a le plus de contrôle sur les différents éléments du marketing viral, soit le messenger, le message, la structure du réseau, les caractéristiques et l'attitude des individus du réseau et la population de diffusion initiale (ou la population d'ensemencement). Qu'en est-il des autres supports (groupes, pages) ? Des autres techniques marketing ?

Nous étudions individuellement les éléments nécessaires pour chaque type de marketing et examinons les possibilités qui s'offrent sur chaque support pour appliquer ou contrôler ces éléments de manière efficace.

Cette analyse nous permet de combiner techniques marketing et supports disponibles sur Facebook et d'imaginer un cadre de travail sur cette plateforme pour les stratégies marketing :

Type de Marketing	Facebook Timelines	Facebook Groups	Facebook Pages
Masse			X
Niche			X
Viral	X		
Relationnel		X	X

Table 17: Marketing techniques and Facebook channels

7.2 Introduction

There is an extensive literature about the changes brought to marketing with the explosion of online social networks (Mangold & Faulds, 2009; Trusov, Bucklin, & Pauwels, 2009; Woodcock, Green, & Starkey, 2011, etc.) and there are no doubts that online social networks have, at least, introduced a new uncontrollable element to the marketing mix: consumer discussions (Mangold & Faulds, 2009).

Yet, most papers discuss online social networks as if they were all identical which, in reality, is not true as they differ in many aspects. To say the least, Facebook is an undirected network while Twitter is a directed network. Facebook is a network based on "friends" or "fans", while Twitter is a network of "followers". Even on Facebook, a user or a brand can be present in three different ways - timelines, groups or pages - each one having different levels of control over the connections and the communication.

On the other hand, the focus has been on viral marketing, neglecting other schools of marketing that can be used on these platforms, like mass marketing and relational marketing.

In this chapter, we center our attention on the online social network Facebook, and particularly the difference between the three channels offered by this platform, Facebook pages, Facebook groups and Facebook personal timelines. We consider different marketing schools (mass marketing, viral marketing, influence marketing) and evaluate their chance of success on those channels.

7.3 Marketing and Online Social Networks

In "The economics of information technology: An introduction", Varian & al. (2004), write how, for new technologies, people take old techniques and try to apply them to a new environment before finding new methods and really taking advantage of the new technology. The most illustrative case of this reality is how it took a decade for factories to realize that electricity allowed them to work in lines in a horizontal structure, rather than the vertical structure required to preserve and use the heat generated by coal. A more contemporary example would be messaging over the Internet. E-mail is a mere copy of what our fathers

have been using for centuries, regular mail, now known as "snail mail". We have just used a technology we are familiar with since the Universal Postal Union (UPU), established in 1874. It took years before email converted to instant messaging, as we know it today with all the file transfer, clickable hyperlinks, voice messages, voice over IP, or video chat capabilities. Are we there yet? Probably not. With the advance in telecommunications, we will probably live long enough to witness a new major breakthrough in online messaging.

Talking about the Internet, Stan Liebowitz declares that "information transmission does not change the Laws of economics" (2002). We also believe that it does not change the laws of marketing either. Marketing on online social networks is merely an enhanced version of what we already know and used since the 1960s like the two step flow theory (Lazarsfeld et al., 1968), the principles of influence (Robert Cialdini, 2001) and the strength of weak ties (M. Granovetter, 1983).

The attractiveness of viral marketing and its link to social and network sciences made it the #1 subject of discussion in scientific literature in relation with online social networks (Aral & Walker, 2011; Bampo, Ewing, Mather, Stewart, & Wallace, 2008; O Hinz, Skiera, Barrot, & Becker, 2011; Liu-Thompkins, 2012; Subramani & Rajagopalan, 2003; D. Walker, 2010; Watts & Dodds, 2007, etc.). The ice bucket challenge is probably one of the most convincing success stories of viral marketing on online social networks (Phing & Yazdanifard, 2014). It helped raise more than 100M\$ and generated more than 2.4 million tagged videos.

Yet, viral marketing may take weeks, months or even years to achieve its goals and we believe that a business or a political organization would rather use mass marketing as a strategy to deliver a message in a very short time to the largest number of people worldwide, without distinction. So, why not consider several marketing strategies for online social networks, like:

- Mass marketing
- Target marketing
- Viral marketing
- Relationship marketing

7.4 Facebook evolution and its impact on marketing strategies

If we had to resume Facebook in four important dates for marketers and brands, these would be:

- Nov. 2004, the creation of Facebook
- Sep. 2006, the date anyone was allowed to join
- Nov. 2007, the introduction of Facebook Ads and Facebook Pages for brands and businesses
- Apr. 2014, Facebook launches business manager for businesses and advertisers having several users controlling one or several business pages

It is obvious that the creation (Nov. 2004) and the free and unconditional subscription to Facebook (Sep. 2006) have set a new milestone in Internet history. Facebook succeeded where Myspace failed and managed to connect more than 1 billion people – and consumers – together.

After several attempts to monetization and ads since 2004 (flyers, marketplace, Microsoft ads, etc.), the Facebook strategy for business really started in 2007 with the creation of targeted advertising and "Facebook pages". Facebook was defining a new "playground for businesses" very different from what was offered to users and communities.

Through different limitations (mainly the number of connections) and goodies (most importantly post boosting and targeted advertising), Facebook has been pushing all brands towards one communication channel, Facebook pages. Yet, the remarkable thing about viral marketing is that it should start with a relatively small seeding population (Oliver Hinz et al., 2011; Liu-Thompkins, 2012). Some authors even suggest that seeding more than 0.2% of the population is a waste (Aral et al., 2011). So, why not use a personal timeline if the customer population is less than 5,000 customers (clubs, specialized shops, village stores, small communities, mayor far a small town, etc.)?

The differences between the three channels (Facebook timelines, Facebook groups and Facebook pages) are fundamental. In the table below, we have compiled what we considered the most significant differences when planning a marketing strategy:

	Timelines (Personal)	Groups	Pages
Number of connections	Up to 5,000	Unlimited	Unlimited
Know connections (names)	All	All (tested with a group of 2,500 users)	Very Few
Engaged users (names)	Yes	Yes	Yes
Control connections (Accept, Ban, etc.)	Accept/Reject except for followers	Open, Closed, Private	Ban only
Reach	Unknown	Known for small groups (names and count)	Percentage only
Paid Reach	Not Available	Not Available	Available
Reach Methods	Lists, reach unknown	Tags, reach unknown	Custom audience, Boost, Ads
Privacy	Good (who sees my stuff)	Best (Private groups)	None
Insights (statistics)	None	Limited (seen by)	Good

Direct Messages	Yes (select one by one)	Yes (option to send to all for small groups)	Reply only
Administrators	One (Real or "Gray")	Many	Many
Post Scheduling	No	No	Yes
Post Location	Yes	Yes	Yes
People Tagging in posts	Yes	Yes	No
Free targeting	Limited (lists created by the user)	No	Yes
Target outside one's network	Friends of friends virally	No	Friends of fans, fans of other networks, broad target (by country, sex, age, language, etc.)
Find and target existing customers	No	No	Yes (custom audiences)
Call to Action	No	No	Yes

Table 18: Differences between timelines, pages and groups on Facebook

7.5 Mass Marketing on Facebook

Mass marketing or undifferentiated marketing is defined in the Business Dictionary (2012) as "an attempt to appeal to an entire market with one basic marketing strategy utilizing mass distribution and mass media". The low cost and ease of mass advertising on Facebook and the complexity of controlling all the elements of viral marketing (Oliver Hinz et al., 2011) may

push some companies or political group to use mass marketing instead of viral marketing. Based on our tests, an advertiser can deliver a message to more than a million users with less than 3,000 US Dollars.

Because maintaining a web page with large group of fans and creating viral content may be a hassle, using mass marketing on Facebook can be a cost-efficient and resources efficient solution.

Mass targeting is all about reaching the largest number of people without distinction. Amongst the three Facebook channels available, this is only possible on pages:

Mass Marketing	Timelines (Personal)	Groups	Pages
Reaching a very large audience without discrimination	No. Only distributes to friends and to friends of friends in case of engagement	No. Only distributes to some group members and the rest of the members in case of engagement	Yes. Very wide targeting is possible (by list of countries)

Table 19: Mass Marketing on Facebook

7.6 Target Marketing, Niche Marketing or Differentiated Marketing

With niche marketing (Stone & Desmond, 2007), the target audience is much more specific. In terms of marketing mix and the 4 P's (product, price, place and promotion), the niche is the "place". It can be a country, an age group, a gender, people interested in some kind of a sport or other activity, people speaking one or more languages, etc.

Facebook ads, limited to Facebook pages, offers a relatively precise targeting:

- Geographically: up to the area level in some countries.
- By gender
- By age

- By interest (sports, food types, parenthood, hobbies, fashion, etc.)

More interestingly, with a small tweak, a brand can target the people who like another brand. This is similar to the "free rider problem" (O. Kim & Walker, 1984): a brand can take advantage of the fans a competitor or an ally strives to acquire on its own page and target them effortlessly.

These options are not available for timelines and groups where targeting is limited to direct connections (friends or members).

Niche Marketing	Timelines (Personal)	Groups	Pages
Reaching a very large audience without discrimination	No. Only distributes to friends and to friends of friends in case of engagement	No. Only distributes to some group members and the rest of the members in case of engagement	Yes. Niche targeting is possible.

Table 20: Niche Marketing on Facebook

7.7 Viral Marketing

Viral Marketing as defined by Bampo & al. (2008) is a mode of communication among peers who are encouraged to spread. Hinz & al. (Oliver Hinz et al., 2011), consider four elements for viral marketing success:

1. The content (JA Berger & Milkman, 2009)
2. The structure of the network (Bampo et al., 2008)
3. The behavioral characteristics of the recipients and their incentives of engaging with the content (Arndt, 1967)
4. The seeding strategy (Bampo et al., 2008; Liu-Thompkins, 2012)

To these four elements, we add a 5th one suggested by Tom Valente (2010):

5. The messenger

Because viral marketing requires a complex setup and a certain level of control over the five elements described above, we try, in the pivot table below, to match the elements of viral marketing (rows) with the three different channels available on Facebook (columns). Explanations follow the table.

Viral Strategy Criteria	Timelines (Personal)	Groups	Pages
Content¹	Yes	Yes	Yes
Network Structure²	Yes	<i>Limited</i>	<i>Limited</i>
Behavior of the recipients³	Can be anticipated	Can be anticipated	Can be anticipated
Seeding Strategy⁴	Yes	<i>Limited to No</i>	<i>Limited to Broad</i>
Messenger⁵	Yes	Yes	<i>Untrusted</i>
Score	5/5	3/5	2/5

Table 21: Viral Strategies on Facebook Channels

- 1. Content** is the first platform independent element fully controlled by the brand or the social media manager in charge of creating content for Facebook.
- 2. Network Structure** is about the connections (or edges) between the vertices (or nodes) of the network. In personal timelines, the user has access to all the connections in his own network (who is a friend with who) and even access to some of the connections outside his network (who are the friends of my friends) depending on the security settings of his friends. In a personal timeline, there is a confusion between strong and weak ties (Friedkin, 1980; M. Granovetter, 1983) because Facebook friends can just be acquaintances (Tong, Van Der Heide, Langwell, & Walther, 2008b), yet,

Facebook offer a "lists" feature that can be handy to separate strong ties from weak ties in one's network. In addition, Open Graph possibilities allow the marketing strategist to draw a larger network of connections reaching friends of friends that are not in the user's network. Moreover, it is also possible to draw the connections between friends who engage with the same post in order to draw a graph of interactions or activity.

With groups, it is only possible to draw a graph of interactions, compare it to the entire population (all members are identifiable) and to the members who have actually seen each post.

With pages, only an extremely small proportion of fans are known by name. It is still possible to link those who engage with posts by their interactions but one can never know if a fan is not engaging because the posts are not delivered to him or because he's just not interested.

The fact that network structure is "invisible" to the end user does not necessarily mean that it is not optimal for viral marketing. It means that it is completely out of the control of the marketer and that it cannot be improved. Filling structural holes and optimizing the network via network engineering or network interventions (Aral et al., 2011; Valente, 2012) is only possible on Facebook personal timelines. In fact, some authors suggest that people are even filling their own network structural holes to maximize their social capital (Chen et al., 2009).

3. **Behavior of the recipients** can be anticipated based on previous reactions to similar messages (Phelps & Lewis, 2004). In fact, companies are using anticipation to prevent blunders (Saravanakumar & SuganthaLakshmi, 2012). This puts all three channels at an equal level of control over the anticipation of the behavior of the recipients.
4. **Seeding Strategy** is defined by Yuping Liu-Thompkins (2012) as the "first-generation consumers to spread a viral message to". She suggests that these consumers should have strong influence on others and strong ties with the marketer. For Watts and Dodds (2007), the seeding population should be consumers that are easily influenced

by others, not influencers. Whatever the case, with Facebook pages, the complete population of fans is made of "unsubs" (a term used in the TV series "Criminal Minds" to describe "unknown subjects") and the marketer can have access to a very small proportion of the global population. In this situation, from a viral marketing perspective, most viral marketers are just shooting in the dark. Ferguson (2008) asks if "without customer identification and access to customer data, are viral marketers just blowing smoke?".

With groups, the global population is known and the marketer can "tag" an initial seeding population making it the recipient of the post. This makes it an ideal candidate for a seeding strategy. Yet, messages distributed within a group cannot be seen by people outside the group itself. Therefore, if the objective is a viral marketing strategy within the limits of a group, a seeding strategy is possible. Nevertheless, if the aim is to create a viral marketing strategy that will extend beyond this limit, the seeding strategy within a group is not an efficient solution.

Personal timelines offer the best solution to initiate a seeding strategy because the whole population is known and an initial seeding population can be targeted by using the "lists" feature available only for timelines.

5. **The Messenger** has a special importance in the diffusion of the message. Valente & Myers showed how, in social networks, "the messenger is as important as the message" itself (2010). On online social networks, the name of the creator of the message, the first messenger, is linked to the message itself. Therefore, when the message is "liked", "shared", "tweeted", "mentioned" or "commented", the name of the first messenger is always visible. When a post is published on a Facebook page, it is received by the users of the network with suspicion, simply because brands are not welcomed on online social networks (Fournier & Avery, 2011).

On groups and personal timelines the message originates from a real user who can be a person of influence (Robert Cialdini, 2001).

In Table 21, we count the number of criteria that can be controlled by the marketer on each channel. The result is surprising: marketer have almost no control over the elements of viral

marketing on Facebook pages, the channel associated with brands, while they have complete control over these elements on personal Facebook timelines.

7.8 Relationship Marketing

Relationship marketing is to "establish, maintain and enhance [...] relationships with customers and other partners, at a profit, so that the objectives of the parties involved are met. This is achieved by a mutual exchange and fulfilment of promises. Such relationships are usually but not necessarily always long term" (Grönroos, 1994).

From relationship marketing literature (Grönroos, 1994, 2004; Herbig & Milewicz, 1993; Williams & Chinn, 2010), we can compile the following goals for successful relationship marketing: Identify customers, build connections, develop relationship, strengthen awareness, understand needs, create engagement, enhance loyalty, provide additional value, retain existing customers, terminate relationships when necessary, create mutual benefits, generate profit and earn trust.

The table below combines the goals of relationship marketing with the capabilities available on each of the three Facebook channels.

	Timelines	Groups	Pages
Identify customers	Yes (mailbox)	Yes (email)	Yes (custom audience)
Build connections			
Develop relationship	Yes	Yes	Reply only, Ads
Strengthen awareness	Yes	Yes	Yes
Understand needs	Yes	Yes	Yes

Create engagement	Yes	Yes	Yes
Enhance loyalty	Yes	Yes	Yes
Provide additional value	No	No	Yes
Retain customers	Yes	Yes	Not controllable
Terminate relationships	Yes	Best	Not entirely
Create mutual benefits	No	No	Yes
Generate profit	No	No	Yes
Earn trust	Yes	Yes	Yes
Score	9/12	9/12	9/12

Table 22: Relationship Marketing Goals and Facebook Channels

Identifying existing customers on Facebook is possible using any of the three channels. On timelines and groups, the user can invite people to his network using an email database. On Facebook pages, the user needs to use the custom audience feature combined with a paid advertisement to invite existing customers.

Developing relationship, understand needs and earning trust is based on interaction via messages, comments and replies. On Facebook timelines and groups, the marketer can initiate the conversation, not on pages. Nevertheless, once the customer initiates a discussion, the marketer can engage with him and open a discussion.

Online social networks help increase customer awareness, insights and engagement (Woodcock et al., 2011). This applies to all three channels indifferently.

Engagement, emotional loyalty and financial value (benefits, profits) are linked together (Woodcock et al., 2011). Engagement in terms of liking, sharing, commenting, opening videos and photos, is at the core of Facebook's platform and, thus, available on the three channels. Nevertheless, Facebook pages offer the highest flexibility and capabilities, like the "call to action button", "Facebook apps", and other features not available for groups and timelines.

Communication and interactions help retain customers. Yet, while it is possible to track the changes in the global population on timelines and groups, it is impossible to know which fans have left the population on Facebook pages.

Fan attacks are not uncommon on online social networks (Champoux et al., 2012; Steel, 2010) and Facebook is no exception. Brands have the choice to ignore negative comments, respond to them (Shaw & Coker, 2010), or delete the messages and ban the users. Timelines and group allow a fair level of privacy and blocking capabilities while pages have an option to prevent the user from writing on the page (ban) but he will always be able to visit the page and read its contents.

In conclusion, while all three channels have their strong and weak points, groups and pages seem to be more appropriate as they allow an unlimited number of customers while personal timelines are limited to 5,000 (see Table 18). If security and privacy issues are important, Facebook groups will provide the best environment to keep conversations private; while the control over reach using post boosting, ads and custom audiences targeting is only available on Facebook pages (see Table 18).

7.9 Conclusion

While studies have mainly focused on viral marketing and online social networks in general, this paper suggests several marketing techniques (mass marketing, niche marketing, viral marketing and relationship marketing) to consider on online social networks. Furthermore, while the natural environment for brands on Facebook is Facebook pages, this paper considers using Facebook timelines and Facebook groups as marketing strategies alternatives mainly because of the level of control they offer over Facebook pages.

The table below summarizes the results and suggests the best channel for each marketing technique:

	Facebook Timelines	Facebook Groups	Facebook Pages
Mass Marketing			X
Niche Marketing			X
Viral Marketing	X		
Relationship Marketing		X	X

Table 23: Marketing techniques and Facebook channels

This paper tries to open a new line of reflection for strategic marketing researchers and practitioners. Additional research, experimentation and analysis is necessary for a better understanding of the marketing strategies that could be used on Facebook.

8 Making Sense of Everything: A Personal Branding Case Study from Start to Finish

8.1 Résumé (Français)

Les recherches et expériences décrites dans cette thèse nous ont permis de mettre en relief l'importance des pages personnelles en tant que support idéal pour le marketing viral sur Facebook. Elle ont aussi permis de confirmer l'importance des populations initiales de diffusion dans le cadre du marketing viral (O Hinz et al., 2011; Liu-Thompkins, 2012).

Dans ce chapitre, nous essayons de mettre la somme des notions théoriques consultées et des résultats des recherches effectuées en application.

Il s'agit de concevoir et d'exécuter pas à pas une campagne de marketing viral sur Facebook dans le contexte d'un personal branding.

La campagne commence le 6/6/2013 avec le premier post de satire sociale et politique d'un écrivain qui se lance et se termine fin 2015 avec deux propositions de publication par des maisons d'édition.

Dans cette expérience, nous contrôlons tous les éléments du marketing viral :

- Le messenger, qui est l'auteur
- Le contenu qui est créé par l'auteur
- La structure du réseau. Il s'agit d'un réseau d'amis dont la densité est de 0.05 au départ.
- Les caractéristiques des personnes ciblées : au départ il s'agit d'amis proches de l'auteur. Soit, des liens forts.
- La population initiale de diffusion qui est constituée par les amis de l'auteur.

Progressivement, nous modifions les éléments de manière à injecter des liens faibles dans le réseau et, par conséquent, à modifier la population de diffusion de chaque post de

manière à ce qu'elle soit composée de liens forts et faibles à la fois. Pour cela l'auteur refuse tous les demandes d'amitié de tous les amis proches et accepte les demandes d'amitié de tous les « inconnus » qui se sont engagés (aimé, commenté, partagé) les posts.

On remarque que la densité du graphe chute avec l'arrivée de personnes qui sont hors du cercle d'ami de l'auteur et une croissance progressive du nombre de likes, commentaires et partages.

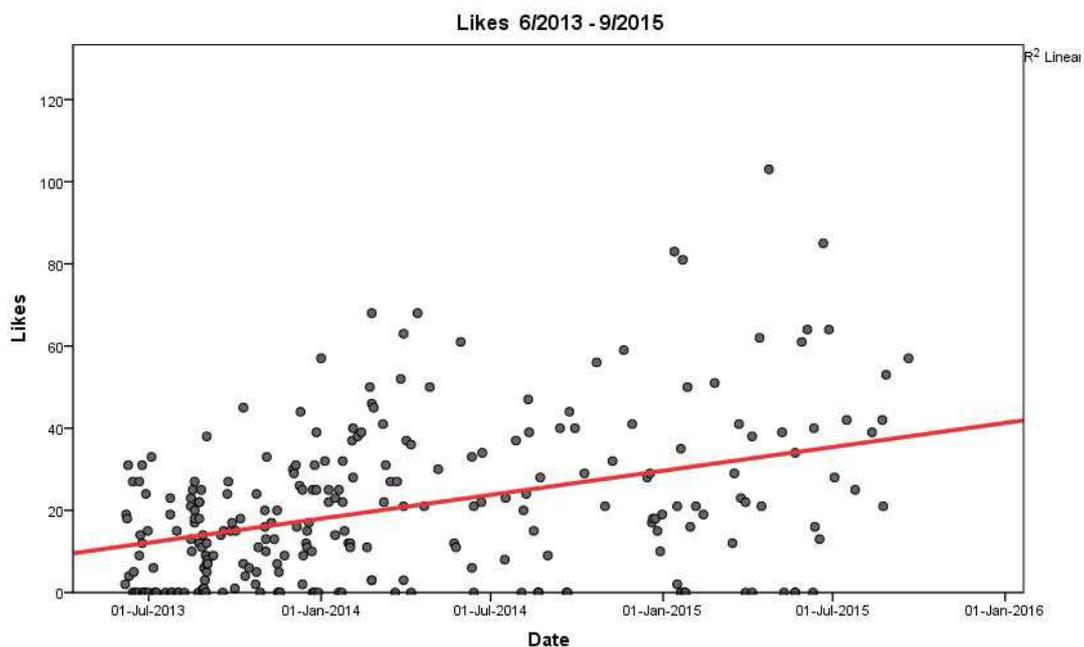


Figure 34: augmentation du nombre de likes 2013-2015

Sans aucun apport extérieur (publicité hors ligne, publicité sur Facebook, autre), les résultats démontrent qu'il est possible de contrôler les éléments du marketing viral sur Facebook et d'optimiser ses éléments, principalement, la structure du réseau et la population de diffusion.

8.2 Introduction

Online social networks in general, and Facebook in particular, have significantly reduced the six degrees of separation and significantly shortened the paths in the social graph of a billion people (Backstrom, Boldi, Rosa, Ugander, & Vigna, 2012; Ugander et al., 2011). More interestingly, people are mixing strong links (friends) with weak links (acquaintances) and filling their structural holes with mutual friends to optimize their social graph (Chen et al., 2009). These factors, and others, made online social networks, an ideal environment to launch viral marketing strategies.

Sociology and psychology scholars have addressed several aspects about the usage and influence of online social networks on one's life, from self-esteem to jealousy (Darvell, Walsh, & White, 2011; Eby, 2010; Gonzales & Hancock, 2011; Marshall, Bejanyan, Castro, & Lee, 2013; Steinfield, Ellison, & Lampe, 2008; Zywicki & Danowski, 2008; etc.). In this paper, we try to look at the personal usage of Facebook from a marketing perspective and ask ourselves if Facebook timelines are or could be an efficient platform for personal branding.

The Internet brought two important economic factors to promote success: low barrier to entry, allowing any brand or person to enter the market with very low investments or technical skills, and the superstar effect allowing increased fame and pay-off for those who establish themselves as superstars in their field (Liebowitz, 2002a; Rosen, 1981; H. R. Varian et al., 2004; H. Varian & Shapiro, 1999). Justin Bieber, a "YouTube phenomenon", is a business model for building fame and maintaining a superstar status on online social networks (Khrabrov & Cybenko, 2010).

