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The Impact of Multiple Affective Reactions on Decision Making: Combination of Affect and the Mediating Mechanisms of Affective Influence

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THÈSE EN COTUTELLE PRÉSENTÉE POUR OBTENIR LE GRADE DE

**DOCTEUR
DE L'UNIVERSITÉ DE BORDEAUX
ET DE L'UNIVERSITÉ DE SARAJEVO**

ÉCOLE DOCTORALE SP 2

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SPÉCIALITÉ : Psychologie

Par Emir EFENDIĆ

L'impact des réactions affectives multiples sur la prise de décision
Combinaison de l'affect et les mécanismes médiateurs de l'influence affective

Sous la direction de François RIC, Professeur, Université de Bordeaux
et de Saša DRAČE, Professeur, Université de Sarajevo

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Titre : L'impact des réactions affectives multiples sur la prise de décision : Combinaison de l'affect et les mécanismes médiateurs de l'influence affective

Résumé : Alors qu'il existe de nombreuses études qui démontrent la manière dont une seule réaction affective impacte une décision, il n'y a pratiquement aucune recherche qui s'intéresse à l'impact des réactions affectives multiples. De plus, les mécanismes médiateurs de cet impact sont encore débattus, et de nombreux modèles de médiation sont proposés, mais ceux-ci n'ont jamais été testés et comparés conjointement. Dans cette thèse, huit études ont été conduites qui s'intéressent de plus près à ces deux enjeux. Les résultats montrent que les réactions affectives multiples se combinent afin d'impacter la prise de décision et que dans cette combinaison les sentiments sont moyennés. Cependant, la combinaison n'a lieu que lorsque les réactions affectives sont liées à la même source de décision (p. ex. deux réactions associées à une potentielle récompense). Quand, d'autre part, les réactions affectives sont associées à deux sources de décision indépendantes (p. ex. l'une des réactions associées à une tâche et l'autre à une récompense potentielle), il n'y a pas de combinaison, et les personnes s'appuient uniquement sur l'affectivité associée à la source conséquente (c.-à-d. les récompenses). Enfin, le modèle de médiation, le plus systématiquement obtenu, était celui dans lequel seules les réactions affectives immédiates étaient médiatrices entre la source de l'affect et la décision. Les résultats élargissent la littérature en démontrant le phénomène de combinaison affective ainsi que les conditions aux limites qui gouvernent son impact sur la décision, ils offrent un nouvel aperçu sur ce qui agit comme médiateur de cet impact, et ils fournissent une base solide pour de futurs travaux visant à étudier l'impact des réactions affectives multiples sur les décisions.

Mots clés : Prise de décision ; Émotion ; Affect intégral ; Affect attendu ;

Title: The Impact of Multiple Affective Reactions on Decision Making: Combination of Affect and the Mediating Mechanisms of Affective Influence

Abstract: While there is plenty of research showing how a single affective reaction impacts a decision, there is practically no research which looked at the impact of multiple affective reactions. Moreover, the mediating mechanisms of this impact are still debated, with several mediation models proposed, but never tested and compared at the same time. In this thesis, eight studies were conducted that took a closer look at these two issues. The results show that multiple affective reactions combine in order to impact the decision and that in this combination, feelings are averaged. However, the combination only happens when the affective reactions are related to the same decision source (e.g. two reactions associated with a potential reward). When, on the other hand, the affective reactions are associated with two independent decision sources (e.g. one reaction associated with a task and the other with the potential reward), there is no combination and people only rely on the affectivity associated with the consequential source (i.e. the rewards). Finally, the most consistently obtained mediation model was where only immediate affective reactions mediated between the affective source and the decision. The results extend the literature by demonstrating the phenomenon of affective combination along with the boundary conditions that govern its impact on the decision, they offer new insights into what mediates this impact, and they provide solid ground for future work aimed at looking at multiple affective reactions' impact on decisions.

Keywords: Decision-Making; Emotion; Integral Affect; Expected Affect;

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Résumé substantiel en français :

Les chercheurs ont longtemps négligé l'impact des émotions sur le jugement et la prise de décision. Les travaux ont principalement été centrés sur le développement de perspectives normatives liées au comportement de choix, ainsi que sur l'identification de différents biais cognitifs (i.e., heuristiques), sur lesquelles se basent les personnes lorsqu'elles prennent des décisions. Néanmoins, depuis quelques années, on note un regain d'intérêt pour les émotions qui se traduit par une croissance exponentielle de publications s'intéressant à la manière dont les réactions affectives impactent les prises de décision.