Low barriers to entry (Liebowitz, 2002b) have significantly reduced the cost of a presence and its maintenance on the Internet has been dropping year after year. In fact, people can build websites and blogs for a few hundred dollars, sometimes less. Cloud hosting and virtual machines gives the brand the opportunity to upgrade and downgrade the hosting package without the hassle of changing the server, reinstalling software, etc. A social network presence is free of charge and stay free as long as the brand does not want to invest in advertising.

The long tail and superstar effects (Hales, 2013): The Internet offers the opportunity for first movers and successful brands to get more and more popular at an accelerated rate. In superstar effects, a small number of prevalent products dominates the demand while demand for less popular products drops down. In a Facebook environment, the distribution algorithm is a secret recipe that is not available for research and end users. Yet, we can safely assume that a person receiving increased praise (likes, comments, shares) will have its posts distributed to more and more people, while people with lower praise will have a much smaller audience.

We know that experiences of personal branding took place on YouTube and that, thanks to low barriers to entry and superstar effects, succeeded. An example would be the ascension of Justin Bieber to stardom thanks to his mother posting YouTube videos about his singing.

8.3 Personal branding and Facebook

We are all our own brands (Peters, 1997) trying to maximize our chances in the market place. We are also social animals using Facebook to improve our self-esteem (Darvell et al., 2011; Gonzales & Hancock, 2011), look for love and happiness (Junghyun Kim & Lee, 2011b), or maximize our social networks (Chen et al., 2009). Optimizing one's presence on Facebook and letting it reflect AFK ("away from keyboard") depends on the choices we make in selecting our friends on the platform. A study by Kim and Lee (2011b) shows that more friends increase one's self-esteem but that this does not reflect on one's IRL ("in real life"). On the other hand, honest self-presentation by choosing one's IRL friends increases happiness and real life social support.

The importance and role of social connections as hubs or bridges, strong and weak links, in politics and elsewhere, etc., has been the subject of many studies for decades (Dietram, 2000; M. Granovetter, 1983, 1995; Lazarsfeld et al., 1968). In a recent video on YouTube⁵, Tom Peters, author of "The Brand Called You" (1997), states that "we are the people we hang out with".

⁵ <https://www.youtube.com/watch?v=ygT8FBVhu0>

The Facebook platform, and specifically Facebook personal timelines, provide an ideal environment to reach strong and weak social ties altogether. Thus, provide an interesting platform to investigate regarding personal branding.

8.4 Timeline or Pages?

For Facebook, the natural environment for brands and businesses is Pages. Pages have access to advertising, multiple users' access, users' roles, unlimited number of fans, and other features that are not available on Facebook Personal Timelines.

Yet, for researcher and the strategic marketers, Pages do not offer the control and flexibility of Personal Timelines. As an example, on Facebook pages, the brand does not have any control on its own fans; it does not know who they are (the list of names is limited to the last few hundreds at the best); it does not know how they are socially connected (who is friend with whom); it cannot target them with a message individually or as groups (no lists, messages or tagging of fans); etc.

From a viral marketing perspective, Personal Timelines offer a much better vector of communication as Facebook Pages, because they allow control over all the elements of viral marketing success: the seeding population (Oliver Hinz et al., 2011; Liu-Thompkins, 2012); The content (JA Berger & Milkman, 2009), the structure of the network (Bampo et al., 2008), the behavioral characteristics of the recipients and their incentives of engaging with the content (Arndt, 1967), the seeding strategy (Bampo et al., 2008; Liu-Thompkins, 2012) and the messenger (Valente & Myers, 2010). Pages, on the other hand, give very limited control over the seeding strategy and the network structure. On a Page, the messenger is also perceived differently and could be associated to a business and rejected (Fournier & Avery, 2011).

8.5 Viral Marketing Strategies for Personal Branding on Facebook

Experience shows that several popstars started on social networks: Justin Bieber was discovered on YouTube by talent manager Scooter Braun, Lana Del Rey become famous when she posted her video "Video Games" on YouTube, Cody Simpson was also discovered on YouTube when he was 12...

Instagram has also created fame for several amateur photographers like Chris Ozer (Price, 2014) and Justin Livingston (Say Daily, 2014).

To our knowledge and based on a thorough search over the Internet, there are no documented success stories of personal branding on Facebook. ***This leads us to wonder if a person can control the elements of viral marketing to develop a successful personal branding strategy on Facebook and succeed.***

8.6 Creation of a Viral Strategy

In this chapter, we investigate the Personal Facebook page of Nasri Messarra (NM, also the author of this thesis). The case is interesting and relevant because NM is known as a University teacher in communication and IT, and as an online communication and business strategy consultant. Before this experiment, NM has never wrote any satire statuses about politics, society, etc., or any literary essays and texts.

The experiment begins June 6, 2013. In our experiment, we look at viral marketing and at the elements that make it succeed or fail (O Hinz et al., 2011; Liu-Thompkins & Rogerson, 2012; Valente & Myers, 2010). Those elements have been described in detail in this dissertation, mainly in "*Negative WoM and its transmission on OSN : the determining role of the seeding population*".

At the beginning of the experiment, the status of the elements of viral marketing is as follows:

1. Content: A few personal photos old and new.
2. The messenger: in our case, the messenger is NM, a teacher and a consultant in online communication. At the beginning of the experiment, he has no – or very little – Facebook popularity because his posts are very limited and he uses Facebook infrequently, even rarely.
3. The network: At the beginning of the experiment, on June 6, 2013, the author has 466 friends, mostly classmates and business acquaintances. The following data, extracted four months after the beginning of the experiment shows a network with a relatively short average geodesic distance (2.6) meaning that it would take in average 2.6 hops

for a friend to know that some other friend liked, commented or shared a post. The graph density is 5.13% meaning that each friend is connected in average to 5.13% of the friends in the friends list, meaning that, depending on Facebook distribution scheme, up to 5.13% of the friends may be notified of the liking, sharing or commenting of one of the friends to one of the posts.

Graph Metric (12/10/2013)	Value
Vertices	476
Unique Edges	5809
Total Edges	5809
Connected Components	9
Single-Vertex Connected Components	7
Maximum Vertices in a Connected Component	465
Maximum Edges in a Connected Component	5806
Maximum Geodesic Distance (Diameter)	7
Average Geodesic Distance	2.686271
Graph Density	0.051384343

Table 24: Graph Metrics of NM as of Oct. 12, 2013

4. Behavioral characteristics of the recipients: most of the friends are classmates or close friends. They have degree of homophily like same similar education, culture, life experiences, etc. We expect at least a few ones to like the message.
5. Initial seeding population: Based on Bernstein et al. (2013), we should expect the content to be distributed to around 61% of the friends each month. This initial seeding population is a random set of strong ties with NM. Watts and Dodds (2007) show, in a computer simulation, that well-connected people are less important as initiators of large cascades of referrals. They also suggest that it is more important to target easily influenced individuals than influencers as an initial seeding population. In our case, we expect close friends to the author to be more easily influenced by his ideas and engage with his posts than social influencers outside his circle of friends.

To control and optimize the elements of viral marketing, the strategy is defined as follows:

1. Content: Limit the content to satire statuses. No other personal post (photos, events, cover photo changes, etc.) will be published on the timeline. Montoya (2002) propose eight laws for personal branding amongst which a "Law of Specialization" for personal branding. This law indicates the need for individuals to focus on one area of

achievement. Shepherd (2005) suggests that a brand should be simple and consistent. It is in the purpose of clarity and simplicity that we focus only on one area of expertise, satire literature.

2. Network Structure: Facebook is the sum of the networks of all its users. Our purpose is to optimize the network of NM by adding weak ties, mostly bridges to the networks to other users. Weak ties are friends of friends with a few friends in common with NM. We need to bypass strong tie to weak tie communication and communicate directly by becoming friend with friends of friends (figure follows):

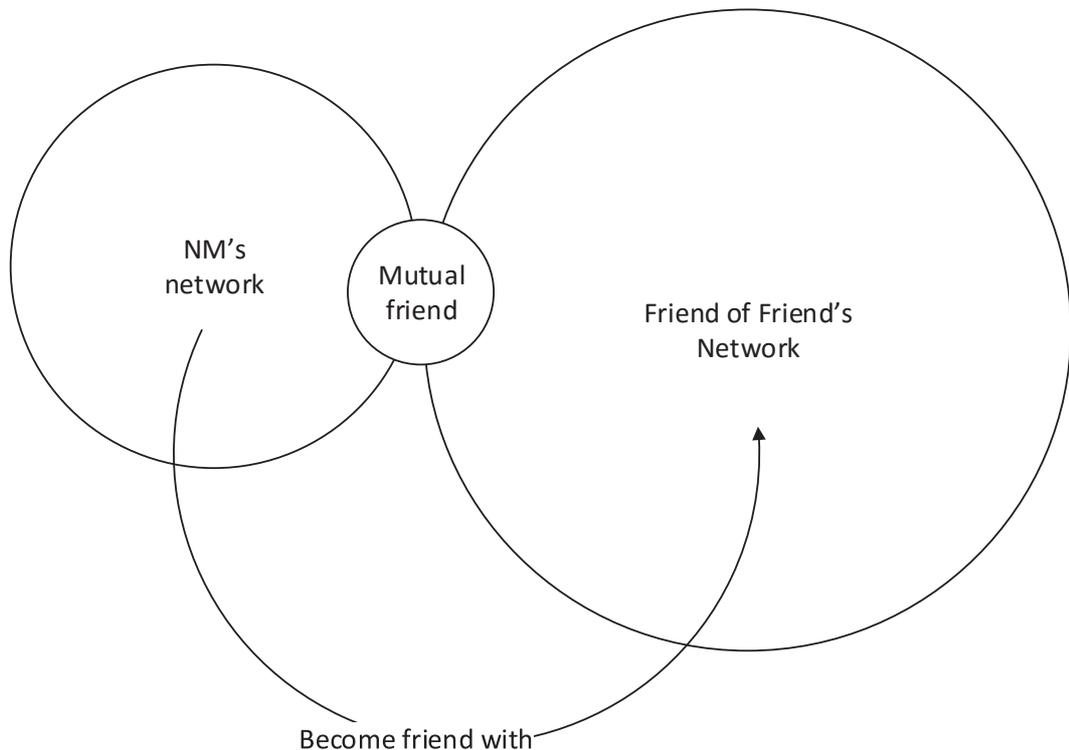


Figure 35: Optimize network by adding weak ties as friends

The process is simple:

- NM publishes a post,
- Facebook distributes to around 61% of NM's friends each month,
- Friends may or may not like, comment or share the post

- If they like, share or comment the post, some of their friends (not necessarily mutual friends with NM) will be notified. If these people are not acquaintances of NM, they are weak ties and they overlap structural holes to networks of people that are outside the circle of friends of NM.
- If those people send a friend request or follow NM, Facebook will deliver future messages directly to them, bypassing the friend's separation.

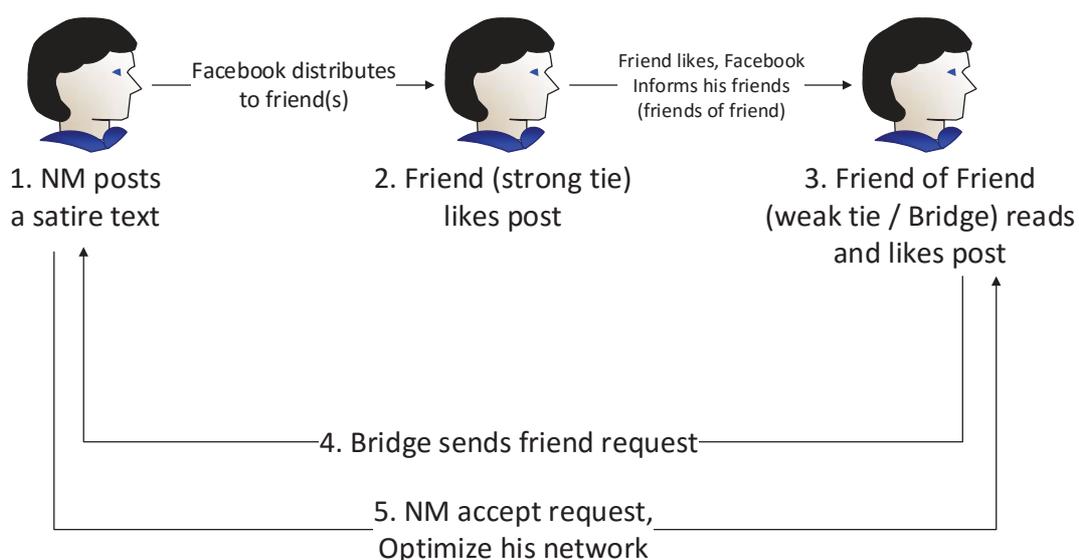


Figure 36: Connecting to weak ties

3. Seeding population: We have seen with the Spartacus Experiment that friends will not engage with the posts of a fake profile. For the targeted population, "the messenger is the medium" (Valente & Myers, 2010). This is why starting with an initial seeding population of real-life strong ties (real friends) is a necessary starting step. Yet, the network should be optimized by adding weaker ties to it. Weak ties will connect people that would otherwise never connected (M. S. Granovetter, 1973). They play an important role as bridges overlapping structural holes and transmitting new and different ideas (Burt, 2004; 2009). This leads us to decide, in order to optimize our seeding strategy continuously to accept friend request from friends of friends (weak ties) and to ignore friend requests from real life friends.

8.7 Outcome of the Strategy

We analyze 253 posts published between 6/6/2013 and 20/9/2015 (836 days). Posts received a total of 5,225 likes (an average of 20.6 likes per post, an a maximum of 103), 1,160 comments and 323 shares.

	N	Maximum	Sum	Mean	Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Statistic
Likes		103	5225	20.65	18.819
Comments		31	1160	4.58	5.143
Shares		32	323	1.28	3.606
Valid N (listwise)	253				

Table 25: Descriptive statistics for NM's 253 posts

The trends of likes, comments and shares over the 836 days period have an increasing trend with a coefficient of determination, R^2 , equal to 0.156, 0.086 and 0.036 respectively. We notice, in both the likes, comments and shares graphs that some post have received a much higher praise than others have. In fact, on January 21, 2015, one of the posts was republished in the top French-speaking daily newspaper in Lebanon, L'Orient-Le-Jour (Messarra, 2015b).

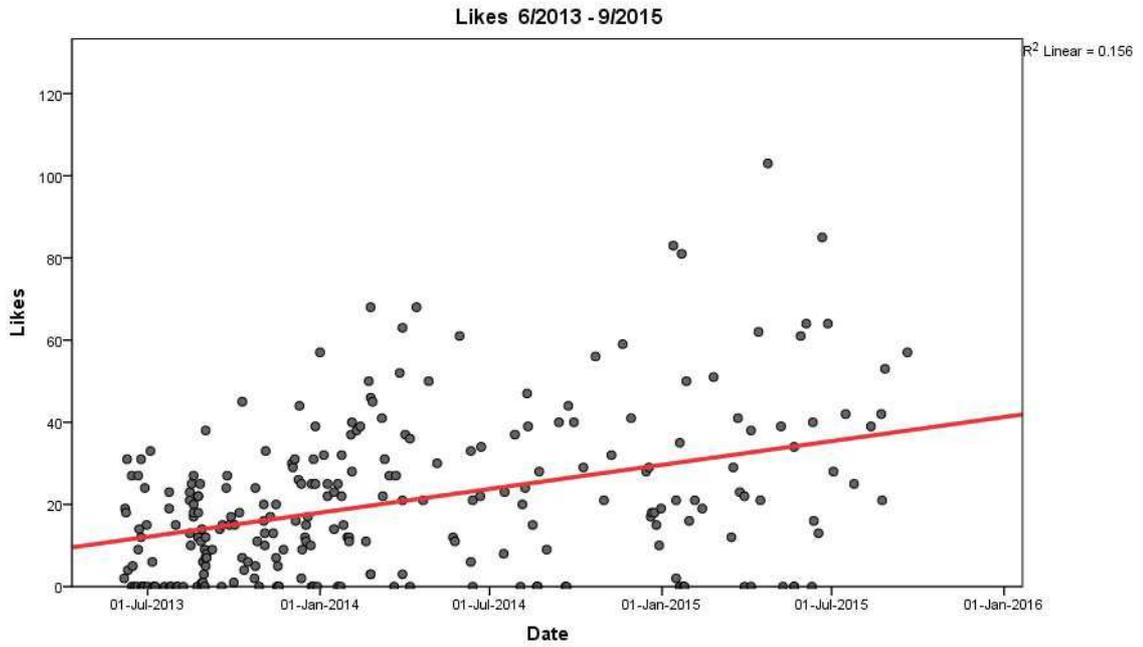


Figure 37: NM likes to posts 2013-2015

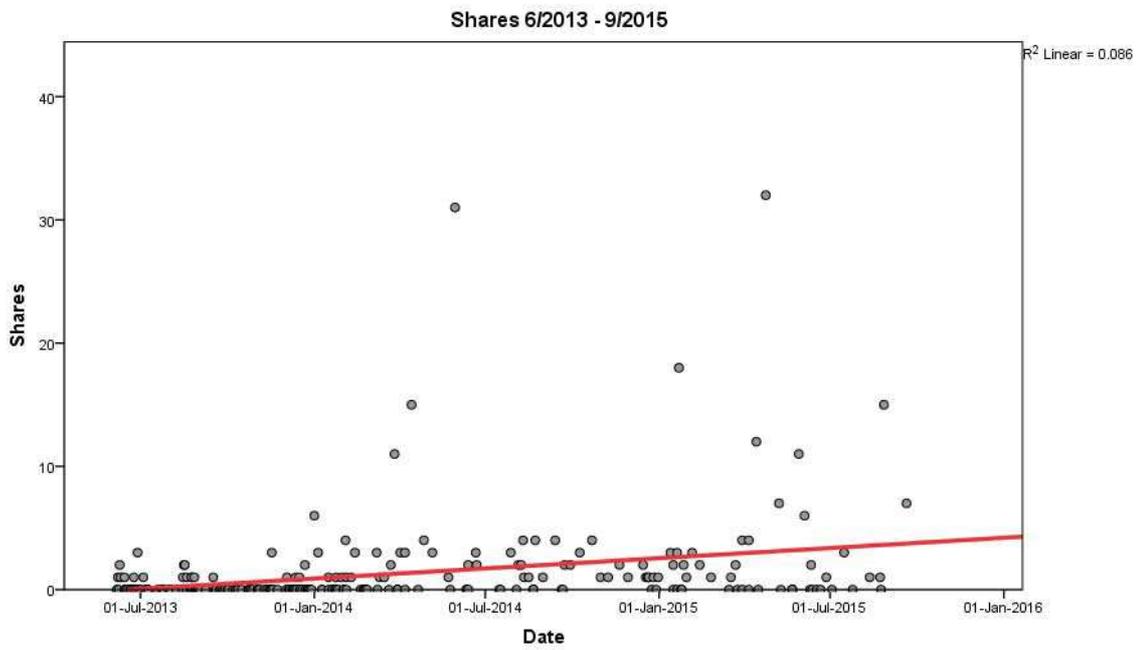


Figure 38: NM shares of posts 2013-2015

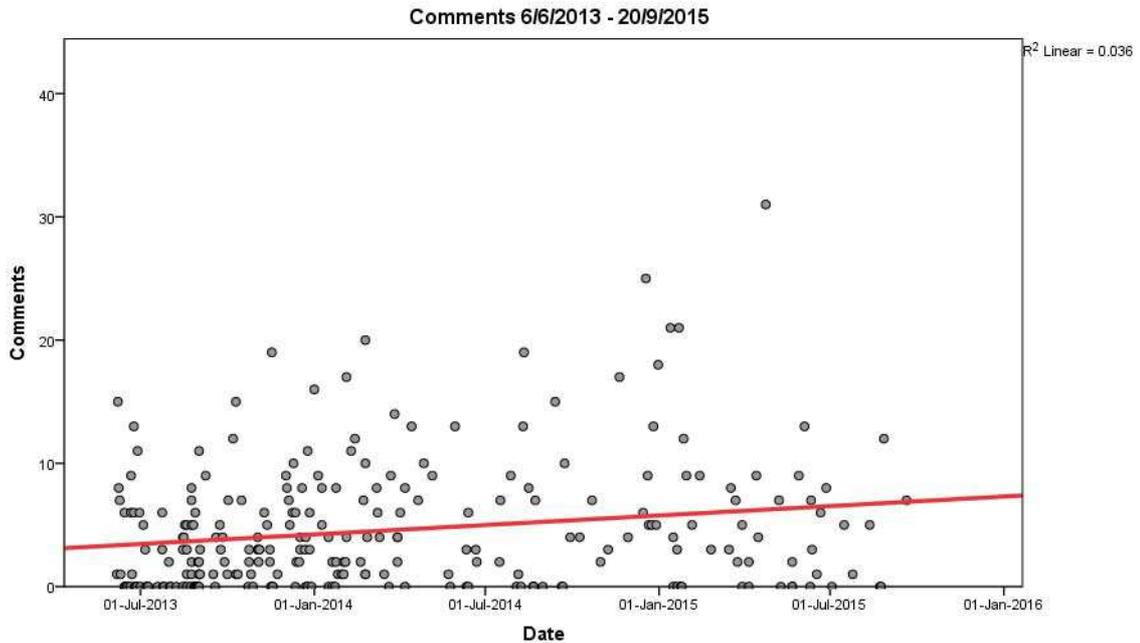


Figure 39: NM comments to posts 2013-2015

Most importantly, we started with an initial seeding population of strong ties, mostly close friends, and gradually moved to a mixed population of strong and weak ties by ignoring all friend requests from real life strong ties and accepting friend requests from people who liked the posts and sent friend requests. As a result, the population transformed from a 100% population of strong ties to a population with 27% of weak ties. In the table below:

- Strong ties are the initial population of close friends known in real life
- Weak ties are complete strangers (never met in real life) that liked comments and sent friend requests to the author
- Ignored are close friends and family members who sent friend requests after the start of the experiment and were ignored (pending friend requests)
- Followers are people who decided to "follow" the author, an option available with Facebook, without sending a friend request. They are a mixture of strong and weak ties.

	12/10/2013	20/9/2015
Strong Ties (Close Friends)	476	476
Weak Ties (Strangers)	0	179
Ignored (Close Friends)	0	22
Followers (Mixed)	0	44

Table 26: Strong and weak ties in the network

Unfortunately, we could not extract the social graph of the author (friends and connections of friends) at the end of the experiment due to a recent Facebook policy change (Facebook, 2015). Nevertheless, we did have a data extraction dated 2/11/2014, (61% of the total duration), and it allowed us to compare graph density after 514 days from the beginning of the experiment. Because we "injected" weak ties to the network, the graph density dropped from 0.051 to 0.049. A small but significant difference as it shows that the newcomers to the author's network (weak ties) had fewer connections than average to other "friends" in the network.