La pensée générale qui émane de ces travaux considère que les émotions ont un impact significatif sur les choix, et qu'elles devraient être incluses dans tout modèle qui a pour l'objectif de comprendre les comportements liés à la prise de décision. Malgré ceci, la littérature qui s'est intéressée à cette thématique reste encore dans un état relativement précoce de son développement. En effet, les études se sont en grande partie concentrées sur la démonstration d'effets intéressants (e.g., comment l'humeur positive vs. négative influence la perception des risques, etc.). En revanche, force est de constater que très peu d'attention a été allouée aux processus expliquant ces effets. Compte tenu de cela, il reste encore quelques questions ouvertes.

L'intérêt principal de cette thèse repose sur deux problèmes théoriques qui ont été identifiés dans la littérature. Le premier concerne l'impact des réactions affectives multiples sur la décision. Alors que de nombreuses recherches montrent comment des réactions affectives uniques impactent la décision, aucune des études n'a essayée d'explorer l'influence des réactions affectives multiples. Cette omission semble étrange car, dans un contexte de prise de décision, il y a souvent de nombreux éléments situationnels qui peuvent produire plusieurs

réactions affectives. Ainsi, la question principale en lien avec le premier problème théorique est la suivante : dans une situation de décision qui peut évoquer de multiples réactions affectives intégrales : i) observerait-on un impact combiné des réactions affectives évoquées, sur la décision, et ii) quelle règle, si nous observons la combinaison, le sous-tendrait ? Pour répondre à ces questions nous avons utilisé un paradigme expérimental permettant d'induire deux réactions affectives et d'explorer la nature de l'effet conjoint de ces réactions sur la prise de décision.

Le second problème théorique concerne les médiateurs de l'impact affectif sur les décisions. Jusqu'ici, dans la littérature, trois voies de médiation potentielles ont été suggérées. Premièrement, des travaux montrent que la réaction affective immédiate est l'unique médiateur, suggérant que seule la sensation phénoménologique guide la prise de décision de décision. Deuxièmement, on trouve des exemples dans lesquels les émotions attendues (qui ne sont pas des émotions en soi, mais des attentes cognitives sur les conséquences possibles d'une décision) sont les seules médiatrices. La troisième voie est une de médiation à plusieurs étapes dans laquelle il est suggéré que les réactions affectives, immédiatement ressenties, viennent impacter différents traits ou attributs décisionnels, tels que la probabilité subjective ou la valeur d'un objet, ceci impactant à son tour la décision (e.g., une sensation négative, à propos d'un événement, pourrait changer les probabilités avec lesquelles nous pensons que cet événement pourrait avoir lieu).

Par conséquent, la question principale relative au deuxième problème théorique est de savoir si, et lorsque l'affect (combiné) impacte une décision, i) cet impact est sous-tendu par la réaction immédiatement ressentie à proprement parler, ii) la réaction affective attendue, ou iii) est-ce que la réaction affective ressentie, de manière immédiate, change un autre attribut associé à la décision, qui, à son tour, impacte la décision. Par conséquent, le deuxième objectif de cette thèse a été d'inclure simultanément tous les médiateurs potentiels et de les tester dans un modèle de médiation multiple afin de voir quel médiateur donnait le meilleur ajustement statistique.

La première étape de cette thèse était de donner un aperçu général de la littérature liée au jugement et la prise de décision. Plus précisément, le Chapitre 1 présentera les points centraux de ce champ théorique en se concentrant sur l'évolution historique de la recherche dans ce domaine ainsi que les paradigmes de décision classiques utilisés jusqu'ici.

Le Chapitre 2 décrit le croisement entre les émotions et la prise de décision. Le premier objectif de ce chapitre était de fournir des démarcations claires et des définitions de concepts reliés aux émotions, tels qu'humeur, émotion, affect, et valence. Il était important de distinguer clairement ces termes car ils ont été utilisés sans distinction dans la littérature antérieure, ce qui a pu conduire à une certaine confusion. Le second objectif était de présenter les différents types d'émotion, en proposant une catégorisation conceptuelle importante qui, jusqu'à présent, n'a pas fait l'objet d'un examen assez approfondi dans le champ du jugement et de la prise de décision. Les types d'émotions sont souvent décrits en fonction de la manière avec laquelle l'émotion aborde la prise de décision. Plusieurs catégorisations ont été passées en revue, avec l'intention de trouver un fil commun et d'illustrer certains biais conceptuels. La conclusion est que l'impact émotionnel peut différer selon qu'il est pré- ou post-décisionnel, selon qu'il est immédiat ou attendu (i.e., réellement ressenti ou potentiellement ressenti) ou encore selon son lien avec la décision, c'est à dire s'il est intégral (associé à la décision) ou accessoire - incidental (pas pertinent pour la décision).