Graph Metric (2/11/2014)	Value
Vertices	513
Unique Edges	6484
Total Edges	6484
Connected Components	14
Single-Vertex Connected Components	11
Maximum Vertices in a Connected Component	490
Maximum Edges in a Connected Component	6456
Maximum Geodesic Distance (Diameter)	7
Average Geodesic Distance	2.601266
Graph Density	0.049372563

Table 27: Graph metrics as of 2/11/2014

We noticed a strong engagement of weak ties to posts. Taking the post that was republished in the local newspaper and the last post of the experiment, we compare the likes of strong ties vs the likes of weak ties (total strangers never met in real life):

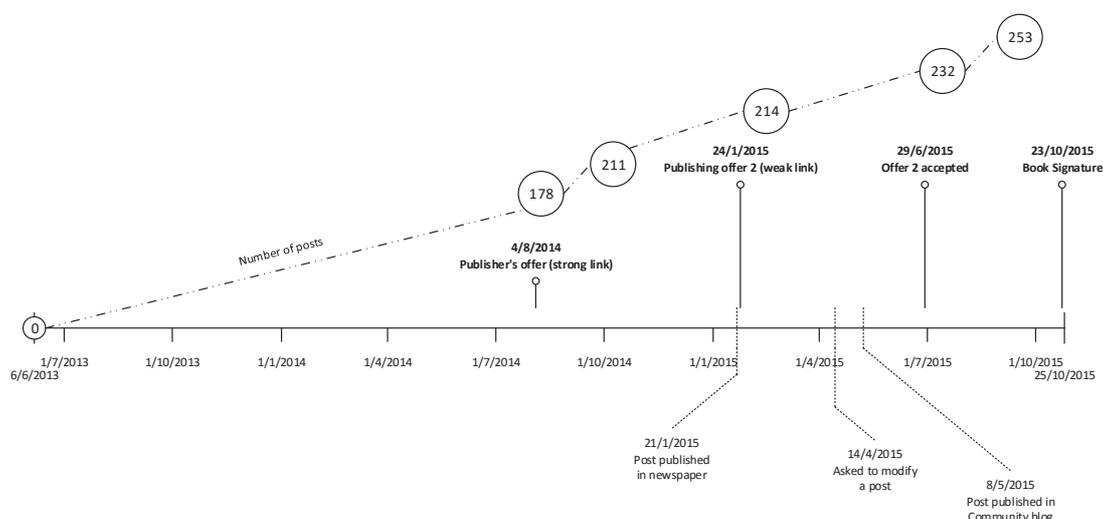
	Total Likes	Likes from strong ties	Likes from weak ties	Likes from weak ties in %
Newspaper Post (21/1/2015)	81	46	35	43.20%
Last Post (20/9/2015)	57	39	18	46.15%

Table 28: Likes from strong and weak ties on posts

Finally, the experiment was a total success. The graph below show the most important milestones of the experiment:

- 6/6/2013: Experiment starts

- 4/8/2014: The author receives an offer after 178 posts. The contact is a strong link, manager at a well-known International publisher, *Tamyras*.
- 21/1/2015: The author is contacted by a reporter at L'Orient-Le-Jour, the most important French-speaking newspaper in Lebanon. The newspaper asks for a permission to publish one of the author's post in the public section.
- 24/1/2015: The author receives a second offer from a publishing house, *Noir, Blanc, Etc*. The publisher is a complete stranger to the author and this is their first contact in real life. This happens after 214 posts.
- 14/4/2015: The author is contacted by the marketing manager of a major Lebanese BOT (Build–Operate–Transfer) company that was mentioned in one of the posts. The manager asked the author to make some modifications to the text because the problems described in the post were resolved. The marketing manager explicitly said to the author that "he is an influencer and had many readers" and that his post could have a bad effect on the company's reputation.
- 8/5/2015: The author is contacted by the manager of a community blog, a complete stranger to the author, and one his posts is translated into Arabic and published on the *Liban Chroniques Civiles* political and social website (Messarra, 2015a).
- 29/6/2015: The author agrees to the terms of the second editor (weak tie). The book will take all the posts from Facebook plus a few unpublished text.
- 23/10/2015: The book will be presented at the most important book event in Lebanon for a signing, the *Salon du Livre de Beyrouth*.



8.8 Conclusion and Discussion

In this chapter, we have defined a viral strategy for personal branding with the problem of control in mind. It would be utopian and naïve to think that all elements of viral marketing could be controlled on a platform like Facebook. However, from a strategic point of view, the researcher or marketer can take advantage of what the system or platform offers. In this case, Facebook personal timelines provide greater flexibility and control over the seeding population and the structure of the network.

The experiment also showed that it is possible to use Facebook for personal branding and for online and offline fame. To our knowledge, Facebook was never used as a launching platform for "online superstars" unlike other platforms like YouTube and Instagram.

While completely controlling all the elements of viral marketing on Facebook is extremely difficult, from a strategic point of view, Facebook timelines give enough control to create a real viral campaign:

1. **Content** is completely user or brand-dependent. The message should be clear and simple (Shepherd, 2005) and follow the standard rules of personal branding, mainly focusing on specialization (Montoya, 2002).
2. The **messenger** is user or brand-dependent and its importance is recognized in scientific literature (Valente & Myers, 2010). Previous experiments in this dissertation has shown that a fake profile will probably be dismissed and the momentum will be lost (the Spartacus Experiment, op. cit.).
3. Regarding the **structure of the network**, we started with a network of strong ties and gradually injected weak ties to the network, modifying the structure of the network in order to fill structural holes and connect to other groups that would have not received the information otherwise. This strategy was based mostly on scientific literature stressing the importance of weak ties and bridges (R. S. Burt, 2004b; R. Burt, 2009; M. S. Granovetter, 1973).
4. Because the initial group of friends was constituted of close friends with similar background and culture, we expected the **behavioral characteristics of the recipients**

to be positive or at least encouraging. Weak ties who will connect later will certainly share the ideas communicated and will most probably share or like future posts.

5. Finally, we started with a small network of friends with strong ties to the messenger as an **initial seeding population**. We believe that a close circle of friends is more likely to be influenced by the author than people outside his circle of friends. The importance of targeting easily influenced people vs influential has been discussed in an article by Watt & Dodds (2007). The seeding population for upcoming posts was modified gradually to include strong and weak ties because those ties will more likely fill the structural holes between the author's circle and other social circle and diffuse the posts to people who would not have heard of the posts otherwise (R. S. Burt, 2004b; R. Burt, 2009; M. S. Granovetter, 1973).

This experiment is of importance as it demonstrates the use of a viral marketing strategy on Facebook from start (the author has never written before) to finish (a publisher discovered him and is publishing his book) over a period of more than two years. Moreover, it is a real-life experiment and the results are real and tangible. The experiment is not biased because Facebook was the only platform used to promote the author and there are no priors, earlier attempts, parallel channels of communication to the experiment.

The data gathered from this period is huge: total activity, friends who liked each post, friend requests activities, messages, etc. Even with Facebook increasing restrictions and limitations, we were able to collect data up to the end of the experiment using scrapping. We focused in this chapter on the results of a marketing strategy with control over the elements of viral marketing. Yet, many questions still need to be investigated:

- How do friends react over time? Do the same people like each or most of the posts?
- Why some friends remain inactive? What would happen if we remove those friends from the network? A simulation could be interesting to play.
- Some people read the posts but do not engage with them (like, share, comment). What is their role away from keyboard (in real life)? Do they influence others offline?
- The main test remains to convert likes and shares to cash. Will likers buy the book? What is the return of this strategy? If the key performance indicator is money, not

fame, how do we calculate it as it will be biased by traditional marketing from the publisher?

9 Discussion and Conclusion (English)

In this dissertation, we have analyzed the elements of viral marketing (Oliver Hinz et al., 2011) and tried, using experimentation, to control its elements on the most popular OSN, Facebook.

9.1 Theoretical Implications and Perspectives

From a theoretical point of view, research and experimentations in the field of online social networks have mainly focused on already existing networks. Our dissertation and experimentations give a proactive role for the researcher.

Our experiments support previous research showing that people optimize their social network by connecting to social bridges to fill structural holes in their network (Chen et al., 2009). Our *Spartacus experiment* (page 99) shows that a well-connected user will automatically attract people trying to maximize their network. However, the same experiment shows that, even if the network of a person is important, this will not make this person an influential. This experiment raises new questions: Why do "friends" of this profile don't see him as an influential? Why do "friends" avoid engaging with his statuses? What role can this fake profile play?

Our experiment "*Negative WoM and its transmission on OSN : the determining role of the seeding population*" (page 138) compares diffusion of the same negative messages on a Facebook page and on the Facebook timelines of fake profiles. The experiment shows a significant increase in engagement when the posts are published on timelines. This experiment opens a new perspective for future experimentations on Facebook by taking into consideration different mediums of this platform (pages, timelines and groups). If this experience has focused on negative WoM, it would be interesting to run the same experiment with positive WoM and compare the results.

"How private is a user's private friends list?" and "Can we expose the network of friends of a user despite security settings?", are the questions we investigate in Chapter "*Using Fake and Real Profiles to Uncover and Rebuild a Fan's Social Graph*". This chapter, in conjunction with Chapter "*A Broader Meditation on Research on OSN*", looks at ethical and confidentiality

questions. This experiment and analysis open new perspectives that deserve to be taken into consideration and investigated further. Further research could tell us more about confidentiality in a connected world and the ethics of research in OSN where users believe that what they publish publicly is private. Those chapters discuss ethical issues with research on online social network and open the door for a debate about what should be allowed and what should be forbidden.

In Chapter "*Finding Bridges for Political Influence*" (page 159), we describe an original method to detect bridges overlapping structural holes between two political groups. Structural holes have a major role as influencers and as a vector of information diffusion. This experiment helped us extract a list of bridges between two antagonistic political groups in Lebanon. This research opens a new perspective and new questions: What is the role of bridges on Facebook? How do they act? Do they influence in reality? How can we "activate" them politically? All those questions deserve further analysis and research due to their implication in politics and influence on OSN.

This dissertation suggests a global strategic vision about marketing on Facebook. We try to define an action scope for different marketing strategies on this platform: mass marketing, niche marketing, relational marketing and viral marketing. We show that, in theory, timelines are the best medium where researchers and practitioners can control all the elements of viral marketing, i.e. the messenger, the message, the network structure, the attitude and behavior of the recipients and the initial seeding population. It would be interesting to run more experiences to challenge this theory.

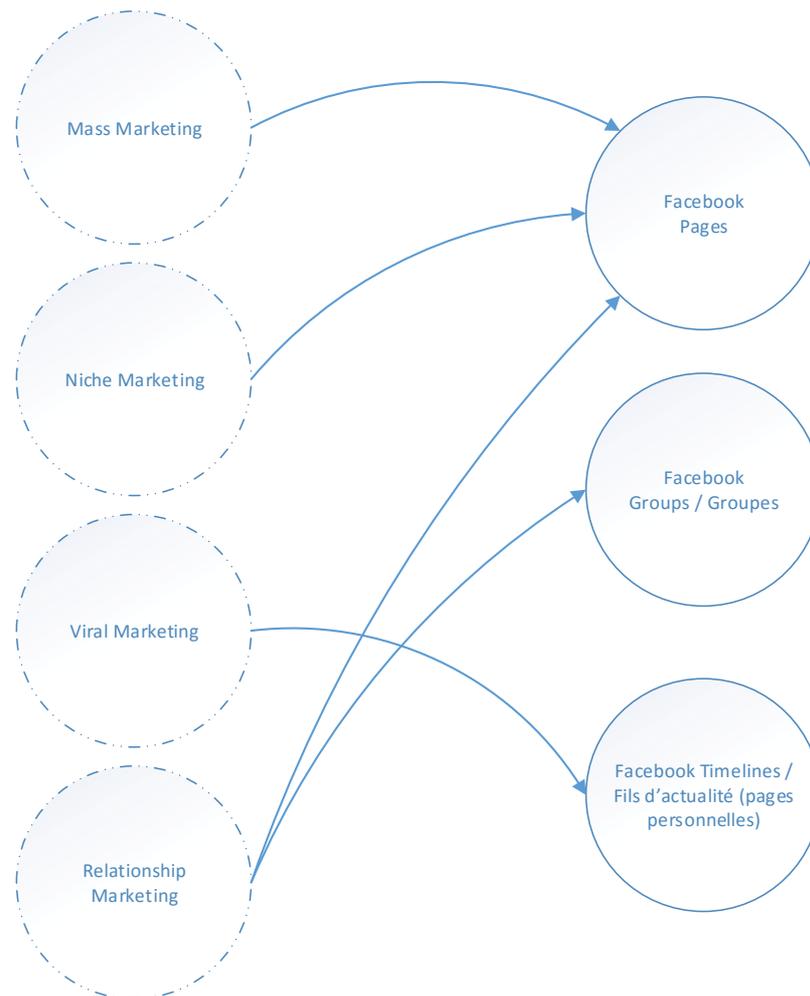


Figure 40: Marketing Strategies and Medium

The ambition of this research was to conciliate research with practice. The analysis and experiments described throughout this dissertation were ruminations, groping, investigations and trial and error work. In the chapter *“Making Sense of Everything: A Personal Branding Case Study from Start to Finish”* (page 189), we apply the findings of more than 4 years of research to a personal branding viral marketing strategy on Facebook. The experiment defines and follows a viral strategy of a satiric author for over 2 years, from his first post to his discovery by to publishers and the printing of his book. The success of this experiment and the tangible results are an important asset for both researchers and practitioners.

9.2 Managerial Implications

If the balance of power is completely inversed on online social network and consumers dominate brands, this dissertation looks at ways to create a new equilibrium to the benefit of the marketing practitioner. It also tries to show what are the means a marketing strategist could use to have a larger margin of manoeuver between a platform, Facebook, that restricts access to information and a public who believes the brand is trespassing on his playground (Fournier & Avery, 2011).

To the managers who only focus on one of the five elements of viral marketing, content, this dissertation suggest the usage of personal profiles in order to control all the elements of viral marketing and to experiment with other marketing techniques on pages and groups. It also links different marketing strategies to different mediums on Facebook (pages, groups, timelines).

We also shown how inefficient are fake profiles in the diffusion on information. We know that fake profiles exist in huge numbers on Facebook and that politicians and actors, amongst others, use them as friends or fans to display higher popularity (Julian, 2013a, 2013b). Our experiments show that fake profiles are not a good vector of information diffusion and that messages that created engagement on the timelines of real people did not create engagement on the timeline of an optimized fake profile.

However, by optimizing an initial seeding population around two fake profiles, malevolent actors can increase the diffusion of negative messages about a company and increase engagement and diffusion significantly. Those actors are outside the comfort zone and control zone of the company. The company will be unable to stop the diffusion of such messages in a timely manner. We warn managers of the possible implications of this technique.

Our experience on structural holes and finding bridges between two political groups could be reproduced to find bridges between two competing companies. With this method, a marketer could find bridges between his company and the competition, and use those bridges as an initial seeding population or, maybe, activate them directly or individually.

Finally, the case of *personal branding* is a real-life application of previous theoretical findings that were initially used in mathematical modelization (Oliver Hinz et al., 2011) or simulations (Watts & Dodds, 2007) and the findings of this dissertation. This experiment can be reproduced by marketers or individuals for self-promotion and personal branding. If the message being communicated has value, probability of success should be equivalent to the success of our experiment.

9.3 Limits

9.3.1 Theoretical Limits

Social networks are by definition made of individuals who could have different motivations and different psychological characteristics. Even with populations of several hundreds of people in each one of our experiments, those experiments do not take into consideration the individual characteristics of each person (Burke, Marlow, & Lento, 2009). Yet, the results of our experiments depend on the sum of microfluences (Heiderich, 2009) passing from one user to the other.

Culture differences also play an important role in the usage of OSN (Vasalou, Joinson, & Courvoisier, 2010). Our subjects were limited, largely, to Lebanese people. Some experiences, like the diffusion of negative WoM (page 138) was tested on one enterprise only due to the difficulty to get access to such information.

To reduce biases that could result from psychological and cultural aspects and support our findings with more arguments, it would be interesting to reproduce those experiments on a larger scale and on different population, culturally different and geographically distant.

9.3.2 Methodological Limits

Increasing Facebook restrictions that are become more and more difficult to bypass and are limiting access to information, may render some of our methods difficult to realize. Experiences like Spartacus (page 99) where we needed to extract all friends and friends of friends could be easily executed in 2012 using NodeXL (Hansen et al., 2011) and its Social

Media Importer. Reproducing the same experiment today will require the usage of a scraping software. A complex and time-consuming procedure.

In some cases, like the extraction of political bridges (page 159), our experiments' objectives were to find seeding population. It would have been interesting to push this analysis further with simulation and mathematical modelization.

Nevertheless, this thesis brings new ideas, new methods and new perspective to existing literature on marketing strategies on online social networks, Facebook specifically.

10 Discussion et Conclusion (Français)

Dans cette thèse, nous avons analysé les éléments du marketing viral (Oliver Hinz et al., 2011) et tenté, par des expériences diverses, d'en contrôler les éléments sur le réseau social en ligne le plus populaire actuellement, avec plus d'un milliard et quatre cent millions d'utilisateurs, Facebook.

10.1 Implications théoriques et perspectives

Sur le plan théorique, les recherches et expérimentations réalisées jusque-là dans le domaine des réseaux sociaux en ligne se sont, en grande partie, axés sur des réseaux déjà existants. Nos recherches et nos expérimentations, non seulement placent le chercheur au cœur de l'action et lui dans un rôle proactif, mais, dans certains cas, appliquent les stratégies sans biais sur des cas réels.

Nos recherches soutiennent les recherches qui montrent que les personnes essaient d'optimiser leur réseau social sur Facebook en devenant "amis" avec des "ponts" pour enjamber les trous structurels à travers la fonction des amis communs (Chen et al., 2009). Notre expérience Spartacus (page 99) montre, en effet, qu'une personne ayant des amis "importants" va automatiquement attirer des personnes soucieuses de maximiser leur propre réseau. Par contre, cette même expérience montre – et c'est là notre apport – que, même si le réseau d'une personne est important, ceci ne rend pas cette personne influente. Cette expérience ouvre aussi des perspectives vers de nouvelles questions : Pourquoi cette personne, considérée comme un "pont", n'est-elle pas considérée comme une personne influente? Pourquoi ses "amis" ne jugent-ils pas bon de s'engager avec ses statuts par des "j'aime" ou des commentaires? Quel rôle peut-elle jouer?

Notre expérience "*Negative WoM and its transmission on OSN : the determining role of the seeding population*" (page 138) compare les diffusions des mêmes messages négatifs à partir de la page Facebook d'une marque et à partir des fils d'actualités de faux profils. L'expérience montre une augmentation très sensible de l'engagement des personnes dans le second cas, soit dans la diffusion à partir des fils d'actualité. Cette expérience ouvre une nouvelle

perspective dans les expérimentations en tenant compte des différents supports de communication sur la plateforme Facebook (les Pages, les fils d'actualité et les groupes), dans l'expérimentation. Si cette expérience s'est focalisée sur le WoM négatif, la même question se pose autour du WoM positif et il serait probablement intéressant de reproduire l'expérience avec des messages positifs et de comparer les résultats obtenus.

"Jusqu'à quel point peut-on considérer les mesures de confidentialité efficaces sur Facebook?" et "Peut-on reconstruire le réseau d'un utilisateur Facebook malgré les mesures de confidentialité offertes par Facebook?" sont les questions auxquelles nous essayons de répondre dans le Chapitre intitulé "*Using Fake and Real Profiles to Uncover and Rebuild a Fan's Social Graph*". Ce chapitre, en conjonction avec le Chapitre "*A Broader Meditation on Research on OSN*", s'attelle aux questions d'éthique et de confidentialité. Cette expérience et cette analyse ouvrent de nouvelles perspectives qui méritent d'être considérées et revisitées par d'autres chercheurs sur les limites de la confidentialité dans un monde connecté et sur l'éthique de la recherche sur les plateformes de réseaux sociaux en ligne où les utilisateurs considèrent du domaine du privé, ce qui est, en fait librement disponible publiquement. Ces chapitres comparent les différentes approches expérimentales sur Internet en général et sur les réseaux sociaux en ligne en particulier et ouvrent le débat plus large du possible et du permis dans les différents champs de recherche. Ces réflexions ouvrent la voie à des questions essentielles au niveau du marketing et de la recherche sur les réseaux sociaux : Peut-on étudier ou travailler sur les réseaux sociaux sans connaître son public ? Comment peut-on cibler des personnes anonymes alors que tout le jeu du BAO, de l'influence et du marketing viral dépendent de la connaissance individuelle des membres du réseau ?

Nous proposons aussi, dans le chapitre "*Finding Bridges for Political Influence*" (page 159), une approche originale pour déceler des ponts dans le cadre de vides structurels entre deux groupes politiques. Les vides structurels ont une importance majeure dans le cadre de la diffusion de l'information et ont leur rôle en tant que facteurs d'influence. Cette expérimentation a permis de définir une liste précise de ponts sociaux entre deux partis politiques antagonistes au Liban. Elle ouvre de nouvelles perspectives et de nouveaux questionnements : quel est le rôle de ces ponts sur Facebook ? Comment agissent-ils ? Influencent-ils effectivement ? Peut-on les "activer" politiquement ? Toutes ces questions

méritent d'être recherchées pour leurs implications directes dans le domaine du politique au niveau de la communication et de l'influence sur les réseaux sociaux en ligne.

Cette thèse propose une vision stratégique globale et exhaustive au niveau du marketing sur Facebook. Nous tentons de définir un cadre d'action pour différentes stratégies marketing sur cette plateforme : marketing de masse, marketing de niche, marketing relationnel et marketing viral. Nous avons montré, qu'en théorie, c'est sur les fils d'actualité (les profils personnels) que le chercheur ou le stratège marketing ont le plus de contrôle sur les différents éléments du marketing viral, soit le messenger, le message, la structure du réseau, les caractéristiques et l'attitude des individus du réseau et la population de diffusion initiale (ou la population d'ensemencement).

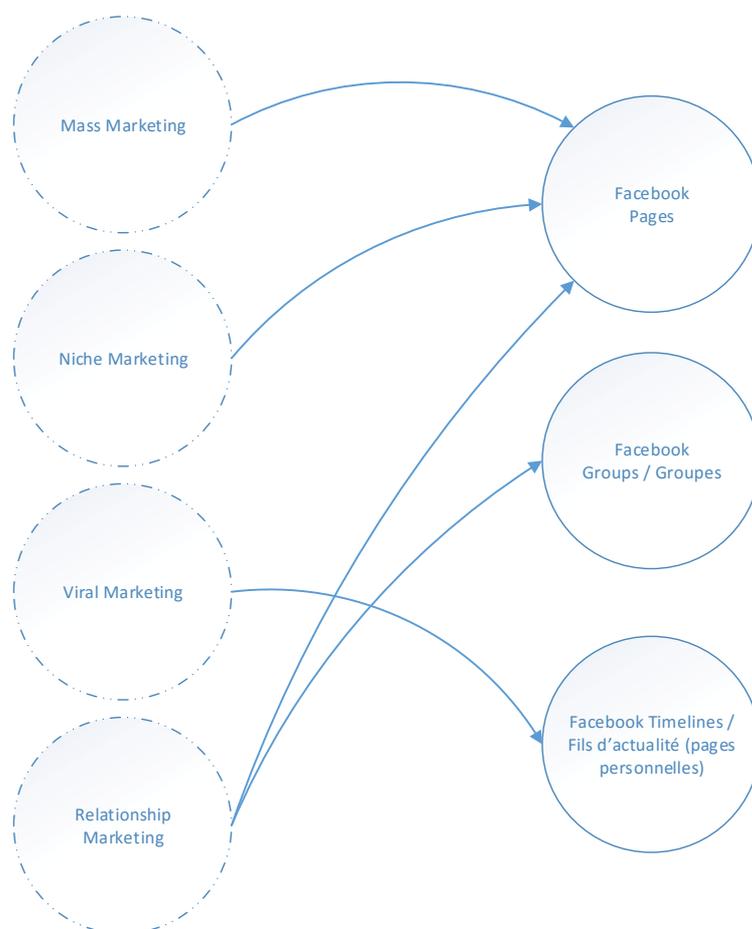


Figure 41: Styles de marketing et canaux Facebook

Finalement, cette thèse a eu l'ambition, dès le départ de servir aussi bien la recherche sur les stratégies du marketing viral sur les réseaux sociaux en ligne, que les praticiens dans le domaine. Le travail d'analyse et les expériences effectuées et décrites dans les chapitres précédents, représente un tâtonnement, une recherche de pistes, de brides de connaissance. Dans le chapitre « *Making Sense of Everything: A Personal Branding Case Study from Start to Finish* » (page 189), nous mettons en action toutes les connaissances cumulées pendant plus de 4 ans de recherche et appliquons ces connaissances sur une stratégie de marketing viral sur Facebook appliqués au cas du *personal branding* d'un auteur de littérature satirique sur une durée de plus de deux années, de l'étape zéro (l'auteur n'a jamais écrit) à la fin (l'auteur est repéré par une maison d'édition). La réussite de cette expérience est une preuve concrète et palpable des résultats de cette recherche et un apport important aussi bien aux chercheurs qu'aux praticiens.

10.2 Implications managériales

Si l'équilibre des forces est complètement renversé sur les réseaux sociaux en ligne au profit du consommateur et si la perte de contrôle par les entreprises est presque totale, cette thèse essaie de rétablir un certain équilibre au profit du stratège marketing. Elle essaie aussi de montrer quels sont les moyens mis à sa disposition pour qu'il puisse jouir d'une certaine liberté de manœuvre entre une plateforme avare d'informations comme Facebook et un public qui considère les entreprises comme des envahisseurs sur son propre terrain (Fournier & Avery, 2011).

Aux managers, qui mettent tous leurs efforts sur un seul des cinq éléments du marketing viral, le contenu, cette thèse propose d'utiliser les profils personnels pour pouvoir contrôler tous les éléments du marketing viral et de pratiquer d'autres stratégies marketing sur les Pages Facebook et les groupes. Elle suggère aussi d'utiliser différentes stratégies marketing sur les différents supports, fils d'actualités, pages et groupes, offerts par Facebook.

Elle démontre aussi l'inefficacité des faux profils dans la diffusion des informations. Nous savons que les faux profils font florès sur Facebook et que les politiciens et acteurs, entre autres, les utilisent pour montrer une plus importante popularité (Julian, 2013a, 2013b). Nos expériences montrent que ces faux profils ne sont pas de bons vecteurs de diffusion de

l'information et que des messages ayant eu du succès sur le profil de vraies personnes, ne créent pas d'engagement lorsqu'ils sont repris par des faux profils, même si ces faux profils ont un réseau de hubs.

Par contre, en optimisant une population initiale de diffusion (*seeding population*) autour de faux profils, des acteurs malveillants peuvent rediffuser des messages négatifs contre une entreprise et augmenter très sensiblement l'engagement et le taux de diffusion de ces messages. Ces acteurs seront en dehors du cadre de contrôle de l'entreprise et l'entreprise ne pourra pas les bloquer instantanément comme c'est le cas lorsqu'ils publient des messages sur sa propre page. Nous prévenons les managers des implications possibles de telles stratégies de diffamation.

Notre expérience sur les vides structurels et la découverte de ponts reliant deux groupes politiques antagonistes pourrait être reproduite sur des entreprises concurrentes. Avec notre méthode, un stratège marketing pourrait trouver des ponts entre son entreprise et un ou plusieurs de ses concurrents et utiliser ces ponts comme population initiale de diffusion ou, peut-être, les activer directement et individuellement.

Finalement, le cas du *personal branding* montre concrètement l'application des préceptes théoriques qui ont à la base, fait l'objet de modélisations mathématiques (Oliver Hinz et al., 2011) ou de simulations (Watts & Dodds, 2007) en y ajoutant les résultats de nos propres analyses et expériences. Ce cas peut être reproduit pas à pas par des personnes voulant faire leur propre promotion. Si le "contenu" des messages est bon, les chances de réussite devraient être pareilles à celles de notre expérience.

10.3 Limites

10.3.1 Théoriques

Les réseaux sociaux sont par définition formés d'individus qui peuvent avoir des caractères psychologiques et des motivations complètement différents. Même avec des centaines d'individus impliqués et analysés dans chaque expérience, ces expériences ne tiennent pas compte du caractère individuel de chaque personne qui peuvent influencer les pratiques

d'utilisation (Burke et al., 2009). Or, les résultats de nos expériences dépendent de la somme des microfluences (Heiderich, 2009) qui se jouent entre les sujets de nos expériences.

Les différences culturelles jouent aussi un rôle important dans l'usage des réseaux sociaux en ligne (Vasalou et al., 2010). Le public de nos expériences s'est limité, en grande partie, à un public Libanais. Certaines expériences, comme l'expérience sur la diffusion du WoM négatif (page 138) à une seule entreprise, ceci étant principalement dû à la difficulté d'obtenir l'accord de l'entreprise concernée.

Pour réduire le biais qu'aurait pu éventuellement causer les effets psychologiques et culturels, et pour corroborer plus fortement certaines expériences, il serait intéressant de les reproduire à plus grande échelle et sur des publics culturellement différents ou géographiquement distants.

10.3.2 Méthodologiques

Les restrictions imposées par Facebook devenant de plus en plus compliquées à surmonter et limitant l'accès à l'information, même personnelle, pourraient rendre certaines de nos méthodes beaucoup plus complexes à réaliser. Des expériences, comme celle de *Spartacus* (page 99) qui nécessitait l'extraction de tous les amis et amis d'amis, se faisait très facilement en 2012 avec le logiciel NodeXL (Hansen et al., 2011) et son module "*Social Media Importer*". Réaliser la même expérience aujourd'hui nécessiterait l'utilisation de modules de *scraping* (grattage) qui interprètent les données affichées sur l'écran et les convertissent en données utilisables, une technique compliquée et longue.

Nos expériences, dans certains cas, comme la recherche de "ponts politiques" (page 159), avaient pour unique objectif de trouver des populations initiales de diffusion (*seeding populations*). Il aurait peut-être été intéressant de pousser ces analyses par des simulations ou des modélisations mathématiques.

Toujours est-il que cette thèse apporte de nouvelles idées, de nouvelles méthodes et de nouvelles perspectives à la littérature existante sur les stratégies marketing sur les réseaux sociaux en ligne, particulièrement Facebook.



DRM Management
& Organisation
UMR CNRS 7088



LABEX Entreprendre
Université de Montpellier

Building reputation vectors using honeypot profiles on Facebook

1

Nasri Messarra, Anne Mione
Université de Montpellier 1 - MRM

2

Background

- E-reputation has become an important concern for firms

- Pampers, Nestlé and other brands have already paid the heavy price of fan attacks (Champoux et al., 2012; Paul Gillin, 2012; Steel, 2010).

- The observation of the buzz and more particularly of the negative buzz (bad buzz) is important (Cuvelier, Aufaure, 2011)

- Attacks on Facebook are more frequent and research is required to better understand and counteract them

3

Litterature review 1 : E-reputation

- 1990 : Howard RHEINGOLD creates the concept of « e-reputation ». He evokes a « digital social life »: public debates, controversies have an impact on the reputation of the firm, individuals, associations, etc...
- 2000 : appearance of tools to manage e-reputation
- customer ratings (evaluation of the supplier by customers on Ebay auctions, evaluation of books by customers on Amazon, etc.)
- and positive and negative buzz management :
 - contribute to positive buzz and
 - identify and counteract negative buzz.

4

Litterature review 1 : E-reputation

■ E reputation)

Three theoretical ambitions (François Xavier de Vaujany, Hélène Lambrix, **DRM**) :

- holistic (the organisation is the level of analysis)
- Individualist (the models are centered on individuals or a key individual in or outside organization)
- Integrative (holistic and individualists aspects are simultaneously taken into account)

Litterature concerns the shaping (distortion) of reputation: **antecedents, maintenance and reputation effects** (Deephouseet Carter, 2005 ; Rindova et al., 2005 ; MacMillan, 2007 ; Walsh et al., 2007 ; Lange et al., 2011)

- **We consider a destabilizing action on reputation**

5

Litterature Review 2 : Viral Marketing

- Hinz, Skiera, Barrot & Becker (2011) define 4 critical viral marketing success factors:
- **1. Content**, in that the attractiveness of a message makes it memorable (Berger and Milman, 2011; Berger and Schwartz, 2011; Gladwell, 2002; Porter and Golan, 2006)
- **2. The structure of the social network** (Bampo et al. 2008)
- **3. The behavioral characteristics of the recipients and their incentives for sharing the message** (Ardnt, 1967);
- **4. The seeding strategy** which determines the initial set of targeted consumers chosen by the initiator of the viral campaign (Bampo et al., 2008; Kalish, Mahajan, and Muler, 1995; Libai, Muller and Peres, 2005)

6

Litterature Review 3 : Seeding strategy

There are debates in literature concerning seeding population :

- Target hubs is not sufficient (Watts et Dodds, 2007, Skiera, Barrot, Becker, 2007)
- Target hubs is still important (Hinz et al. , 2011)
- Size does not matter (Scarpi, 2010) and one of the keys to success is **the initial seeding** population (Liu-Thompkins, 2012)
- Literature refers to fans and community members as "nobodies" and "somebodies" (Booth & Matic, 2011) and more and more researchers focus on the quality of the members rather than on the size of network (Scarpi, 2010; Wallace, Buil, Chernatony, 2014).

7

Research questions

- Can we conceive and realize an original attack of a company through Facebook
- in real situation but with the General Management agreement (Research action) ?
- In order to :
 - Check the feasibility of such a strategy
 - Increase the methodological understanding of such an attack
 - Measure the WoM diffusion model
 - Contribute to the seeding population strategy debate

8

Methodology

- we target a small European company with around 1,500 fans on its Facebook page
- European market
- Services activity
- We create a schema

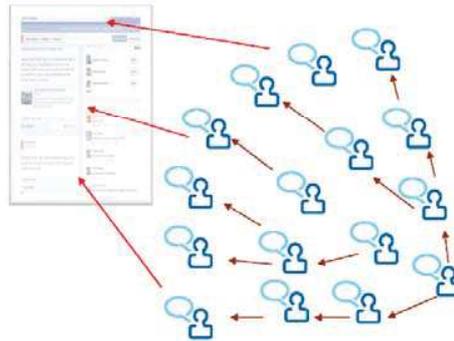
9

Methodology: How consumers act on Facebook with or against brands and companies

1- Post directly on the brand's page



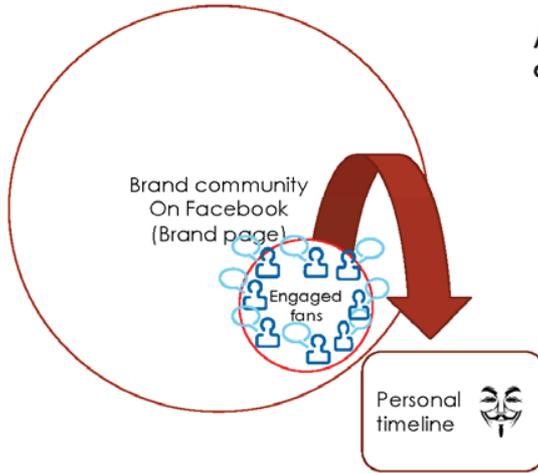
2- Post on their own social networks and wait for the viral effect of WoM to reach the brand



Reported cases & littérature about Nestlé, Pampers, DKNY, Marie-Claire, Capri Sun, Cooks Source, Bershka...

Methodology: The schema

10



A three steps attack through OSN using an optimized seeding population

1. Create a fake profile
2. Attract engaged fans of a brand to befriend the fake profile (our initial seeding population)
3. Diffuse information organically to engaged fans (no need for WOM for diffusion)

11

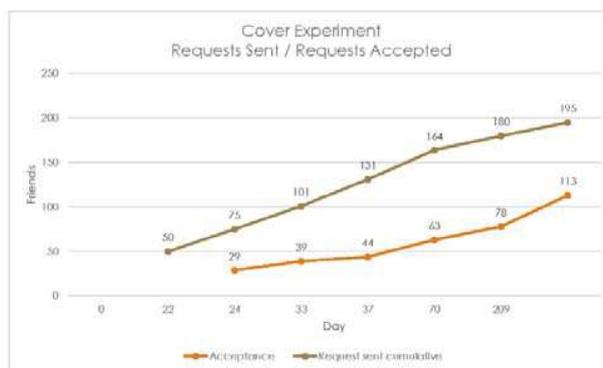
First step : Create a Fake profile

- ▀ Based on homophily (cover experiment)
- ▀ Stereotype of existing fake profiles on Facebook (Barracuda networks,)

12

Second step : acquiring friends

▀ Cover Experiment



13 Second step : **acquiring friends**

► **Stereotyped fake Profile**

Barracuda Networks' statistics (Rashid, 2012):
a woman living in a major city, having a high
education degree, interested in both men
and women...

**We attract 200 engaged fans
in 7 months**



14 Second step : **acquiring friends**

1. We visit the brand's Facebook page
2. We locate the fans who engaged with the brand (like, comment, share)
3. We send a friend request from both profiles a week apart

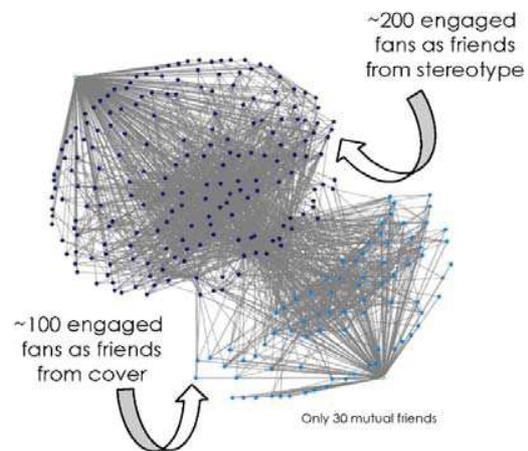
Third step : **diffusion of information**

15

- We reuse **6 posts** from the fan page of the brand

16

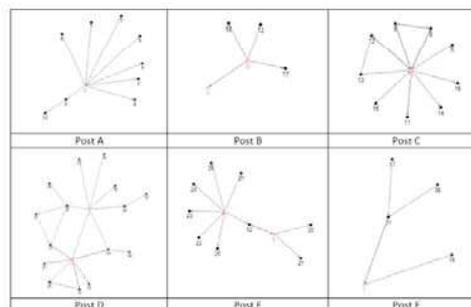
Results : resulting network



17

Results: diffusion of information and generation of WoM

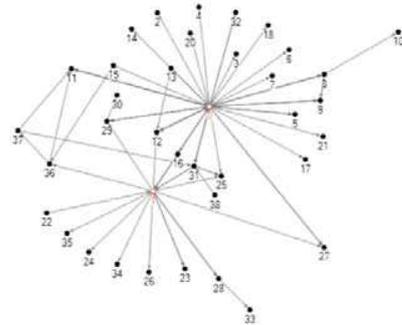
- In average, **105 engaged fans receive the message organically**
- **44 "friends" engage in the conversation**
- **Generates WoM and interaction**



18

Results: Directed Communication Graph of All Conversations

- Both profiles generated one larger network of communication and influence.
- They acted as bridges between two sub-networks who react differently (we mentioned that our profiles only have 30 friends in common)
- 33 engagement actions (comments/like) were made on the statuses or comments posted by one of the honeypot profiles and 44 engagement actions were made on the statuses or comments made by the other honeypot profile.
- 14.8% of edges (connections) are reciprocated showing that communication got back and forth between engaged fans.
- The maximum geodesic distance is 5 showing that the information was viral to a certain extent and travelled from one node to the other with an average of 2.32 nodes on a path.



19

Results

- Posts were directly received by engaged fans of the brand itself which shared, commented or liked these posts, generating word of mouth reaching friends of friends to the 5th level
- Information was served directly to these fans at no cost (organically) and at a higher reach than it would have been possible if these posts were published directly on the company's page.
- This forced changes IRL (in real life)

20

Results

- This answers our initial question and confirms our hypothesis: it is possible to attract engaged fans of a brand and distribute information organically to them bypassing the control of the brand itself and preventing it to stop the information sharing.
- The campaign was a success: The company did not take any action for a while and stood as an observer until it realized that the movement was not going to stop and that it would not be able to contain it. It then tried to respond shyly to our posts and, finally, changes were made to the company's management team.

21

Contributions to Viral marketing, WoM Literature

Back to the 4 critical viral marketing success factors (Hinz, Skiera, Barrot & Becker (2011):

1. Content (Berger and Milman, 2011; Berger and Schwartz, 2011; Gladwell, 2002; Porter and Golan, 2006)- **We did not work on the content, using posts already published on the brand's page**
2. The structure of the social network (Bampo et al. 2008): **We engineered a network of engaged fans of a brand around fake profiles and described a schema that can be reproduced or anticipated.**
3. The behavioral characteristics of the recipients and their incentives for sharing the message (Ardnt, 1967): **We helped reach more engaged fans without dispersion using organic reach (without WoM) which resulted in a higher engagement and interaction.**
4. The seeding strategy (Bampo et al., 2008; Kalish, Mahajan, and Muler, 1995; Libai, Muller and Peres, 2005): **We showed that an optimized initial population engages more with posts , which results in higher pressure and influence offline.**

22

Contributions to Social Network building methodology

- We engineered a network of online "friends" who may not be friends or even know each other in real life. This social network would have never existed if it wasn't for our experiment.
- We created a new type of Honeypot profiles
 - Webb, Caverlee and Pu (2008) defined Honeypot profiles as real profiles used to attract fake ones. Our experiment does the opposite as it uses fake profiles to catch real ones.
- attraction realized by homophily:
 - Boshmaf, Muslukhov and Beznosov (2011) used social bots to attract friends based on mutual friendship. Our cover experiment shows that, on Facebook, people may engage others based on homophily:

23

Contributions to e-reputation management

- Managers should be aware about the usage of such vectors that could ruin the reputation of a firm.

24

Discussion

- We are aware that our experiments on honeypot profiles and influence in online social networks raise ethical questions.
- The number of fake profile is so important nowadays that scholars have to develop their knowledge about them, as they constitute a potential tool in influence strategies.
- The same experiments can be reproduced with real Facebook accounts and the findings can be used as well to create engaged communities and improve a company's reputation or promote brands in an ethical way.

25

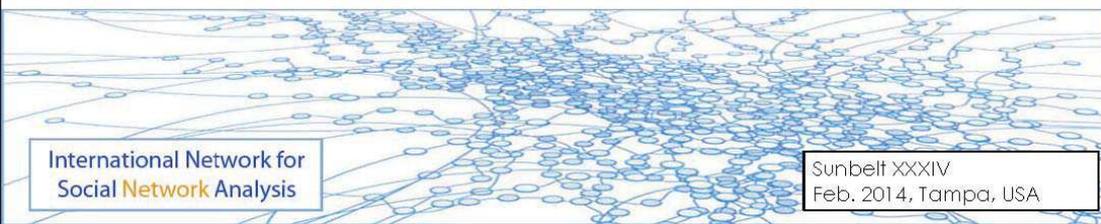
Conclusion

- Many scholars agree that the key to success in information diffusion is influencing the influencer (Galeotti & Goyal, 2009; Hinz et al., 2011) and using strategy to target an optimized initial seeding population (Liu-Thompkins, 2012).
- Information of peers tends to be more influential than the information diffused by brands or similar source (Hinz et al., 2011).
- Our contribution exposed a strategy to build an optimal seeding population from scratch in a container, the circle of friends of our fake profiles, and diffuse information organically to them.

26

Thank You

- Nasri Messarra: nasri@messarra.com
- Anne Mione: anne.mione@univ-montp1.fr



International Network for
Social Network Analysis

Sunbelt XXXIV
Feb. 2014, Tampa, USA

Honeypot profiles and malevolent e-reputation attacks on Facebook

1

Nasri Messarra, Anne Mione
Université de Montpellier 1 - MRM

2

Background

- Most SN studies in general & OSN studies in particular work on already existing networks to find influencers (Trusov, Bodapati & Bucklin), hubs, bridges, etc., and restructure them (Valente)
- Social bots and fake profiles have one objective: maximizing the number of friends and then, eventually studying the resulting network (Boshmaf, Muslukhov). They are in majority based on sexual attraction (Barracuda statistics) and are used as carriers of information – not as influencers (empiric)
- Recent studies show that size does not matter (Scarpi) and that one of the keys to success is the initial seeding population (Liu-Thompkins)
- We believe that Facebook is not really a non-directed network (in & out degrees matter)

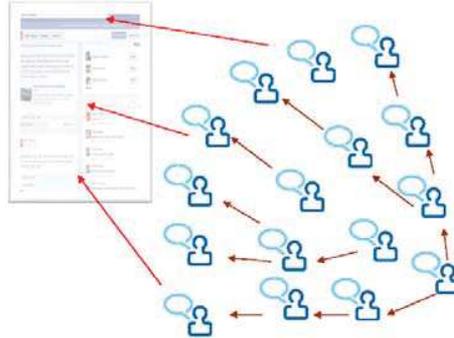
3

How activists attack on Facebook

1- Post directly on the brand page



2- Post on their own social networks and Facebook communities and wait for the viral effect to reach the brand



Reported cases & littérature about Nestlé, Pampers, DKNY, Marie-Claire, Capri Sun, Cooks Source, Bershka...

4

Weaknesses of both methods

1- Post directly on the brand page



Exposure of consumer posts on the page was reduced since FB has chosen to put all customer comments in a small discrete area

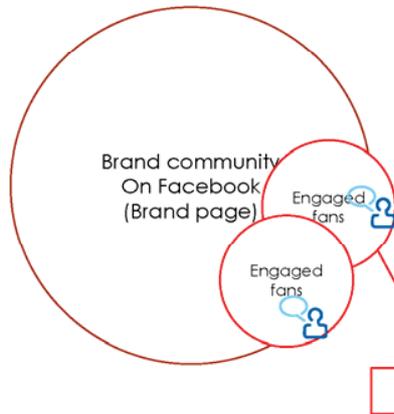
The user gets banned, Communication is closed

2- Post on their own social networks and Facebook communities and wait for the viral effect to reach the brand



Creating viral content is demanding and complex. Information may never break through

Efficient schema for a blitz unstoppable attack



What if a person can become friend on his own timeline/profile with engaged fans of a brand?

Diffusion will only need to be organic, not viral (no need for WOM for diffusion)

The brand will not have direct control to ban the user

6

Honeypot profiles

- **Can we attract engaged fans** of a brand
- Around a **high-prestige profile** (in degree > out degree) with **common interests** and **call for reciprocity** (the illusion of social proof)
- In order to create an efficient **initial seeding population**
- That can be reached directly through **organic communication?**

7

Attraction by common interest

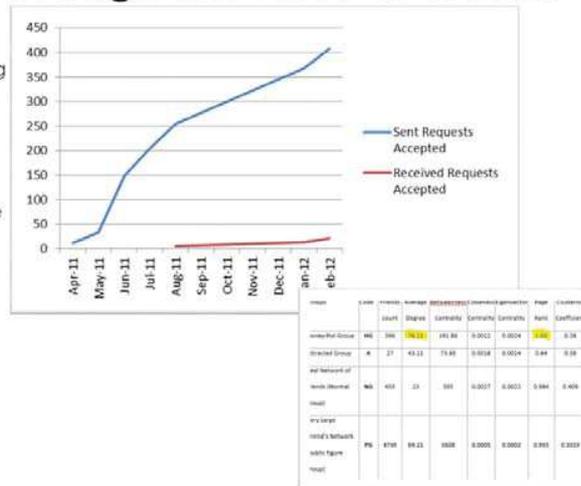


- **The cover experiment**
- Infiltration of a politician network: Obama, Hariri..., Infiltration of a movement: Syrian revolution, Infiltration of a star: Ronaldo, Infiltration of a company's group – using a profile with a cover photo that reflect a common interest and without any other content
- Sending requests to 100 engaged users - 40% responded positively

8

Attraction through the value of friends

- Creating network value by choosing popular friends
- The **Spartacus experiment** (male, very small set of photos, standard mid-age person with kids, etc.) - Different from social bots: unattractive male, weird name (cannot be confused with someone else),
- Started with 5 real friends & only chooses the most popular mutual friends
- After 4 months from the beginning of the experiment we started receiving friend requests on a regular basis (Prestige = 10% after 2 years)
- Currently has more than 500 friends



name	id	friends	likes	average	likes_per_friend	likes_per_like	likes_per_post	likes_per_comment	likes_per_reaction
Unlabeled Group	46	306	101	151.84	0.2022	0.0024	1.01	0.14	
Unlabeled Group	4	27	43.11	75.89	0.0018	0.0014	0.44	0.18	
app Network of									
Unlabeled Group	46	403	23	100	0.0007	0.0003	0.44	0.408	
name									
it's target									
Unlabeled Group	76	8708	88.11	8808	0.0005	0.0002	0.993	0.0019	
name									

9

Attraction by impersonation



- Impersonating a public figure
- Zero friend request sent
- The impersonator just likes comments on Facebook talking about him and his actions
- 2 experiments, 5000 friends reached exponentially in a matter of weeks

10

The strategic power of honeypot profiles

- **Build their network**
- Which is an **optimized seeding population**
- Of **engaged fans** of an **adversary or friend**.

Honeypot profiles

- **Cannot be banned from a page**
- **Reach fans organically**
- Can have a very **high prestige rate** depending on the method used
- Have the **illusion of social proof, liking and reciprocity**.

11

Discussion

- We are aware that our experiments on honeypot profiles and malevolent influence in online social networks raise ethical questions. Yet, we hope that our work will make brands and consumer more aware of the manipulation they can face on online social network and help them find ways to immune themselves again such malevolent attacks.
- We're only seeing the tip of the OSN iceberg. Brands and consumers should be ready for future and smarter evolutions.
- The same experiments can be reproduced with real Facebook accounts and the findings can be used as well to create engaged communities and improve a company's reputation or promote brands in an ethical way.