Le Chapitre 3 se centre sur la présentation des approches théoriques emblématiques de la littérature sur l'émotion et la prise de décision. Cette thèse n'adhère pas spécifiquement à l'une ou l'autre des approches théoriques. Toutefois, il a été nécessaire de donner une vue d'ensemble de ces recherches car nous faisons référence à plusieurs approches théoriques tout au long des parties empiriques de cette thèse. Cette revue montre que les théories sont plutôt centrées sur différents types d'émotions et qu'elles ont été peu opposées entre-elles.

Le Chapitre 4 introduit les deux principaux centres d'intérêts de la présente thèse plus en détail. Concernant le premier centre d'intérêt, il est indiqué que des chercheurs ont soulevé la possibilité d'observer l'impact des réactions émotionnelles multiples, et qu'il y a même eu des

suggestions d'une combinaison affective. Nous soulevons certaines limites, en soutenant que ces travaux ne peuvent pas affirmer la démonstration de la combinaison, et encore moins dans un contexte de prise de décision. De plus, nous expliquons que cette thèse est centrée sur les réactions affectives intégrales, étant donné qu'elles sont généralement les réactions affectives les plus pertinentes puisque, par définition, l'affect intégral est induit par la perception de la cible de décision ou par la simple représentation mentale de la cible de décision.

Par la suite, nous présentons des travaux qui se sont intéressés aux règles possibles de la combinaison affective dans d'autres domaines tels que la psychophysique ou les évaluations cognitives (e.g., l'algèbre cognitive et la formation d'impressions), qui peuvent être appliqués analogiquement si l'existence d'un effet de combinaison affective est réellement montrée. Précisément, trois règles arithmétiques de combinaison sont proposées : moyenne, addition, et multiplication. Conjointement à ceci, nous discutons des perspectives alternatives concernant la manière dont les réactions émotionnelles multiples pourraient impacter conjointement les décisions. Concernant le deuxième sujet, nous présentons plusieurs travaux qui démontrent les trois modèles de médiation potentielles et nous illustrons le fait que ces voies n'ont pas été testées simultanément.

Le Chapitre 5, présente huit études empiriques (dont un pré-test). Dans ces études, les participants se trouvaient dans des situations qui ont été conçues pour évoquer deux réactions affectives distinctes. Dans la plupart des expériences habituelles traitant du jugement et de la prise de décision, les preneurs de décision disposent d'un choix (i.e., *un acte qu'ils doivent réaliser*) ainsi que de récompenses possibles (i.e., *conséquences ou issues de leurs décisions*). Conformément à ce protocole à deux éléments, nous avons présentés aux participants un jeu sous forme d'une situation de prise de décision de type « gambling-task », qui consistait en une tâche (l'acte qui doit être réalisé) et une récompense potentielle (i.e., *conséquence ou issue de la décision*). Cette situation reprend le protocole utilisé dans le champ du jugement et de la prise de décision et est constituée de deux éléments d'information. Ces deux éléments d'informations étaient manipulés dans leur description pour qu'ils puissent évoquer des réactions affectives

plaisantes ou moins plaisantes. Ceci nous permettait ainsi de tester l'impact des réactions affectives sur la décision du participant de prendre part, ou non, dans la situation décisionnelle.

Les résultats généraux (dans les six premières études) semblent indiquer que lorsque les récompenses diffèrent au niveau de l'affect, et alors même que l'affectivité des tâches différait aussi, les personnes se fient uniquement à l'affectivité des récompenses (cf. études 1, 2 et 6). Pourtant, lorsque les récompenses ne diffèrent pas au niveau de l'affect, les personnes se fient uniquement à l'affectivité des tâches (cf. études 3 et 4). Ceci indiquerait que les réactions affectives associées aux récompenses sont, d'une certaine manière, les indices les plus importants pour le preneur de décision et, étonnamment, que les réactions affectives ne se combinent pas pour impacter la décision. De plus, ces effets semblent être indépendants de l'intensité affective des récompenses, et de la demande expérimentale. L'explication la plus probable est que les récompenses sont essentiellement une issue possible (i.e., la conséquence) de la décision. Or, il a été démontré que les preneurs de décision sont plus sensibles aux conséquences de la décision qu'à tout autre attribut décisionnel. Ainsi, l'indice affectif associé avec les récompenses est plus pertinent pour les preneurs de décision.