12

Thank You

- Nasri Messarra: nasri@messarra.com
- Anne Mione: anne.mione@univ-montp1.fr



Initiating a Network Effect in a Social Network

- Can we initiate network effects on the Facebook social network in a non-automated experiment under controlled environment?
- How to put into evidence network effects in a social network?

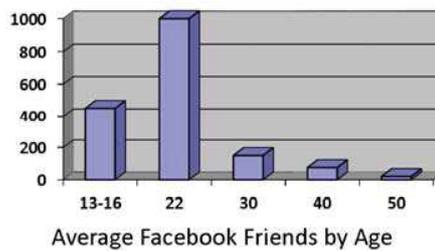
Nasri Messarra – Anne Mione

Objectives

Recent studies have focused on social network analysis suggesting different methods to measure the density and activity of these networks but also the role of the individuals as nodes and hubs, as well as their centrality within these networks (Lazega, 2007; Wasserman & Faust, 1994; Krackhardt, 1995, 1993). These **studies allow us to understand the workings of a network and the behavior of its members, but they adopt a descriptive and analytical approach**, following Granovetter's social approach (1974, 1985, 2000). They examine established networks in adopting the position of observers. **We intend to explore the construction and development of a social network from the perspective of its creator, in a strategic entrepreneurial perspective.** This posture supposes to handle specific questions: what about the creator's intervention? Can a social network reach a critical mass allowing it to sustain itself and increase in size without further intervention?

The Experiment

We created a **fake unattractive profile** on Facebook: Man, over 40, married with children, doesn't reply, doesn't post messages or photos, etc. (most Facebook fake profiles are young attractive women with a lot of photos, message postings, etc.)



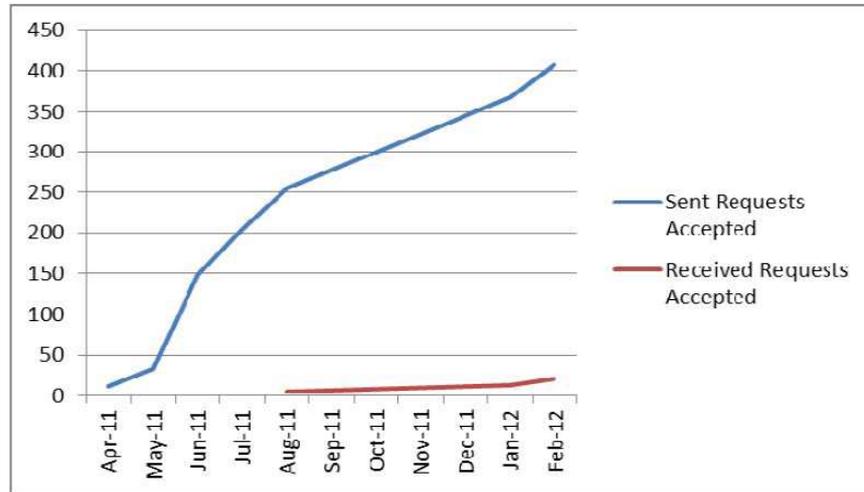
The Befriending Strategy

- Other fake profiles experiments* have been conducted by other researchers but they used “bots” (automated scripts) to send friend requests. Our method, which is completely manual, tries to focus on the importance of the “nodes” or friends as a catalyst in the network growth.
- Using the “people you may know” or “mutual friends” feature in Facebook
- Sending requests to public figures (TV broadcasters, public figures, etc.) of second category.



* Boshmaf, Muslukhov, Beznosov & Ripeanu (2011) at the University of Columbia

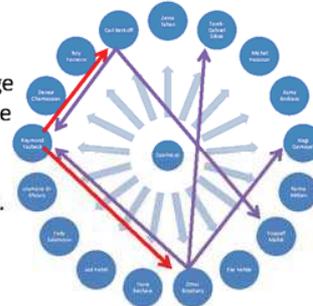
Network Effects Set Off



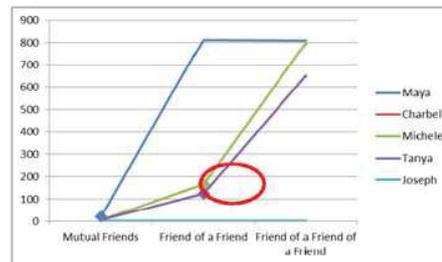
Friends acceptance over time (cumulative) and friends request (network effects take off)

The multiplier role : a determinant actor in the network

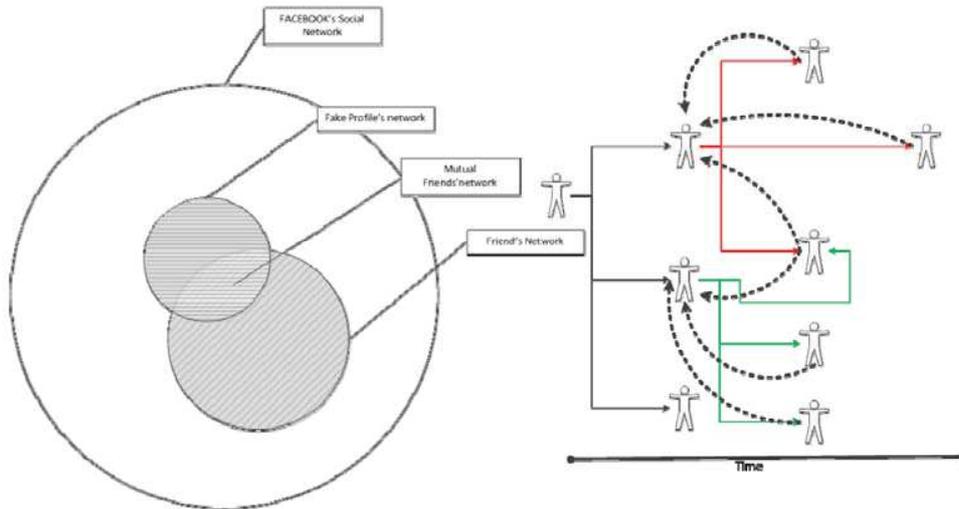
Some nodes (or friends) on the network will encourage other people to accept friends request, whereas, some of them, will bring no friends but themselves. Detecting these “multipliers” within the network can bring more understanding and control of the network.



#	First Name	Friends	Friends of Friends	Friends of Friends of Friends
1	Ahmad	0	0	0
2	Asma	133	2960	5514
3	Assaad	54	985	2997
4	Eileen	11	182	724
5	Farah	0	0	0
6	Ghassan	0	0	0
7	Hani	28	1356	8185
8	JeanMarc	50	837	2487
9	Jourmana	34	1797	9858
10	Nadine	17	704	6615
11	Nasri	12	540	6256
12	Omar	176	5396	9402
13	Patrick	13	169	725



Analyzing Social Network



Future analysis will take into consideration the imbrication of Networks and the Time (precedence) variable

Results

- We created a social network to an inexistent person and reached a critical mass where, through externalities, our fake profile started receiving friend requests without any action or reaction from his end.
- This experiment also showed that network externalities, as developed by Katz and Shapiro (1985) for several types of networks, may be applied to social networks with all the benefits associated to such networks, and that an entrepreneur can have better control over social networks than over non-virtual networks.
- We have also shown how the number of adherents and the role of the first adopters are determinant. We have demonstrated that this network has strong and weak nodes and how some of the users can have dangerous repercussions on the whole network.

Discussion

- In this experiment, the nature and role of the adopters are examined. A next step of the experimentation can be to interview the adherents. We can also announce professional, commercial, or personal events to specific people within the network, on a multiplier path or outside it, and measure the reaction on the network.
- A lot remains to be analysed and automation using accurate and powerful software tools should be investigated. This experiment does not answer all the questions asked but opens a door for a more thorough and quantitative analysis.

Annexe 4: Marketing Science Conference



37th ISMS Marketing Science Conference

JOHNS HOPKINS CAREY BUSINESS SCHOOL

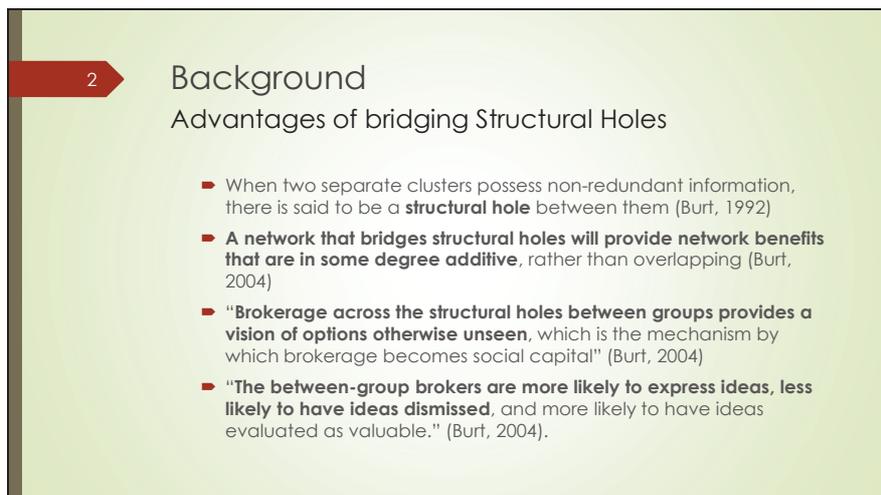
MRM Montpellier Research in Management

LABEX Entreprendre

Finding Political Network Bridges on Facebook

1

Nasri Messarra, Anne Mione
Université de Montpellier 1 - MRM



2

Background

Advantages of bridging Structural Holes

- When two separate clusters possess non-redundant information, there is said to be a **structural hole** between them (Burt, 1992)
- **A network that bridges structural holes will provide network benefits that are in some degree additive**, rather than overlapping (Burt, 2004)
- **"Brokerage across the structural holes between groups provides a vision of options otherwise unseen**, which is the mechanism by which brokerage becomes social capital" (Burt, 2004)
- **"The between-group brokers are more likely to express ideas, less likely to have ideas dismissed**, and more likely to have ideas evaluated as valuable." (Burt, 2004).

Ward, M. D., Stovel, K., & Sacks, A. (2011). Network Analysis and Political Science. *Annual Review of Political Science*, 14(1), 245–264. doi:10.1146/annurev.polisci.12.040907.115949

Mercanti-Guerin, M. (2010). Facebook, un nouvel outil de campagne: Analyse des réseaux sociaux et marketing politique. *La Revue Des Sciences de Gestion*, 17–29. Retrieved from http://www.cairn.info/article.php?ID_ARTICLE=RSG_242_0017

Lazarsfeld, P., Berelson, B., & Gaudet, H. (1968). *The People's Choice: How the Voter Makes Up His Mind in a Presidential Campaign* (3rd ed.). Columbia University Press.

Burt, R. S. (2004). Structural Holes and Good Ideas. *American Journal of Sociology*, 110(2), 349–399. doi:10.1086/421787

Burt, Ronald (1992). *Structural Holes: The Social Structure of Competition*. Cambridge, MA: Harvard University Press

Smith, M. a, Rainie, L., Himelboim, I., & Shneiderman, B. (2014). Mapping Twitter Topic Networks: From Polarized Crowds to Community Clusters. *The Pew Research Center*, (February 20), 1–57. Retrieved from <http://www.pewinternet.org/2014/02/20/mapping-twitter-topic-networks-from-polarized-crowds-to-community-clusters>

3

Structural holes and bridges in the context of polarized crowds

- **Polarized Crowd** (Smith, 2014):
 - Two big and dense groups
 - Little or no connection between them despite the fact that they are focused on the same topic
 - The topics being discussed are often highly divisive and heated political subjects.
 - Ignoring one another

Question
How to identify bridges in the context of polarized crowds?

[Isolated] Polarized Crowds	[Unified] Fight Crowd
[Fragmented] Brand Clusters	[Clustered] Community Clusters
[Central & Spoke] Broadcast Network	[Central & Spoke] Support Network

4

Research Question

Is it possible to use Facebook to identify bridges overlapping structural holes in **polarized crowds**?

Experimenting on a political situation

5

Literature Review: Politics and OSN

- **Political science is fascinated with networks** (Ward & al., 2011)
- **Online social networks are now an essential part of any political campaign** (Mercanti-Guerin, 2010)
- Online social networks are used as a **news or rumor diffusion tool** through WoM (Berinsky, 2012; Finke & Harris, 2012; Huang, 2013)
- On OSN politicians use a "politics of threat" to change **Citizens' perception regarding foreign policy views**. Emotional status influence views even when the facts are the same (Gadarian, 2010)
- Emergence and creation of centrally-controlled accounts to create the appearance of widespread support for a candidate or opinion (Ratkiewicz & al., 2011)

6

Polarized Crowds and Structural holes: Lebanon's situation

- Lebanese **division** between the **two major political movements**, March 8 and March 14, has reached a dramatic point where all the political and economical activity is literally **paralyzed**
- Media (newspapers, televisions, radio) are owned by political figures and only give their own interpretation of every event, increasing the gap between the two movements.
- A few movements strive to initiate a change in directions but they represent a very small minority of the Lebanese population.

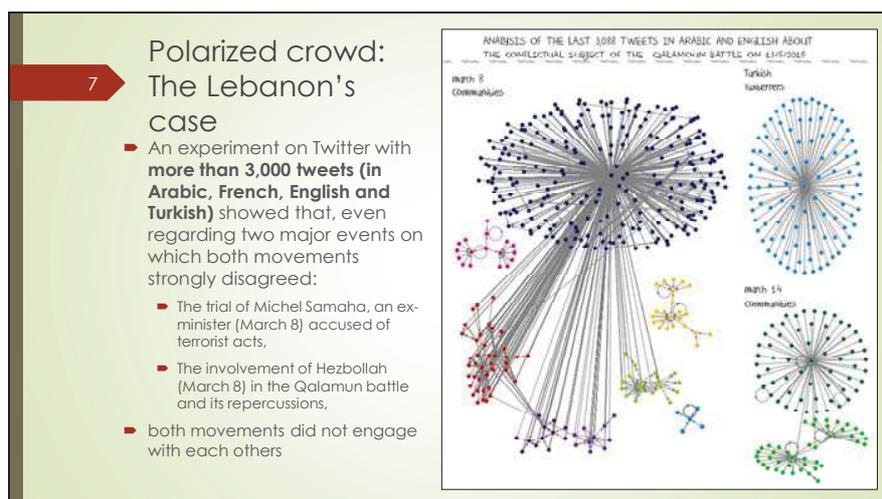


<https://www.lebanese-forces.com/2015/06/09/maya-keyrouz/>

<https://now.mmedia.me/lb/en/reportsfeatures/522533-clashes-rock-usj-campus>

<http://www.naharnet.com/stories/en/153295>

Lebanon is a good illustration of polarized crowds. The divergence is such that the 2 major groups (representing more than 90% of the voters) don't agree on anything: presidential elections, budget and economic strategies, house of representatives, etc.



To show that these groups are polarized crowds, we conducted 2 experiments on Twitter and extracted around 3,000 tweets regarding the trial of a former minister of march 8 accused of terrorist acts, and the involvement of march 8 in the war in Syria, and saw that we were in a definite situation of a polarized crowd:

Polarized Crowd (Smith, 2014):

Two big and dense groups

Little or no connection between them despite the fact that they are focused on the same topic

The topics being discussed are often highly divisive and heated political subjects.

Ignoring one another

Smith, M. a, Rainie, L., Himelboim, I., & Shneiderman, B. (2014). Mapping Twitter Topic Networks: From Polarized Crowds to Community Clusters. *The Pew Research Center*, (February 20), 1–57. Retrieved from <http://www.pewinternet.org/2014/02/20/mapping-twitter-topic-networks-from-polarized-crowds-to-community-clusters>

Smith: 6 types of social media networks

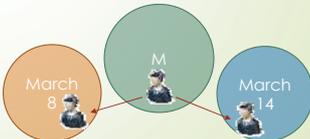
Tweets that were not commented, retweeted or favorited have been removed.

Controversial / conflictual / divergent

8

Methodology

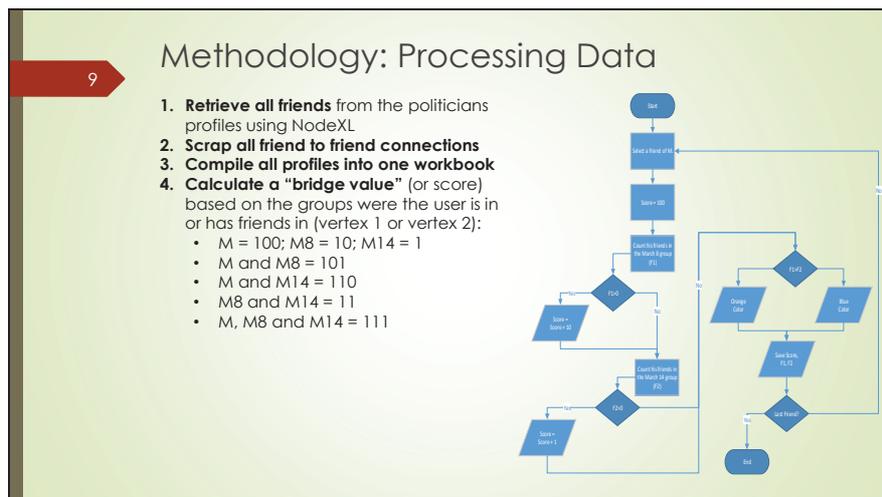
- We use **Facebook** because it is the largest OSN and a network of “friends”
- We use Facebook **timelines** (not pages) because timelines provide access to friends relations while Facebook pages and Facebook groups have limited functionality.
- We use the network a **third profile**, a politician that is not aligned and is himself a bridge between the two major political movements to increase the chances of finding friends in his networks that bridge over structural holes.
- We use the profiles of:
 - March 14 politician with 994 Facebook friends
 - March 8 politician with 4,889 friends
 - The profiles of “M”, a non aligned politician (8,440 unique friends).
- Using OpenGraph, NodeXL and Gephi, we draw the edges (friends of friends) and combine the 3 networks to find Facebook users who belong to the M.A. group but have friends in the other 2 groups (March 8 and March 14)



For our methodology, we used Facebook as it is the osn with the highest adoption by far in Lebanon.

We used timelines not pages in order to be able to gather friend to friend relationships (what friends are connected with each other)

We had the idea to use the profile of a small independent politician to increase our chances of finding bridges but we could have as well chosen a non-political figure. The main idea being to introduce a third profile into the equation.

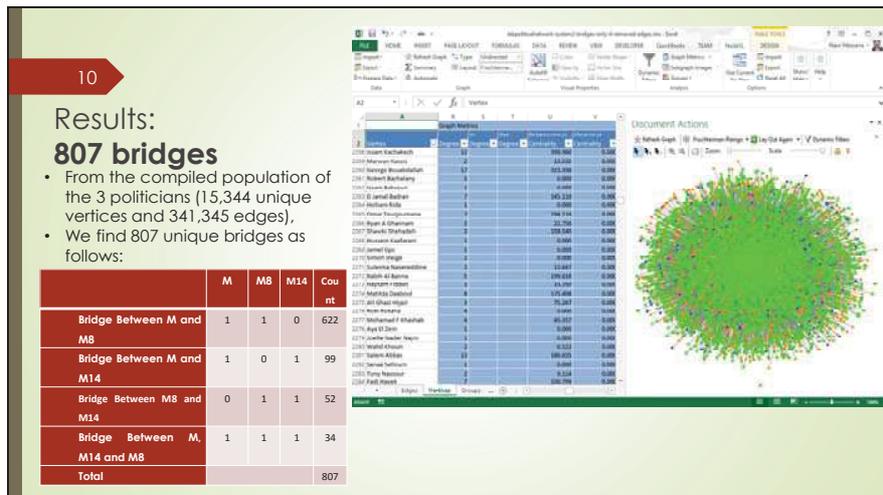


We retrieved all the friends' names from the 3 profiles,

We scrapped all friend to friend connections

We combined all the data into one NodeXL worksheet

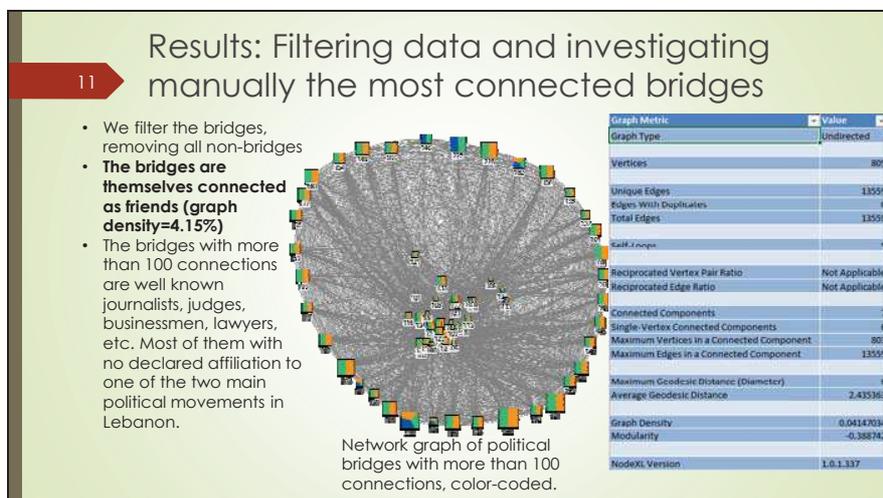
And gave a score for each vertice: 111 means that it is a member or has friends in the 3 groups, 110 means it has friends with the independent politician and M14, 101 if it has friends with the independent politician and March 8, etc.



This is the resulting network as it was graphed by NodeXL

We found 807 bridges:

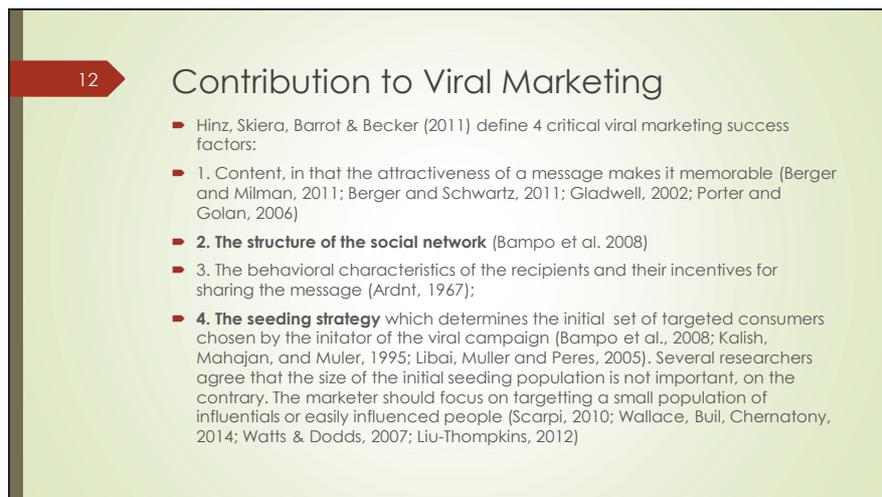
622...



The last question we asked ourselves is: Are these bridges connected? Or do we have a connected network of bridges?

So, we filtered our network leaving only the bridges and found that we had a density of 4.15%

We also analyzed the top 100 individually and found that most of these persons are well-known figures, like politicians, journalists, lawyers who never publicly declared their affiliation or political opinion.



12

Contribution to Viral Marketing

- Hinz, Skiera, Barrot & Becker (2011) define 4 critical viral marketing success factors:
- 1. Content, in that the attractiveness of a message makes it memorable (Berger and Milman, 2011; Berger and Schwartz, 2011; Gladwell, 2002; Porter and Golan, 2006)
- 2. **The structure of the social network** (Bampo et al. 2008)
- 3. The behavioral characteristics of the recipients and their incentives for sharing the message (Ardnt, 1967);
- 4. **The seeding strategy** which determines the initial set of targeted consumers chosen by the initiator of the viral campaign (Bampo et al., 2008; Kalish, Mahajan, and Muler, 1995; Libai, Muller and Peres, 2005). Several researchers agree that the size of the initial seeding population is not important, on the contrary. The marketer should focus on targetting a small population of influentials or easily influenced people (Scarpi, 2010; Wallace, Buil, Chernatony, 2014; Watts & Dodds, 2007; Liu-Thompkins, 2012)

We know how teens strive to avoid the low friends count humiliation and the effect of friend count on self-esteem (Kim & Lee). Opt-in to become a friend with someone should have a value (empiric)

Trusov, M., Bodapati, A. V, & Bucklin, R. E. (2010). Determining Influential Users in Internet Social Networks. *Journal of Marketing Research*, XLVII(August), 643–658.

Tom Valente, Network Interventions

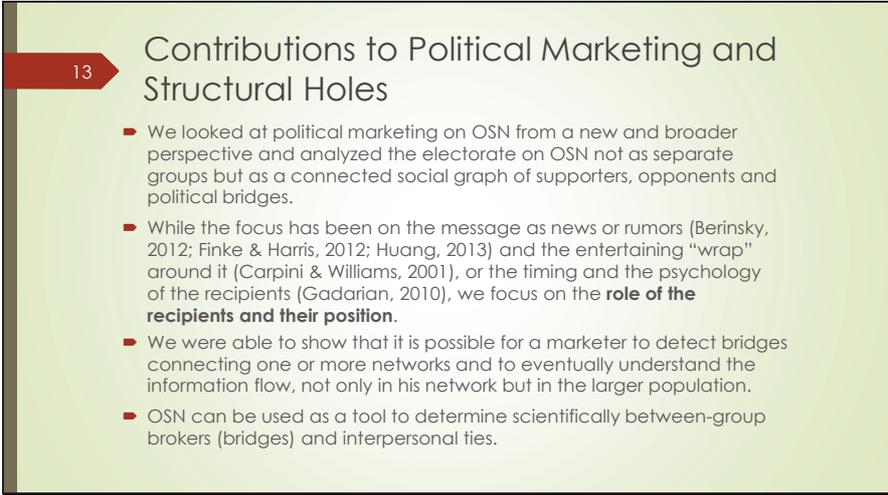
Kim, J., & Lee, J.-E. R. (2011). The Facebook paths to happiness: effects of the number of Facebook friends and self-presentation on subjective well-being. *Cyberpsychology, Behavior and Social Networking*, 14(6), 359–64. doi:10.1089/cyber.2010.0374

Scarpi, D. (2010). Does size matter? An examination of small and large web-based brand communities. *Journal of Interactive Marketing*. Retrieved from <http://www.sciencedirect.com/science/article/pii/S1094996809000899>

Boshmaf, Y., & Muslukhov, I. (2011). The socialbot network: when bots socialize for fame and money. *Proceedings of the 27th* Retrieved from <http://dl.acm.org/citation.cfm?id=2076746>

Libai: The Social Value of Word-of-Mouth Programs: Acceleration versus Acquisition

Domingos: **Mining the Network Value of Customers**



13

Contributions to Political Marketing and Structural Holes

- We looked at political marketing on OSN from a new and broader perspective and analyzed the electorate on OSN not as separate groups but as a connected social graph of supporters, opponents and political bridges.
- While the focus has been on the message as news or rumors (Berinsky, 2012; Finke & Harris, 2012; Huang, 2013) and the entertaining "wrap" around it (Carpini & Williams, 2001), or the timing and the psychology of the recipients (Gadarian, 2010), we focus on the **role of the recipients and their position**.
- We were able to show that it is possible for a marketer to detect bridges connecting one or more networks and to eventually understand the information flow, not only in his network but in the larger population.
- OSN can be used as a tool to determine scientifically between-group brokers (bridges) and interpersonal ties.

4 critical viral marketing success factors

(Hinz, Skiera, Barrot & Becker (2011))

4. Content (Berger and Milman, 2011; Berger and Schwartz, 2011; Gladwell, 2002; Porter and Golan, 2006)

Conclusion

- Our method could be used as a first step to define an initial seeding population (Bampo et al., 2008; Kaish, Mahajan, and Muler, 1995; Libai, Muller and Peres, 2005) and start a viral marketing campaign.
- With the larger perspective offered by a combined graph of several groups of politically engaged people, the marketer could choose to target hubs to diffuse information to his supporters quickly or target bridges to influence or diffuse information to the opposition.
- Having identified bridges, we can anticipate some of their **behavioral characteristics** (Ardnt, 1967; Hinz, Skiera, Barot & Becker, 2011) and monitor them to see how they react (or not) to messages.

Discussion

- This experiment helped locate political bridges between the different political networks on Facebook. Yet, we don't know if these bridges will be willing to diffuse political information, create a snowball effect and if others are or will be influenced by them.
- It would be interesting to push this experiment further and understand what type of information these bridges share on Facebook and Twitter and understand their behavior.
- While this experiment can be reproduced today, Facebook is continuously limiting one's access to his own data (fans, friends of friends, etc.) and this experiment may not be possible in the future.

Thank You

- ▶ Nasri Messarra: nasri@messarra.com
- ▶ Anne Mione: anne.mione@univ-montpl.fr

Table of figures

Figure 1: Nombre d'utilisateurs actifs en millions sur les réseaux sociaux en ligne avec le plus grand nombre d'utilisateurs (Statista, 2015).....	26
Figure 2: Meilleures pratiques des PME en matière de communication sur les RSO (Vásquez et Escamilla, 2014).	33
Figure 3: De la réflexion à la synthèse	40
Figure 4: Number of active users in millions for the most popular OSN (Statista, 2015)	59
Figure 5: Best practices for SME in OSN communication (Vásquez et Escamilla, 2014).....	65
Figure 6: from thinking to synthesis	71
Figure 7: Facebook Friend List Privacy Setting	102
Figure 8: Visible and Invisible Friends of a Facebook User	103
Figure 9: Uncovered friends of M.H.	107
Figure 10: Uncovered friends of T.	107
Figure 11: Uncovered friends of V.	108
Figure 12: Uncovered friends of M.G.	108
Figure 13: Uncovered friends of M.A.....	108
Figure 14: Uncovered friends of C.	108
Figure 15: Uncovered friends of N.N.	109
Figure 16: Uncovered friends of R.	109
Figure 17: Uncovered friends of M.N.	109
Figure 18: Uncovered friends of N.H.	109
Figure 19: Average number of friends per age group on Facebook.....	118
Figure 20: Facebook users by age group	119
Figure 21: Sending requests based on high number of mutual friends and real-life popularity (some pictures have been blurred for privacy reasons).....	122
Figure 22: solicited friends (circles) and attracted friends (triangles).....	128
Figure 23: Solicited versus attracted friends	129
Figure 24: Sent versus accepted requests over time.....	129
Figure 25: Clusters of communication	146
Figure 26: Requests sent and requests accepted	148

Figure 27: Resulting network.....	149
Figure 28: M.'s network of friends on Facebook.....	166
Figure 29: Hubs in M.'s network on Facebook.....	167
Figure 30: Finding connections throughout Facebook profiles.....	168
Figure 31: Shortests path from Amal to Maurice throughout both M.'s profiles.....	169
Figure 32: Bridges between political groups in Lebanon.....	171
Figure 33: Bridges between several Lebanese political groups.....	172
Figure 34: augmentation du nombre de likes 2013-2015.....	190
Figure 35: Optimize network by adding weak ties as friends.....	196
Figure 36: Connecting to weak ties.....	197
Figure 37: NM likes to posts 2013-2015.....	199
Figure 38: NM shares of posts 2013-2015.....	199
Figure 39: NM comments to posts 2013-2015.....	200
Figure 40: Marketing Strategies and Medium.....	208
Figure 41: Styles de marketing et canaux Facebook.....	214

Table of tables

Table 1: Types de connaissance dans la théorie critique d'Habermas (Maclsaac, 1996)	42
Table 2: Méthodes de recherche (Dash, 2005)	43
Table 3: Pourcentage d'amis exposés.....	46
Table 4: Stratégies Marketing sur Facebook	50
Table 5: Types of knowledge in Habermas' critical theory (Maclsaac, 1996)	73
Table 6: Research Methods (Dash, 2005)	73
Table 7: Percentage of uncovered friends.....	76
Table 8: Marketing strategies on Online Social Networks.....	79
Table 9: Attackers Profiles	105
Table 10: Targeted users and friends count	107
Table 11: Initial friends group and resulting intra-network links	124
Table 12: Centrality of some of the members of the engineered network	125
Table 13: Comparison of the inversed honeypot network to other real networks	130
Table 14: Comparaison des résultats de la diffusion de messages négatifs initialement publiés sur une page Facebook d'entreprise, republiés sur les pages de faux profils avec une population initiale de diffusion optimisée.....	139
Table 15: Comparison of Facebook engagement using posts on the brand's Facebook page and using a seeding population on Facebook timelines.....	154
Table 16: Personal Timelines versus Pages for Social Marketing	163
Table 17: Marketing techniques and Facebook channels	174
Table 18: Differences between timelines, pages and groups on Facebook	179
Table 19: Mass Marketing on Facebook	180
Table 20: Niche Marketing on Facebook	181
Table 21: Viral Strategies on Facebook Channels.....	182
Table 22: Relationship Marketing Goals and Facebook Channels.....	186
Table 23: Marketing techniques and Facebook channels	188
Table 24: Graph Metrics of NM as of Oct. 12, 2013	195
Table 25: Descriptive statistics for NM's 253 posts.....	198
Table 26: Strong and weak ties in the network	200

Table 27: Graph metrics as of 2/11/2014	201
Table 28: Likes from strong and weak ties on posts.....	201

Bibliography

- Adida, C. L., Laitin, D. D., & Valfort, M.-A. (2010). Identifying barriers to Muslim integration in France. *Proceedings of the National Academy of Sciences of the United States of America*, 107(52), 22384–90. doi:10.1073/pnas.1015550107
- Agorapulse. (2015). Facebook Page Barometer. Retrieved May 22, 2015, from <http://barometer.agorapulse.com/>
- Ahonen, T., & Moore, A. (2005). *Communities dominate brand: business and marketing for the 21st century*. futuretext Ltd.
- Alexa. (2015). Alexa Traffic Ranks. Retrieved August 22, 2015, from <http://www.alexa.com/siteinfo/huffingtonpost.com>
- Allen, C. (2004). The Dunbar number as a limit to group sizes. Retrieved August 23, 2015, from http://www.lifewithalacrity.com/2004/03/the_dunbar_numb.html
- Aral, S., Muchnik, L., & Sundararajan, A. (2011). Engineering Social Contagions: Optimal Network Seeding and Incentive Strategies. *SSRN Electronic Journal*. doi:10.2139/ssrn.1770982
- Aral, S., & Walker, D. (2011). Viral Product Design: A Randomized Trial of Peer Influence in Networks. *Management Science*, 57(9), 1623–1639.
- Arndt, J. (1967). Role of product-related conversations in the diffusion of a new product. *Journal of Marketing Research*, IV(1), 291–295. Retrieved from <http://www.jstor.org/stable/3149462>
- Attackers Use Fake Friends to Blend Into Facebook. (2012). *Yahoo! Finance*. Retrieved from <http://finance.yahoo.com/news/attackers-fake-friends-blend-facebook-153000795.html>
- Backstrom, L., Boldi, P., Rosa, M., Ugander, J., & Vigna, S. (2011). Four Degrees of Separation. *Physics and Society*. Retrieved from <http://arxiv.org/abs/1111.4570>
- Backstrom, L., Boldi, P., Rosa, M., Ugander, J., & Vigna, S. (2012). Four degrees of separation. *Proceedings of the 3rd Annual ACM Web Science Conference on - WebSci '12*, 33–42. doi:10.1145/2380718.2380723
- Backstrom, L., Sun, E., & Marlow, C. (2010). Find me if you can: improving geographical prediction with social and spatial proximity. ... *of the 19th International Conference on ...* Retrieved from <http://dl.acm.org/citation.cfm?id=1772698>
- Bakshy, E. (2012). Rethinking Information Diversity in Networks. Retrieved July 6, 2015, from <https://www.facebook.com/notes/facebook-data-science/rethinking-information-diversity-in-networks/10150503499618859>
- Bakshy, E., & Hofman, J. (2011). Everyone's an influencer: quantifying influence on twitter. *Proceedings of the Fourth ...* Retrieved from <http://dl.acm.org/citation.cfm?id=1935845>
- Bakshy, E., Rosenn, I., Marlow, C., & Adamic, L. (2012). The role of social networks in information diffusion. *Proceedings of the 21st ...* Retrieved from <http://dl.acm.org/citation.cfm?id=2187907>
- Bampo, M., Ewing, M. T., Mather, D. R., Stewart, D., & Wallace, M. (2008). The Effects of the

- Social Structure of Digital Networks on Viral Marketing Performance. *Information Systems Research*, 19(3), 273–290. doi:10.1287/isre.1070.0152
- Barnes, N. G., Lescault, A. M., & Wright, S. (2013). 2013 Fortune 500 Are Bullish on Social Media. *University of Massachusetts Dartmouth*. Retrieved from <http://www.umassd.edu/cmr/socialmediaresearch/2013fortune500/>
- Bassett, E., & O’Riordan, K. (2002). Ethics of Internet research: Contesting the human subjects research model. *Ethics and Information Technology*, 1–16. Retrieved from <http://link.springer.com/article/10.1023/A:1021319125207>
- Bastian, M., Heymann, S., & Jacomy, M. (2009). Gephi: an open source software for exploring and manipulating networks. *ICWSM*. Retrieved from <http://www.aaai.org/ocs/index.php/ICWSM/09/paper/viewPDFInterstitial/154Forum/1009>
- Baynes, K. (1992). The Normative Grounds of Social Criticism. *Kant Studien: Philosophische Zeitschrift Der Kant Gesellschaft*, 86(3), 694–697.
- Bell, G. (2004). Intimate computing? *IEEE Internet Computing*. Retrieved from <http://www.computer.org/csdl/mags/ic/2004/06/w6091.pdf>
- Berger, J., & Milkman, K. (2009). What makes online content viral? Available at SSRN 1528077, XLIX(April), 192–205. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1528077&download=yes
- Berger, J., & Schwartz, E. (2011). What do people talk about? Drivers of immediate and ongoing word-of-mouth. *Journal of Marketing Research*, ..., (August), 1–48. doi:10.2139/ssrn.1822246
- Berinsky, A. (2012). Rumors, truths, and reality: A study of political misinformation. *Massachusetts Institute of Technology. Manuscript*. Retrieved from <http://202.154.59.182/ejournal/files/A STUDY OF POLITICAL MISINFORMATION.pdf>
- Bernstein, M., Bakshy, E., Burke, M., & Karrer, B. (2013a). Quantifying the invisible audience in social networks. *Proceedings of the SIGCHI ...*. Retrieved from <http://dl.acm.org/citation.cfm?id=2470658>
- Bernstein, M., Bakshy, E., Burke, M., & Karrer, B. (2013b). Quantifying the invisible audience in social networks. *Proceedings of the SIGCHI ...*. Retrieved from <http://dl.acm.org/citation.cfm?id=2470658>
- Berthon, P. R., Pitt, L. F., Plangger, K., & Shapiro, D. (2012). Marketing meets Web 2.0, social media, and creative consumers: Implications for international marketing strategy. *Business Horizons*, 55(3), 261–271. doi:10.1016/j.bushor.2012.01.007
- Bilge, L., Strufe, T., Balzarotti, D., & Kirda, E. (2009). All your contacts are belong to us: automated identity theft attacks on social networks. *Proceedings of the 18th ...*, 551–560. Retrieved from <http://dl.acm.org/citation.cfm?id=1526784>
- Booth, N., & Matic, J. A. (2011). Mapping and leveraging influencers in social media to shape corporate brand perceptions. *Corporate Communications: An International Journal*. doi:10.1108/13563281111156853
- Borgatti, S. P. (2005). Centrality and network flow. *Social Networks*, (27.1), 55–71.
- Bos, N., & Karahalios, K. (2009). Research ethics in the facebook era: privacy, anonymity, and

- oversight. *CHI'09 Extended ...*, 1–4. Retrieved from <http://dl.acm.org/citation.cfm?id=1520402>
- Boshmaf, Y., & Muslukhov, I. (2011). The socialbot network: when bots socialize for fame and money. *Proceedings of the 27th ...*. Retrieved from <http://dl.acm.org/citation.cfm?id=2076746>
- Brandes, U. (2001). A faster algorithm for betweenness centrality. *Journal of Mathematical Sociology*, (25.2), 163–177.
- Bronner, F., & de Hoog, R. (2010). Consumer-generated versus marketer-generated websites in consumer decision making. *International Journal of Market Research*, 52(2), 231. doi:10.2501/S1470785309201193
- Brown, J., & Reingen, P. (1987). Social ties and word-of-mouth referral behavior. *Journal of Consumer Research*, 350–363. Retrieved from <http://www.jstor.org/stable/2489496>
- Bruckman, A. (2002). Studying the amateur artist: A perspective on disguising data collected in human subjects research on the Internet. *Ethics and Information Technology*. Retrieved from <http://link.springer.com/article/10.1023/A:1021316409277>
- Bruckman, A., & Karahalios, K. (2010). Revisiting research ethics in the Facebook era: challenges in emerging CSCW research. *The 2010 ...*, 623–624. Retrieved from http://yardi.people.si.umich.edu/pubs/Yardi_ResearchEthics10.pdf
- Brydon-Miller, M., Greenwood, D., & Maguire, P. (2003). Why action research? *Action Research*, 1(1), 9–28.
- Buchanan, D. (1988). Getting in, getting on, getting out, and getting back in. In *Doing research in organisations* (Bryman., pp. 53–67). London: Routledge.
- Buchanan, M. (2008). The law of accelerating returns. *Nature Physics*, 4(7), 507–507. doi:10.1038/nphys1010
- Built With. (2015). Forum Software Usage. Retrieved August 22, 2015, from <http://trends.builtwith.com/cms/forum-software>
- Burke, M., Marlow, C., & Lento, T. (2009). Feed me: Motivating Newcomer Contribution in Social Network Sites. *Proceedings of the 27th International Conference on Human Factors in Computing Systems - CHI '09*, (September), 945. doi:10.1145/1518701.1518847
- Burt, R. (2009). *Structural holes: The social structure of competition* (Harvard Un.).
- Burt, R. S. (2004a). An Introduction to Social Capital.
- Burt, R. S. (2004b). Structural Holes and Good Ideas. *American Journal of Sociology*, 110(2), 349–399. doi:10.1086/421787
- Cai, R., Yang, J., Lai, W., Wang, Y., & Zhang, L. (2008). iRobot : An Intelligent Crawler for Web Forums. *Proceedings of the 17th International Conference on World Wide Web*, 447–456. doi:10.1145/1367497.1367558
- Carpini, M. D., & Williams, B. (2001). Let us infotain you: Politics in the new media age, (January), 160–181. Retrieved from http://repository.upenn.edu/asc_papers/14/
- Carr, N. (2008). Is Google Making Us Stupid? *The Atlantic Monthly*, 302(1), 56–58,60,62–63. doi:10.1111/j.1744-7984.2008.00172.x

- Champoux, V., Durgee, J., & McGlynn, L. (2012). Corporate Facebook pages: when “fans” attack. *Journal of Business Strategy*, 33(2), 22–30. doi:10.1108/02756661211206717
- Chen, J., Geyer, W., Dugan, C., Muller, M., & Guy, I. (2009). Make new friends, but keep the old: recommending people on social networking sites. *Proceedings of the 27th International Conference on Human Factors in Computing Systems - CHI '09*, 201–210. doi:10.1145/1518701.1518735
- Cialdini, R. (2001). Harnessing the science of persuasion. *Harvard Business Review*. Retrieved from http://www.obanalytics.com/images/Cialdini_2001.pdf
- Cialdini, R. (2005). Basic social influence is underestimated. *Psychological Inquiry*, 16(4), 158–161. Retrieved from http://www.tandfonline.com/doi/pdf/10.1207/s15327965pli1604_03
- Constine, J. (2014). Why Is Facebook Page Reach Decreasing? More Competition And Limited Attention. Retrieved from <http://techcrunch.com/2014/04/03/the-filtered-feed-problem/>
- Cooper, D. J. (2014). A Note on Deception in Economic Experiments. *Journal of Wine Economics*, 9(02), 111–114. doi:10.1017/jwe.2014.18
- Cooper, D., & Schindler, P. (2008). *Business research methods (10th ed.)*. Retrieved from <http://mathstore.ac.uk/newsletter/feb2003/pdf/businessresearch.pdf>
- Corrigan, J. (2013). A Short History of Deception in the Experimental Social Psychology Literature. Retrieved from http://economics.kenyon.edu/corrigan/publications/A_History_of_Deception_in_the_Experimental_Social_Psychology_Literature.pdf
- Cuvelier, E., & Aaufaure, M. (2011). EVARIST : un outil de monitoring du buzz et de l' e-reputation sur Twitter 1 Introduction 2 Twitter et Micro-Blogging.
- Darvell, M. J., Walsh, S. P., & White, K. M. (2011). Facebook Tells Me So: Applying the Theory of Planned Behavior to Understand Partner-Monitoring Behavior on Facebook. *Cyberpsychology, Behavior, and Social Networking*, 14(12), 717–722. doi:10.1089/cyber.2011.0035
- Dash, N. K. (2005). Module: Selection of the Research Paradigm and Methodology. Retrieved from http://www.celt.mmu.ac.uk/researchmethods/Modules/Selection_of_methodology/
- Delre, S. a., Jager, W., & Janssen, M. a. (2006). Diffusion dynamics in small-world networks with heterogeneous consumers. *Computational and Mathematical Organization Theory*, 13(2), 185–202. doi:10.1007/s10588-006-9007-2
- Dietram, A. (2000). Media effects on political and social trust.
- Domingos, P., & Richardson, M. (2001). Mining the Network Value of Customers. *Proceedings of the Seventh {ACM} {SIGKDD} International Conference on Knowledge Discovery and Data Mining*, 57–66. doi:10.1145/502512.502525
- Dunbar, R. I. M. (1993). Coevolution of neocortical size, group size and language in humans. *Behavioral and Brain Sciences*, 16, 681–735. doi:10.1017/S0140525X00032325
- Dunn, H., & Allen, C. (2005). Rumors, urban legends and internet hoaxes. *Proceedings of the Annual Meeting of ...*, 85–91. Retrieved from <http://pascalfroissart.online.fr/3-cache/2005-dunn-allen.pdf>

- East, R., Hammond, K., & Wright, M. (2007). The relative incidence of positive and negative word of mouth: A multi-category study. *International Journal of Research in Marketing*, 24, 175–184. doi:10.1016/j.ijresmar.2006.12.004
- Eby, J. (2010). The Effects of Facebook on Jealousy in Relationships. *Lagrange.edu*. Retrieved from http://www2.lagrange.edu/resources/pdf/citations/2011/18_Eby_Psychology.pdf
- Elishar, A., Fire, M., Kagan, D., & Elovici, Y. (2012). Organizational Intrusion: Organization Mining Using Socialbots. *2012 International Conference on Social Informatics*, (SocialInformatics), 7–12. doi:10.1109/SocialInformatics.2012.39
- Ellison, N. B., & Boyd, D. M. (2007). Social Network Sites: Definition, History, and Scholarship. *Journal of Computer-Mediated Communication*, 13(1), 210–230. doi:10.1111/j.1083-6101.2007.00393.x
- Elmer, G. (2015). Going Public on Social Media. *Social Media + Society*, 1(1). doi:10.1177/2056305115580341
- Elphinston, R. a, & Noller, P. (2011). Time to face it! Facebook intrusion and the implications for romantic jealousy and relationship satisfaction. *Cyberpsychology, Behavior and Social Networking*, 14(11), 631–5. doi:10.1089/cyber.2010.0318
- Emerson, T. I. (1976). Legal Foundations of the Right to Know. *Washington University Law Quarterly*, 1(1), 1–24. Retrieved from http://digitalcommons.law.yale.edu/fss_papers/2800?utm_source=digitalcommons.law.yale.edu/fss_papers/2800&utm_medium=PDF&utm_campaign=PDFCoverPages
- Enli, G., & Thumim, N. (2012). Socializing and self-representation online: exploring Facebook. *Observatorio (OBS*)*, 6, 87–105. Retrieved from <http://obs.obercom.pt/index.php/obs/article/view/489>
- Euler, L. (1736). The seven bridges of Königsberg. *Anesthesiology*. doi:10.1097/ALN.0b013e318210f580
- Facebook. (2013). *Wikipedia*. Retrieved from <http://en.wikipedia.org/wiki/Facebook>
- Facebook. (2014). Who can see the Friends section of my profile? Retrieved from https://www.facebook.com/help/115450405225661/?ref=timeline_about
- Facebook. (2015). Facebook Platform Changelog. Retrieved from https://developers.facebook.com/docs/apps/changelog#v2_0_login
- Ferguson, R. (2008). Word of mouth and viral marketing: taking the temperature of the hottest trends in marketing. *Journal of Consumer Marketing*, 25(3), 179–182. doi:10.1108/07363760810870671
- Finke, R., & Harris, J. (2012). Wars and Rumors of Wars: Explaining Religiously Motivated Violence. *Religion, Politics, Society and the State*. Retrieved from [http://www.thearda.com/workingpapers/download/War and Rumors of War.pdf](http://www.thearda.com/workingpapers/download/War%20and%20Rumors%20of%20War.pdf)
- Flynn, G. (n.d.). How Facebook is Ruining Your Romantic Relationships.
- Fournier, S., & Avery, J. (2011). The uninvited brand. *Business Horizons*, 54(3), 193–207. doi:10.1016/j.bushor.2011.01.001
- Franceschi-Bicchierai, L. (2014). Google Reveals Information About “Right to Be Forgotten” Requests. *Mashable*. Retrieved October 12, 2014, from <http://mashable.com/2014/10/10/google-145000-right-to-be-forgotten-requests->

transparency-report/

- Freeman, L. (1977). A set of measures of centrality based on betweenness. *Sociometry*, 35–41.
- Freeman, L. (1979). Centrality in social networks conceptual clarification. *Social Networks*, (1.3), 215–239.
- Friedkin, N. (1980). A test of structural features of Granovetter's strength of weak ties theory. *Social Networks*, 2. Retrieved from <http://www.sciencedirect.com/science/article/pii/0378873380900064>
- Friedman, D., & Sunder, S. (1994). *Experimental methods: A primer for economists*. Retrieved from http://books.google.com/books?hl=en&lr=&id=3lxmCqLG6kkC&oi=fnd&pg=PR9&dq=experimental+methods:+a+primer+for+economists&ots=BR_HLFVzt5&sig=edZoCVUzoEBgK73oW9T7AKEGorY
- Friesen, N. (2008). Critical Theory: Ideology Critique and the Myths of E-learning. *Ubiquity*, (June).
- Gaines-Ross, L. (2010a). Reputation warfare. *Harvard Business Review*. Retrieved from <http://broward.k2dsquared.com/cfbroward/media/Documents/Reputation-Warfare--HBR-December-2010.pdf>
- Gaines-Ross, L. (2010b). Reputation Warfare. *Harvard Business Review*, (December), 70–77.
- Galeotti, A., & Goyal, S. (2009). Influencing the influencers: a theory of strategic diffusion. *The RAND Journal of Economics*, 40(3), 509–532. doi:10.1111/j.1756-2171.2009.00075.x
- Garland, A. (2015). *Ex Machina* (Kindle.).
- Gladwell, M. (2002). *The Tipping Point: How little things can make a big difference* (Back Bay B.). Boston. doi:10.1057/palgrave.im.4340262
- Goldenberg, J. (2009). Integrating the social network to diffusion model and evaluation of the value of hubs in the adoption process. *SSRN eLibrary*. Retrieved from <http://ssrn.com/abstract=1526490>
- Gonzales, A. L., & Hancock, J. T. (2011). Mirror, mirror on my Facebook wall: effects of exposure to Facebook on self-esteem. *Cyberpsychology, Behavior and Social Networking*, 14(1-2), 79–83. doi:10.1089/cyber.2009.0411
- Gosling, S. D., Augustine, A. a, Vazire, S., Holtzman, N., & Gaddis, S. (2011). Manifestations of personality in Online Social Networks: self-reported Facebook-related behaviors and observable profile information. *Cyberpsychology, Behavior and Social Networking*, 14(9), 483–8. doi:10.1089/cyber.2010.0087
- Granovetter, M. (1983). The strength of weak ties: A network theory revisited. *Sociological Theory*, 1(1983), 201–233. Retrieved from [http://www.soc.ucsb.edu/faculty/friedkin/Syllabi/Soc148/Granovetter 1983.pdf](http://www.soc.ucsb.edu/faculty/friedkin/Syllabi/Soc148/Granovetter%201983.pdf)
- Granovetter, M. (1985). Economic action and social structure: the problem of embeddedness. *American Journal of Sociology*, 481–510.
- Granovetter, M. (1995). *Getting a job: A study of contacts and careers*. University of Chicago Press.

- Granovetter, M. (2000). *Le marché autrement*. Paris: Desclée de Brouwer.
- Granovetter, M. S. (1973). The Strength of Weak Ties. *American Journal of Sociology*, (6), 1360–1380. doi:10.1086/225469
- Greener, S. (2008a). *Business research methods*. Dr. Sue Greener & Ventus Publishing ApS. Retrieved from <http://mathstore.ac.uk/newsletter/feb2003/pdf/businessresearch.pdf>
- Greener, S. (2008b). *Business Research Methods*.
- Grönroos, C. (1994). Quo Vadis, marketing? Toward a relationship marketing paradigm. *Journal of Marketing Management*. doi:10.1080/0267257X.1994.9964283
- Grönroos, C. (2004). The relationship marketing process: communication, interaction, dialogue, value. *Journal of Business & Industrial Marketing*, 19(2), 99–113. doi:10.1108/08858620410523981
- Guo, F., Yang, Z., & Zhou, T. (2013). Predicting link directions via a recursive subgraph-based ranking. *Physica A: Statistical Mechanics and Its Applications*, 392(16), 3402–3408. doi:10.1016/j.physa.2013.03.025
- Habermas, J. (1962). RGEN (1989) The Structural Transformation of the Public Sphere: An Inquiry into a Category of Bourgeois Society. *Trans. by Thomas Burger with Assistance of Frederick ...* Retrieved from <http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:the+structural+transformation+of+the+public+sphere:+an+inquiry+into+a+category+of+bourgeois+society#7>
- Habermas, J. (1985). The Theory of Communicative Action: Reason and the rationalization of society. doi:10.2307/590724
- Hales, T. L. I. (2013). *The long tail: an evaluation of the causal assumptions in market determination*. Baylor University.
- Hall, J. (2014). “Right to be forgotten” ruling creates a quagmire for Google et al. *the Guardian*. Retrieved October 12, 2014, from <http://www.theguardian.com/commentisfree/2014/may/13/right-to-be-forgotten-ruling-quagmire-google>
- Hann, I.-H., Hui, K.-L., Lee, S.-Y. T., & Png, I. P. L. (2008). Consumer Privacy and Marketing Avoidance: A Static Model. *Management Science*, 54(6), 1094–1103. doi:10.1287/mnsc.1070.0837
- Hansen, D., Shneiderman, B., & Smith, M. (2011). *Analyzing social media networks with NodeXL: Insights from a connected world*. (Elsevier, Ed.) *Proceedings of the ...* Retrieved from <http://dl.acm.org/citation.cfm?id=1556497>
- Harary, F. (1969). Graph theory, 274. Retrieved from http://books.google.pt/books/about/Graph_theory.html?id=QNxgQZQH868C&pgis=1
- Heath, C., & Heath, D. (2008). Made to stick: Why some ideas survive and others die. *CHSRF - Insight and Action*, 1–4.
- Heath, C., & Heath, D. (2010a). *Switch: How to Change Things When Change Is Hard*. New York. Retrieved from <http://www.amazon.com/dp/0385528752>
- Heath, C., & Heath, D. (2010b). *Switch: How to Change Things When Change Is Hard*. New York, 305. Retrieved from <http://www.amazon.com/dp/0385528752>

- Heiderich, D. (2009a). *Influence sur internet*. Retrieved from <http://books.google.com/books?hl=en&lr=&id=vs1BZwKUpE4C&oi=fnd&pg=PP3&dq=influence+sur+internet&ots=3nCq1cax8z&sig=2jHFwSoZmxlnmx5atj3c4Dn8Vck>
- Heiderich, D. (2009b). *Influence sur internet*. Observatoire International des Crises. Retrieved from http://books.google.com/books?hl=en&lr=&id=vs1BZwKUpE4C&oi=fnd&pg=PP3&dq=influence+sur+internet&ots=3nCq_ieA0t&sig=_wiEY4YZ16KXLHwxpuJv8-6Zj5k
- Herbig, P., & Milewicz, J. (1993). The relationship of reputation and credibility to brand success. *Journal of Consumer Marketing*, 10, 18–24. doi:10.1108/EUM0000000002601
- Hertwig, R., & Ortmann, A. (2008). Deception in Experiments: Revisiting the Arguments in Its Defense. *Ethics & Behavior*, 18(1), 59–92. doi:10.1080/10508420701712990
- Herzfeld, N. (2002). Creating in our own image: Artificial intelligence and the image of God. *Zygon*, 37(2), 303–316. doi:10.1111/0591-2385.00430
- Hey, J. D. (1998). Experimental economics and deception: A comment. *Journal of Economic Psychology*, 19(3), 397–401. doi:10.1016/S0167-4870(98)00013-0
- Hill, K. (2014). 10 Other Facebook Experiments On Users , Rated On A Highly-Scientific WTF Scale. *Forbes*. Retrieved September 28, 2015, from <http://www.forbes.com/sites/kashmirhill/2014/07/10/facebook-experiments-on-users/print/>
- Hill, S., Provost, F., & Volinsky, C. (2006). Network-Based Marketing: Identifying Likely Adopters via Consumer Networks. *Statistical Science*, 21(2), 256–276. doi:10.1214/088342306000000222
- Hinz, O., Skiera, B., Barrot, C., & Becker, J. (2011). Seeding strategies for viral marketing: an empirical comparison. *Journal of Marketing*. Retrieved from <http://journals.ama.org/doi/abs/10.1509/jm.10.0088>
- Hinz, O., Skiera, B., Barrot, C., & Becker, J. (2011). Seeding strategies for viral marketing: an empirical comparison. *Journal of Marketing*, 75(November), 55–71. Retrieved from <http://www.journals.marketingpower.com/doi/abs/10.1509/jm.10.0088>
- Hoffman, D. L., & Novak, T. P. (2012). Toward a Deeper Understanding of Social Media. *Journal of Interactive Marketing*, 26(2), 69–70. doi:10.1016/j.intmar.2012.03.001
- Hollenbeck, C., & Zinkhan, G. (2006). Consumer activism on the internet: the role of anti-brand communities. *Advances in Consumer Research*, 479–485. Retrieved from http://www.acrwebsite.org/volumes/v33/v33_10337.pdf
- Horgan, J. (2004). The end of science revisited. *Computer*, 37(3), 6–7. doi:10.1109/MC.2004.1273992
- Huang, H. (2013). A War of (Mis) Information: The Political Effects of Rumors and Rumor Rebuttals in an Authoritarian Country. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2131538
- Hudson, J., & Bruckman, A. (2005). Using empirical data to reason about internet research ethics. *ECSCW 2005*. Retrieved from http://link.springer.com/chapter/10.1007/1-4020-4023-7_15
- Hudson, J. M., & Bruckman, A. S. (2004). The Bystander Effect: A Lens for Understanding

- Patterns of Participation. *Journal of the Learning Sciences*, 13(2), 165–195. doi:10.1207/s15327809jls1302_2
- Irani, D., Balduzzi, M., Balzarotti, D., Kirida, E., & Pu, C. (2010). Reverse Social Engineering Attacks in Online Social Networks, (March).
- Jagatic, T., Johnson, N., Jakobsson, M., & Menczer, F. (2007). Social phishing. *Communications of the ACM*, 2005, 1–10. Retrieved from <http://dl.acm.org/citation.cfm?id=1290968>
- Johnson, S. (2010). *Where good ideas come from: the natural history of innovation*. doi:10.5840/traddisc2011/201238113
- Julian, S. (2013a). Facebook et Twitter: le business des faux amis fait florès. *L'expansion - L'Express*.
- Julian, S. (2013b). People ou politiques sur Twitter, à chacun ses followers bidon. *L'expansion - L'Express*.
- Jung, A. (2011). Twittering Away the Right of Publicity: Personality Rights and Celebrity Impersonation on Social Networking Websites. *Chi.-Kent L. Rev.*, 86(1). Retrieved from http://heinonlinebackup.com/hol-cgi-bin/get_pdf.cgi?handle=hein.journals/chknt86§ion=18
- Kamins, M., Folkes, V., & Perner, L. (1997). Consumer responses to rumors: Good news, bad news. *Journal of Consumer Psychology*, (29), 22–23. doi:10.1207/s15327663jcp0602
- Katona, Z., Zubcsek, P., & Sarvary, M. (2011). Network effects and personal influences: The diffusion of an online social network. *Journal of Marketing Research*, XLVIII(June), 425–443. Retrieved from <http://journals.ama.org/doi/abs/10.1509/jmkr.48.3.425>
- Katz, M. L., & Shapiro, C. (1985). Network Externalities, Competition, and Compatibility. *The American Economic Review*, (June).
- Kelly, J. N. (2004). Play Time: An Overview of the MMORPG Genre.
- Khrabrov, a., & Cybenko, G. (2010). Discovering Influence in Communication Networks Using Dynamic Graph Analysis. *Social Computing (SocialCom), 2010 IEEE Second International Conference on*. doi:10.1109/SocialCom.2010.48
- Kim, J., & Lee, J.-E. R. (2011a). The Facebook paths to happiness: effects of the number of Facebook friends and self-presentation on subjective well-being. *Cyberpsychology, Behavior and Social Networking*, 14(6), 359–64. doi:10.1089/cyber.2010.0374
- Kim, J., & Lee, J.-E. R. (2011b). The Facebook paths to happiness: effects of the number of Facebook friends and self-presentation on subjective well-being. *Cyberpsychology, Behavior and Social Networking*, 14(6), 359–64. doi:10.1089/cyber.2010.0374
- Kim, J., Schneider, F., Ager, B., & Feldmann, A. (2010). Today's Usenet usage: NNTP traffic characterization. *Proceedings - IEEE INFOCOM*. doi:10.1109/INFOCOMW.2010.5466665
- Kim, O., & Walker, M. (1984). The free rider problem: Experimental evidence. *Public Choice*, 43(1), 3–24. doi:10.1007/BF00137902
- Kleinfeld, J. S. (2002). Could it be a big world after all? The “Six Degrees of Separation” Myth, 1–8.
- Korn, J. (1997). *Illusions of reality: A history of deception in social psychology*. State University of New York Press. Retrieved from

<http://books.google.com/books?hl=en&lr=&id=pn2mN93Fy04C&oi=fnd&pg=PR11&dq=Illusions+of+Reality:+A+History+of+Deception+in+Social+Psychology&ots=lzEcF2CuSL&sig=pVbJhbCUtpQ6EMBDg5TL7eSyVts>

- Krackhardt, D. (1995). Entrepreneurial opportunities in an entrepreneurial firm : A structural approach. *Entrepreneurship Theory and Practice*, (Spring), 53–69.
- Krackhardt, D., & Hanson, J. R. (1993). Informal networks. *Harvard Business Review*, (71.4), 104–11.
- Kraut, R., Olson, J., Banaji, M., Bruckman, A., Cohen, J., & Couper, M. (2004). Psychological research online: report of Board of Scientific Affairs' Advisory Group on the Conduct of Research on the Internet. *The American Psychologist*, 59(2), 105–17. doi:10.1037/0003-066X.59.2.105
- Krombholz, K., Merkl, D., & Weippl, E. (2012). Fake identities in social media: A case study on the sustainability of the Facebook business model. *Journal of Service Science Research*, 4(2), 175–212. doi:<http://dx.doi.org/10.1007/s12927-012-0008-z>
- Kurzweil, R. (1999). The age of spiritual machines. Retrieved from <http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:the+age+of+spiritual+machines#0>
- Laczniak, R. N., DeCarlo, T. E., & Ramaswami, S. N. (2001). Consumers' Responses to Negative Word-of-Mouth Communication: An Attribution Theory Perspective. *Journal of Consumer Psychology*, 11(1), 57–73. doi:10.1207/S15327663JCP1101_5
- Landherr, A., Friedl, B., & Heidmann, J. (2010). A critical review of centrality measures in social networks. *Business & Information Systems ...*, 2, 371–385. Retrieved from <http://link.springer.com/article/10.1007/s12599-010-0127-3>
- Lazarsfeld, P., Berelson, B., & Gaudet, H. (1968). *The People's Choice: How the Voter Makes Up His Mind in a Presidential Campaign* (3rd ed.). Columbia University Press.
- Lazega, E. (2007). *Réseaux sociaux et structures relationnelles*.
- Lee, J. (2013). How We Talk Online: A History of Online Forums, From Cavemen Days To The Present. Retrieved August 20, 2015, from <http://www.makeuseof.com/tag/how-we-talk-online-a-history-of-online-forums-from-cavemen-days-to-the-present/>
- Lee, N. (2012). *Facebook nation: Total information awareness*. Springer. Springer US. Retrieved from <http://link.springer.com/content/pdf/10.1007/978-1-4614-5308-6.pdf>
- Lee, N. (2014). Facebook used you like a lab rat and you probably don't care. *Engadget International Editions*. Retrieved from <http://www.engadget.com/2014/07/01/facebook-experiment/>
- Leskovec, J., Huttenlocher, D., & Kleinberg, J. (2010). Predicting positive and negative links in online social networks. *Proceedings of the 19th International Conference on World Wide Web - WWW '10*, 641. doi:10.1145/1772690.1772756
- Li, C., & Bernoff, J. (2011). *Groundswell: Winning in a world transformed by social technologies* (Vol. 2). Retrieved from <http://books.google.com/books?hl=en&lr=&id=tdnM1MWv5KQC&oi=fnd&pg=PR7&dq=Groundswell:+Winning+in+a+World+Transformed+by+Social+Technologies&ots=6ith6RDahC&sig=54N9gPSTPUPHDm3hjwt0zCs5ISIA>

- Liebowitz, S. (2002a). *RE-Thinking the Network Economy: The True Forces That Drive the Digital Marketplace*. (A. M. A. Inc., Ed.).
- Liebowitz, S. (2002b). Rethinking the networked economy: The true forces driving the digital marketplace. *Dallas: AMACOM Div. American Mgmt Assn.* Retrieved from http://www.pub.utdallas.edu/~liebowit/knowledge_goods/book.pdf
- Linden Lab. (2013). Infographic: 10 Years of Second Life. Retrieved August 23, 2015, from <http://www.lindenlab.com/releases/infographic-10-years-of-second-life>
- Lindner, K. A. (2012). The effects of Facebook “Stalking” on romantic partners’ satisfaction, jealousy, and insecurity.
- Liu-Thompkins, Y. (2012). Seeding viral content: : The Role of Message and Network Factors. *Journal of Advertising Research*, 52(4), 465. doi:10.2501/JAR-52-4-465-478
- Liu-Thompkins, Y., & Rogerson, M. (2012). Rising to Stardom: An Empirical Investigation of the Diffusion of User-generated Content. *Journal of Interactive Marketing*, 26(2), 71–82. doi:10.1016/j.intmar.2011.11.003
- Loomer, J. (2015). No, Facebook Organic Page Reach Is Not Dead. Retrieved May 22, 2015, from <http://www.jonloomer.com/2015/02/03/facebook-organic-page-reach-is-not-dead/>
- Lu, L., & Zhou, T. (2010). Link Prediction in Complex Networks: A Survey, (October 2010). Retrieved from <http://arxiv.org/abs/1010.0725v1>
- MacIsaac, D. (1996). The Critical Theory of Jurgen Habermas. Retrieved January 1, 2015, from <http://physicsed.buffalostate.edu/danowner/habcritthy.html>
- Mangold, W. G., & Faulds, D. J. (2009). Social media: The new hybrid element of the promotion mix. *Business Horizons*, 52(4), 357–365. doi:10.1016/j.bushor.2009.03.002
- MarketingTechBlog. (2015). 2014 Statistics and Trends on Social Media. Retrieved from <https://www.marketingtechblog.com/2014-statistics-trends-businesses-social-media/>
- Marshall, T. C., Bejanyan, K., Castro, G. Di, & Lee, R. a. (2013). Attachment Styles as Predictors of Facebook-Related Jealousy and Surveillance in Romantic Relationships. *Personal Relationships*, 20(1), 1–22.
- Martin, A., Jacob, C., & Guéguen, N. (2013). Similarity Facilitates Relationships on Social Networks: a Field Experiment on Facebook. *Psychological Reports*, 113(1), 217–220. doi:10.2466/21.07.PR0.113x15z8
- Mashable. (2011). The History of Advertising on Facebook.
- McNealy, J. (2012). The Emerging Conflict Between Newsworthiness and the Right to Be Forgotten. *Northern Kentucky Law Review*, 02211(10). Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2027018
- Mennecke, B. E., McNeill, D., Ganis, M., & Townsend, A. M. (2008). Second Life and Other Virtual Worlds : A Roadmap for Research Second Life and Other Virtual Worlds : A Roadmap for Research. *CAIS - Communications of the Association for Information Systems*, 22(March 2008), 371–388.
- Mercanti-Guerin, M. (2010). Facebook, un nouvel outil de campagne: Analyse des réseaux sociaux et marketing politique. *La Revue Des Sciences de Gestion*, 17–29. Retrieved from http://www.cairn.info/article.php?ID_ARTICLE=RSG_242_0017

- Mermier, F., & Mervin, S. (2012). *Leaders et partisans au Liban*. Retrieved from http://books.google.com/books?hl=en&lr=&id=2aF6PSJLs_sC&oi=fnd&pg=PA16&dq=Leaders+et+partisans+au+Liban&ots=eI3R7NzmbP&sig=Z26XOXLQaTIXs7L1n0NeWyVHOFs
- Messarra, N. (2014). NetVizz to NodeXL converter. Retrieved from <http://nasri.messarra.com/netvizz-to-nodexl-converter/>
- Messarra, N. (2015a). رسالة الى زعيم. Retrieved September 22, 2015, from <https://libanchroniquesciviles.wordpress.com/2015/05/22/nasri-messarra--رسالة-الى-زعيم/>
- Messarra, N. (2015b, January 24). Le plus dur métier du monde. *L'Orient-Le Jour*. Retrieved from <http://www.lorientlejour.com/article/907710/le-plus-dur-metier-du-monde.html>
- Messarra, N., & Mione, A. (2012). Initiating a network effect in a social network. In *Euras Proceedings of the 17th EURAS Annual Standardization Conference* (pp. 261–280).
- Messarra, N., & Mione, A. (2014). Honey-pot profiles and malevolent e-reputation attacks on Facebook, presentation at the XXXIV Sunbelt Social Networks Conference of the International Network for Social Network Analysis (INSNA). Tampa, USA.
- Miller, S. (2013a). The Bigger the Facebook Page, the Harder it is to Reach Fans, 1–2. Retrieved from <http://blogs.adobe.com/socialpractice/the-bigger-the-facebook-page-the-harder-it-is-to-reach-fans/>
- Miller, S. (2013b). The Bigger the Facebook Page, the Harder it is to Reach Fans. Retrieved August 22, 2013, from <http://blogs.adobe.com/socialpractice/the-bigger-the-facebook-page-the-harder-it-is-to-reach-fans/>
- Montoya, P. (2002). The personal branding phenomenon. *Personal Branding Press*, (2002), 1–6.
- Moravec, H. (1998). When will computer hardware match the human brain? *Journal of Evolution and Technology*, 1(1), 10. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.136.7883&rep=rep1&type=pdf>
- Mouw, T., & Verdery, A. M. (2012). Network Sampling with Memory: A proposal for more efficient sampling from social networks. *Sociological Methodology*, 42(1), 206–256. doi:10.1177/0081175012461248
- Mui, C. (2011). Why Facebook Beat MySpace, and Why MySpace's Revised Strategy will Probably Fail. *Forbes*, 1–4. Retrieved from http://blogs.forbes.com/chunkamui/2011/01/12/why-facebook-beat-myspace-and-why-myspaces-revised-strategy-will-probably-fail/#post_comments
- Muruganantham, A., & Ghandi, G. M. (2014). Identification of potential influencers in Facebook using network graph metrics. In *Proceedings of 6th SARC - IRF International Conference* (pp. 17–21). New Delhi, India.
- Naylor, G., & Kleiser, S. (2000). Negative versus positive word-of-mouth: An exception to the rule. *JOURNAL OF CONSUMER SATISFACTION* Retrieved from [http://lilt.ilstu.edu/staylor/csdcb/articles/Volume13/Naylor et al 2000.pdf](http://lilt.ilstu.edu/staylor/csdcb/articles/Volume13/Naylor%20et%20al%202000.pdf)
- Newman, M. E. (2005). A measure of betweenness centrality based on random walks. *Social*

Networks, (27.1), 39–54.

- Nielsen. (2011). Buzz in the Blogosphere: Millions More Bloggers and Blog Readers. Retrieved August 23, 2015, from <http://www.nielsen.com/us/en/insights/news/2012/buzz-in-the-blogosphere-millions-more-bloggers-and-blog-readers.html>
- Nitzberg, S. (1998). Conflict and the computer: Information warfare and related ethical issues. ... *Information Systems Security Conference.*, Retrieved from http://download.adamas.ai/dlbase/ebooks/VX_related/Conflict and the Computer Information Warfare and Related Ethical Issues.pdf
- Opsahl, T., Agneessens, F., & Skvoretz, J. (2010). Node centrality in weighted networks: Generalizing degree and shortest paths. *Social Networks*, (32.3), 245–251.
- Ott, M., Cardie, C., & Hancock, J. (2012). Estimating the prevalence of deception in online review communities. ... *of the 21st International Conference on ...* Retrieved from <http://dl.acm.org/citation.cfm?id=2187864>
- Ott, M., Cardie, C., & Hancock, J. (2013). Negative Deceptive Opinion Spam. *HLT-NAACL*, (June), 497–501. Retrieved from <http://www.aclweb.org/anthology-new/N/N13/N13-1053.pdf>
- Pan, L.-Y., & Chiou, J.-S. (2011). How Much Can You Trust Online Information? Cues for Perceived Trustworthiness of Consumer-generated Online Information. *Journal of Interactive Marketing*, 25(2), 67–74. doi:10.1016/j.intmar.2011.01.002
- Paul Gillin. (2012). Attack of the Customers: The Pampers Dry Max Crisis, 1–7. Retrieved from <http://gillin.com/blog/2012/08/attack-of-the-customers-the-pampers-dry...> Social Media and the Open Enterprise Posted on August 29, 2012 by Paul
- Peters, T. (1997). The brand called you. *Fast Company*.
- Phelps, J., & Lewis, R. (2004). Viral marketing or electronic word-of-mouth advertising: Examining consumer responses and motivations to pass along email. *Journal of ...* doi:10.1017/S0021849904040371
- Phing, A. N. M., & Yazdanifard, R. (2014). How does ALS ice bucket challenge achieve its viral outcome through marketing via social media? *Global Journal of Management and Business Research*.
- Price, M. (2014). Here's How an Amateur Used Instagram to Become a Successful Pro Photographer. *Huffington Post*. Retrieved from http://www.huffingtonpost.com/michaelprice/heres-how-an-amateur-used-instagram-to-become-a-pro-photographer_b_5687621.html
- Protalinski, E. (2014). Facebook estimates that between 5.5% and 11.2% of accounts are fake. *The Next Web*. Retrieved from <http://tnw.to/b4ZyU>
- Rashid, F. Y. (2012). IT Security & Network Security News: Facebook Scammers Create Fake Profiles to Facebook Scammers Create Fake Profiles to Spam Users , Click-Jacking ... *eweek.com*.
- Ratkiewicz, J., Conover, M., & Meiss, M. (2011). Detecting and Tracking Political Abuse in Social Media. *ICWSM*, 297–304. Retrieved from <http://www.aaai.org/ocs/index.php/ICWSM/ICWSM11/paper/viewFile/2850/3274>
- Reed, D. P. (2001). The law of the pack. *Harvard Business Review*, 79(2), 23–24, 154.

- Rheingold, H. (2002). *Smart mobs: The next social revolution*. Perseus, Cambridge, Mass. Retrieved from <http://muse.jhu.edu/journals/sof/summary/v083/83.4kotamraju.html>
- Rheingold, H. (2010). *Smartmobs Revisited*. Mobile Monday Amsterdam. Retrieved from <https://www.youtube.com/watch?v=EhqwluqJIA0>
- Riach, P. A., & Rich, J. (2002). FIELD EXPERIMENTS OF DISCRIMINATION IN THE MARKET PLACE *, *112*(1974), 480–518.
- Rieder, B. (2013). Studying Facebook via data extraction: the Netvizz application. *Proceedings of the 5th Annual ACM Web Science ...*. Retrieved from <http://dl.acm.org/citation.cfm?id=2464475>
- Rivers, C., & Lewis, B. (2013). Framework for the ethical use of Twitter for public health research (Poster). In *American Public Health Association, 141st Annual Meeting and Expo*. Retrieved from <https://apha.confex.com/apha/141am/webprogram/Paper285978.html>
- Rivers, C. M., & Lewis, B. L. (2014). Ethical research standards in a world of big data. *F1000Research*, *3*, 3–7. doi:10.12688/f1000research.3-38.v1
- Rosen, S. (1981). The Economics of Superstars. *American Economic Review*, *71*(5), 845–858. doi:10.2307/1803469
- Sabidussi, G. (1966). The centrality index of a graph. *Psychometrika*, *(31.4)*, 581–603.
- Saravanakumar, M., & SuganthaLakshmi, T. (2012). Social Media Marketing, *9*(4), 4444–4451.
- Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students, 5/e*. (P. E. Limited, Ed.). Retrieved from <http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Research+methods+for+business+students#0>
- Say Daily. (2014). 9 Instagram Influencers Being Courted by Big Brands. *SayDaily*. Retrieved from <http://www.saydaily.com/2014/06/9-instagram-influencers-being-courted-by-big-brands>
- Scarpi, D. (2010). Does size matter? An examination of small and large web-based brand communities. *Journal of Interactive Marketing*. Retrieved from <http://www.sciencedirect.com/science/article/pii/S1094996809000899>
- Sen, S., & Lerman, D. (2007). Why are you telling me this? An examination into negative consumer reviews on the Web. *Journal of Interactive Marketing*, *21*(4), 76–94. doi:10.1002/dir.20090
- Shaw, V., & Coker, B. (2010). Keeping negative Facebook comments leads to more trust in your brand. Retrieved from <http://world-comp.org/p2012/EEE2138.pdf> \n<http://elrond.informatik.tu-freiberg.de/papers/WorldComp2012/EEE2138.pdf>
- Shepherd, I. D. H. (2005). From cattle and coke to Charlie: meeting the challenge of self marketing and personal branding. *Middlesex University's Research Repository*. doi:10.1362/0267257054307381
- Silverman, G. (1997). How to harness the awesome power of word of mouth. *Direct Marketing Review*, *November*, 32–37.
- Smith, A. N., Fischer, E., & Yongjian, C. (2012). How Does Brand-related User-generated

- Content Differ across YouTube, Facebook, and Twitter? *Journal of Interactive Marketing*, 26(2), 102–113. doi:10.1016/j.intmar.2012.01.002
- Smith, M., Rainie, L., Himelboim, I., & Shneiderman, B. (2014). Mapping Twitter Topic Networks: From Polarized Crowds to Community Clusters. *The Pew Research Center*, (February 20), 1–57. Retrieved from <http://www.pewinternet.org/2014/02/20/mapping-twitter-topic-networks-from-polarized-crowds-to-community-clusters>
- Snopes.com. (2013). Christian Woman Murdered in Syria. Retrieved from <http://www.snopes.com/photos/politics/syriamurder.asp>
- Social Media Research Foundation. (2015). Social Network Importer for NodeXL. Retrieved May 23, 2015, from <http://socialnetimporter.codeplex.com/>
- Sparrow, B., Liu, J., & Wegner, D. M. (2011). Google effects on memory: cognitive consequences of having information at our fingertips. *Science (New York, N.Y.)*, 333(6043), 776–778. doi:10.1126/science.1207745
- Sprague, R., & Wells, M. E. (2010). Regulating Online Buzz Marketing: Untangling a Web of Deceit. *American Business Law Journal*, 47(3), 415–454. doi:10.1111/j.1744-1714.2010.01100.x
- Steel, E. (2010). Nestlé takes a beating on social-media sites. *The Wall Street Journal*. Retrieved from <http://vandyketing.typepad.com/files/2010-3-29-social-media-sites-become-warfront-for-nestl%C3%A9---wsj.com.pdf>
- Steinfeld, C., Ellison, N. B., & Lampe, C. (2008). Social capital, self-esteem, and use of online social network sites: A longitudinal analysis. *Journal of Applied Developmental Psychology*, 29(6), 434–445. doi:10.1016/j.appdev.2008.07.002
- Stemple, H. (2012). EU court limits privacy rights for public figures. *Jurist*. Retrieved from <http://jurist.org/paperchase/2012/02/eu-court-limits-privacy-rights-for-public-figures.php>
- Stone, M. A., & Desmond, J. (2007). *Fundamentals of Marketing (Google eBook)*. Retrieved from <http://books.google.com/books?id=lqN-AgAAQBAJ&pgis=1>
- Subramani, M., & Rajagopalan, B. (2003). Knowledge-sharing and influence in online social networks via viral marketing. *Communications of the ACM*, 46(12), 300–307. Retrieved from <http://dl.acm.org/citation.cfm?id=953514>
- Sweney, M. (2012). Facebook quarterly report reveals 83m profiles are fake. *The Guardian*.
- Tanase, R., & Radu, R. (2009). PageRank Algorithm - The Mathematics of Google Search. *Cornell.edu*. Retrieved from <http://www.math.cornell.edu/~mec/Winter2009/RalucaRemus/Lecture3/lecture3.htm>
- The Mendeley Support Team. (2011). Getting Started with Mendeley. *Mendeley Desktop*. London: Mendeley Ltd. Retrieved from <http://www.mendeley.com>
- Thompson, C. (2006). A Timeline of the History of Blogging. *New York Magazine*. Retrieved from <http://nymag.com/news/media/15971/>
- Tong, S. T., Van Der Heide, B., Langwell, L., & Walther, J. B. (2008a). Too Much of a Good Thing? The Relationship Between Number of Friends and Interpersonal Impressions on

- Facebook. *Journal of Computer-Mediated Communication*, 13(3), 531–549. doi:10.1111/j.1083-6101.2008.00409.x
- Tong, S. T., Van Der Heide, B., Langwell, L., & Walther, J. B. (2008b). Too Much of a Good Thing? The Relationship Between Number of Friends and Interpersonal Impressions on Facebook. *Journal of Computer-Mediated Communication*, 13(3), 531–549. doi:10.1111/j.1083-6101.2008.00409.x
- Trusov, M., Bodapati, A. V., & Bucklin, R. E. (2010). Determining Influential Users in Internet Social Networks. *Journal of Marketing Research*, XLVII(August), 643–658.
- Trusov, M., Bucklin, R. E., & Pauwels, K. (2009). Effects of Word-of-Mouth Versus Traditional Marketing: Findings from an Internet Social Networking Site. *Journal of Marketing*. doi:10.1509/jmkg.73.5.90
- Tumbridge, J. (2010). Twitter: who's really there? *Journal of Intellectual Property Law & Practice*, 116–118. doi:10.1093/jiplp/jpp223
- Ugander, J., Karrer, B., Backstrom, L., & Marlow, C. (2011). The anatomy of the facebook social graph. *arXiv Preprint arXiv: ...*, 1–17. Retrieved from <http://arxiv.org/abs/1111.4503>
- Vaille, E. (2010). La prise en compte du risque d'opinion dans les stratégies d'influences sur Internet.
- Valente, T. W. (2012). Network interventions. *Science (New York, N.Y.)*, 337(6090), 49–53. doi:10.1126/science.1217330
- Valente, T. W., & Myers, R. (2010). The Messenger is the Medium: Communication and Diffusion Principles in the Process of Behavior Change. *Estudios Sobre Las Culturas ...*, XVI, 249–276. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&profile=ehost&scope=site&authType=crawler&jrnl=14052210&AN=52223309&h=NO9FuLriBcKP9EhAo4WKGi1I4ALr2wj3bq%2FdFw0XzcnHH4HB905oqOCu6gcA18VMmd0qS0GfZmMkm2LcDTI3zQ%3D%3D&crI=c>
- Valos, M. J., Bednall, D. H. B., & Callaghan, B. (2007). The impact of Porter's strategy types on the role of market research and customer relationship management. *Marketing Intelligence & Planning*, 25(2), 147–156. doi:10.1108/02634500710737933
- Varian, H. R., Farrell, J., & Carl Shapiro. (2004). *The economics of information technology: An introduction*. European Journal of Operational Research. Cambridge university press. doi:10.1016/0377-2217(87)90117-2
- Varian, H., & Shapiro, C. (1999). Information rules. *A Strategic Guide to the Network*. Retrieved from http://www.challenge2000.net/docs/articoli/pdf/14/C14_scelti_per_voi.pdf
- Vasalou, A., Joinson, A. N., & Courvoisier, D. (2010). Cultural differences, experience with social networks and the nature of "true commitment" in Facebook. *International Journal of Human Computer Studies*, 68(10), 719–728. doi:10.1016/j.ijhcs.2010.06.002
- Vásquez, G. A. N., & Escamilla, E. M. (2014). Best Practice in the Use of Social Networks Marketing Strategy as in SMEs. *Procedia - Social and Behavioral Sciences*, 148(443), 533–542. doi:10.1016/j.sbspro.2014.07.076
- Vázquez-Casielles, R., Suárez-Álvarez, L., & del Río-Lanza, A. B. (2013). The word of mouth dynamic: How positive (and Negative) WOM drives purchase probability: An analysis of

- interpersonal and non-interpersonal factors. *Journal of Advertising Research*, 53(1), 43–60. doi:10.2501/JAR-53-1-043-060
- Viswanath, B., Mislove, A., Cha, M., & Gummadi, K. P. (2009). On the Evolution of User Interaction in Facebook. *Proceedings of the 2nd ACM Workshop on Online Social Networks - WOSN '09*, 37. doi:10.1145/1592665.1592675
- Vitak, J. M. (2008). *Facebook“ Friends”: How Online Identities Impact Offline Relationships*. Georgetown University. Retrieved from <http://aladinrc.wrlc.org/handle/1961/4433>
- Walker, D. (2010). Creating Social Contagion through Viral Product Design : A Randomized Trial of Peer Influence in Networks.
- Walker, R. K. (2012). The right to be forgotten. *Hastings Law Journal*, 64:101, 257–285. Retrieved from http://www.stanfordlawreview.org/online/privacy-paradox/right-to-be-forgotten?em_x=22
- Wang, Y., Leon, P. G., Chen, X., Komanduri, S., Norcie, G., Scott, K., ... Sadeh, N. (2013). From Facebook Regrets to Facebook Privacy Nudges. *Ohio State Law Journal*, 74:6, 1308–1334.
- Wasserman, S., & Faust, K. (1994). *Social network analysis: Methods and applications* (Vol. 8.). Cambridge university press.
- Wassim Nasr, D. B. (2014). Esclavagisme , excision , mariage collectif : la manipulation des images sur l ' EILL. *France 24*. Retrieved from <http://observers.france24.com/fr/content/20140812-esclavagisme-excision-mariage-collectif-fausses-images-circulent-eiil-califat-syrie-irak>
- Watts, D., & Dodds, P. (2007). Influentials, networks, and public opinion formation. *Journal of Consumer Research*, 34(4), 441–458. Retrieved from <http://www.jstor.org/stable/10.1086/518527>
- Wegner, D. M., & Ward, A. F. (2013). How Google Is Changing Your Brain. *Scientific American*, 309(6), 58–61. doi:10.1038/scientificamerican1213-58
- Wejnert, C., & Heckathorn, D. D. (2008). Web-Based Network Sampling: Efficiency and Efficacy of Respondent-Driven Sampling for Online Research. *Sociological Methods & Research*, 37(1), 105–134. doi:10.1177/0049124108318333
- Werro, F. (2009). The right to inform v. the right to be forgotten: A transatlantic clash. *The Right to Be Forgotten: A Transatlantic Clash (May 8 ...)*, (2). Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1401357
- Wikipedia. (2015). Usenet. Retrieved August 17, 2015, from <https://en.wikipedia.org/wiki/Usenet>
- Williams, J., & Chinn, S. J. (2010). Meeting relationship-marketing goals through social media: a conceptual model for sport marketers. *International Journal of Sport Communication*, 3, 422–437.
- Woodcock, N., Green, A., & Starkey, M. (2011). Social CRM as a business strategy. *Journal of Database Marketing & Customer Strategy Management*, 18(1), 50–64. doi:10.1057/dbm.2011.7
- Yan, B., & Gregory, S. (2013). Identifying Communities and Key Vertices by Reconstructing Networks from Samples, 8(4). doi:10.1371/journal.pone.0061006
- Young, K. (2011). Social ties, social networks and the Facebook experience. ... *Journal of*

- Emerging Technologies and Society*, 9(1), 20–34. Retrieved from <http://gabe.palomares.com.au/uni/63479455 - Copy.pdf>
- Zeevi, D. (2013). The Ultimate History of Facebook. *SocialMediaToday*. Retrieved from <http://www.socialmediatoday.com/content/ultimate-history-facebook-infographic>
- Zhang, Z., Ye, Q., Law, R., & Li, Y. (2010). The impact of e-word-of-mouth on the online popularity of restaurants: A comparison of consumer reviews and editor reviews. *International Journal of Hospitality Management*, 29(4), 694–700. doi:10.1016/j.ijhm.2010.02.002
- Zolfagharifard, E. (2015). Don't let AI take our jobs (or kill us): Stephen Hawking and Elon Musk sign open letter warning of a robot uprising. *Mail Online*. Retrieved May 28, 2015, from <http://www.dailymail.co.uk/sciencetech/article-2907069/Don-t-let-AI-jobs-kill-Stephen-Hawking-Elon-Musk-sign-open-letter-warning>
- Zywica, J., & Danowski, J. (2008). The Faces of Facebookers: Investigating Social Enhancement and Social Compensation Hypotheses; Predicting Facebook™ and Offline Popularity from Sociability and Self-Esteem, and Mapping the Meanings of Popularity with Semantic Networks. *Journal of Computer-Mediated Communication*, 14(1), 1–34. doi:10.1111/j.1083-6101.2008.01429.x
- كشفت حقيقة فيديو "الطفل البطل" في سوريا | The Lebanese Forces Official Website. (2014), 2014.
- ...وانفجر اللغم بالفاجر (2014). *The Lebanese Forces Official Website*. Retrieved from <http://www.lebanese-forces.com/2014/11/01/rifi-akhbar-2/>

Contents

Résumé	3
Summary	4
Abrégé	7
Remerciements	14
Sommaire	15
1 Introduction Générale (Français)	17
1.1 Les réseaux sociaux en ligne, une longue histoire	17
1.1.1 Les années 1970-2006	17
1.1.2 Les connections inter-utilisateurs ou la révolution des réseaux sociaux en ligne 19	
1.1.3 Un survol rapide des plateformes les plus importantes	22
1.2 Des mathématiques à la stratégie : la recherche sur les réseaux sociaux en ligne ..	27
1.2.1 La perspective en sciences de gestion	30
1.2.2 Les stratégies d'influence sur les réseaux sociaux en ligne et la microfluence sur Internet 36	
1.3 Le problème du contrôle des éléments du marketing viral	38
1.3.1 Questionnements	39
1.3.2 Paradigme et méthodes	41
1.3.3 Analyses et expérimentations	44
1 Introduction (English)	51
1.1 Online Social Network, a Long Story	51
1.1.1 The 1970 to 2006 years	51
1.1.2 User to User Connections, the Real Breakthrough in OSN	52
1.1.3 A Quick Glance at the Most Important OSN	55

1.1.4	Facebook	55
1.1.5	Google+	56
1.1.6	Twitter.....	56
1.1.7	Instagram	57
1.1.8	LinkedIn.....	57
1.1.9	Other OSN Platforms	58
1.2	From Mathematics to Strategy: Research on OSN	59
1.2.1	Online Social Networks Research in Business and Management.....	62
1.2.2	Influence and Microfluence Strategies on OSN.....	67
1.3	The Problem of Control in Viral Marketing	70
1.3.1	Theoretical Questions.....	70
1.3.2	Research Paradigm and Methods.....	72
1.3.3	Analysis and Experimentations.....	75
2	A Broader Meditation on Research on OSN	81
2.1	Résumé (Français)	81
2.2	Introduction.....	82
2.3	The Philosophical and Legal Approach.....	82
2.4	Perspectives for Studying Online Social Networks	83
2.5	From ethics in management and IT research to the ethics of research on online social networks	85
2.5.1	Introduction	85
2.5.2	Protection of Privacy.....	87
2.5.3	Ethics in Research	89
2.5.4	The special case of the Internet.....	91
2.5.5	Ethical issues in this research	96
3	Using Fake and Real Profiles to Uncover and Rebuild a Fan's Social Graph.....	99

3.1	Résumé (Français)	99
3.2	Introduction.....	100
3.3	Facebook and Friend's List Privacy Settings.....	101
3.4	Methodology	103
3.4.1	Mutual Friends on Facebook	103
3.4.2	Combination of Mutual Friends.....	107
3.5	Discussion.....	110
3.6	Conclusion	111
4	A web of hubs: the Spartacus experiment.....	113
4.1	Résumé (Français)	113
4.2	Introduction.....	114
4.3	1. The creation ex-nihilo of an attractive online social network	116
4.3.1	Objectives of the experiment	116
4.3.2	The fake profile and the befriending model.....	117
4.4	2. The inversed honeypot social analysis.....	123
4.4.1	Social Graph Centrality	123
4.4.2	The multiplier role: a determinant actor in the network	123
4.5	3. Diffusion using the inversed honeypot as a vector.....	125
4.6	Findings	127
4.6.1	The inversed honeypot effect.....	127
4.6.2	The inversed honeypot structure	129
4.6.3	Diffusion to the Inversed Honeypot's friends.....	131
4.6.4	Implications for marketers.....	132
4.7	Discussion.....	133
4.7.1	Ethical issues	133
4.7.2	Methodological questions	133

4.7.3	The existence of network externalities?.....	135
4.7.4	Time and direction of vertices	135
4.7.5	A real network paradoxically based on a fake profile	136
4.8	Conclusion	137
5	Negative WoM and its transmission on OSN : the determining role of the seeding population.....	138
5.1	Résumé (Français)	138
5.2	Highlights.....	139
5.3	Abstract	139
5.4	Introduction.....	140
5.5	Negative WoM and its transmission	141
5.6	Methods	145
5.6.1	The resulting global network	148
5.6.2	Redistributing the messages to the seeding population	149
5.7	Results	151
5.8	Implications for WOM.....	155
5.9	Limitations and Future Research Directions	156
5.10	Conclusion	157
6	Finding Bridges for Political Influence	159
6.1	Résumé (Français)	159
6.2	Introduction.....	160
6.3	Political Landscape in Lebanon	160
6.4	Facebook Restrictions and their Impact on Social Political Strategies	161
6.5	The Political Subject of this Experiment	163
6.6	The Cover Experiment.....	164
6.7	M's network	165

6.8	Finding 1: A social marketing advantage for multiple profiles	168
6.9	The big picture: mixing political networks	169
6.10	Finding 2: Bridges between Lebanon political groups	171
6.11	Real life evaluation of the results	172
6.12	Conclusion	173
7	Rethinking Marketing on Facebook	174
7.1	Résumé (Français)	174
7.2	Introduction.....	175
7.3	Marketing and Online Social Networks.....	175
7.4	Facebook evolution and its impact on marketing strategies.....	177
7.5	Mass Marketing on Facebook	179
7.6	Target Marketing, Niche Marketing or Differentiated Marketing.....	180
7.7	Viral Marketing.....	181
7.8	Relationship Marketing	185
7.9	Conclusion	187
8	Making Sense of Everything: A Personal Branding Case Study from Start to Finish	189
8.1	Résumé (Français)	189
8.2	Introduction.....	191
8.3	Personal branding and Facebook.....	192
8.4	Timeline or Pages?	193
8.5	Viral Marketing Strategies for Personal Branding on Facebook	193
8.6	Creation of a Viral Strategy	194
8.7	Outcome of the Strategy.....	198
8.8	Conclusion and Discussion	203
9	Discussion and Conclusion (English)	206
9.1	Theoretical Implications and Perspectives.....	206

9.2	Managerial Implications.....	209
9.3	Limits	210
9.3.1	Theoretical Limits.....	210
9.3.2	Methodological Limits	210
10	Discussion et Conclusion (Français).....	212
10.1	Implications théoriques et perspectives	212
10.2	Implications managériales.....	215
10.3	Limites.....	216
10.3.1	Théoriques	216
10.3.2	Méthodologiques.....	217
	Annexe 1: Dauphine Conference	218
	Annexe 2: INSNA Conference	228
	Annexe 3: Euras Conference.....	234
	Annexe 4: Marketing Science Conference.....	239
	Table of figures	250
	Table of tables.....	252
	Bibliography	254
	Contents.....	272