Etant donné que ces études ont montré que les réactions affectives ne se sont pas combinées, les deux dernières études ont été modifiées au niveau du protocole pour tester si le fait de ne pas avoir observé de combinaison était dû à des réactions affectives invoquées par deux sources indépendantes et pertinentes pour la décision (i.e., la tâche et la récompense). Les études 7 et 8 montrent que lorsque les réactions affectives sont invoquées par une seule source (i.e., les récompenses), ils se combinent pour impacter la décision. De plus, dans l'étude 8, il a été confirmé que cette combinaison suit une règle de moyennisation.

En ce qui concerne les mécanismes explicatifs, les résultats obtenus dans les études 4, 6, 7, et 8 (d'autres études n'ont pas testé cette médiation), ont montré que l'impact de l'affect sur la décision est uniquement médié par la réaction affective immédiatement ressentie (ce qui est en accord avec la première voie). Ce résultat a été obtenu dans les situations où nous avons

observé un impact combiné sur la décision comme dans les situations où nous n'avons pas observé un impact combiné.

Le Chapitre 6 propose une discussion générale de ces travaux ainsi qu'une conclusion. Il est centré sur les découvertes principales et comment elles étendent la littérature traitant de l'émotion, du jugement, et de la prise de décision. On conclut que les réactions affectives ne se combinent pas pour impacter la décision, lorsqu'elles sont évoquées par des sources différentes, mais pertinentes pour la décision. Plus important, si l'une des sources est une récompense potentielle, les personnes se fient uniquement sur ce signal conséquent (i.e. le signal qui leur donne des informations sur la conséquence potentielle de leur décision). Néanmoins, quand les réactions affectives sont associées à la même source, nous observons un impact combiné sur la décision. Par ailleurs, quelques limitations sont discutées. Parmi elles, le fait que seulement l'affect intégral a été examiné (la combinaison pourrait facilement être examinée entre autres types d'affect, e.g., entre l'affect accessoire – incidental et l'affect intégral), que les résultats, pour l'instant, dépendent du paradigme décisionnel utilisé, et finalement, que d'autres arithmétiques possibles de la combinaison doivent être considérées et étendues, en tenant compte des effets d'ordre et de l'intensité affective qui pourraient changer cette arithmétique. Enfin, nous évoquons des pistes de recherche qui nous paraissent prometteuses.

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During the preparation of the administrative documents for the thesis defense, I have noticed that I was reluctant to name either of my mentors as a “co-mentor”. The “co-” seemed to kind of cheapen the experience and wherever I could, I’ve randomized the usage of the “co-” so as to minimize its impact (hopefully, the bureaucrats won’t notice). In all seriousness, I can honestly say that having not one, but two voices guide me through this, at times, very arduous journey, was a privilege like no other.

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Finally, I leave you with this quote by Douglas Adams: “Don’t Panic!”

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Introduction

It is somewhat of a cliché amongst psychologists that phenomena usually studied in the literature appear to be uniquely bound by an intuitive grasp that people have. Like every cliché, it has been flipped on its head and graduated towards notoriety with the most coveted and prized findings, in the psychological domain, being those that leave the reader dumbfounded by their “counter-intuitive” nature. One common reason given for this is that people have an excellent, but also naïve understanding of the psychological processes and features that govern their behavior (Nisbett & Wilson, 1977), which makes these findings quite revealing. Whatever the reason might be, one such psychological area, that has seen its fair share of counter-intuitive findings, is judgment and decision making (or “JDM” for short). Decision making is a part of, pretty much every imaginable activity and people, perhaps rightfully so, assume that they understand their choices. They are, in all effect, *their* choices. Most importantly, they also assume that their decision-making process is entirely independent and impervious to outside influence. However, the real story of what impacts their choices and the decision-making process, is another matter entirely. One “every-day” feature that impacts JDM is emotion and affect¹. Affective reactions have been shown to predictably impact human decision making, so much so that the crossover field of emotion and JDM has been “in bloom”, so to speak, in recent years (see Lerner, Li, Valdesolo, & Kassam, 2015). With this in mind, in a rather general sense, this thesis is concerned with the way affective reactions impact decision making.

In slightly more precise terms, the overall challenge set out for this thesis is twofold. First, to try to clearly represent what we know so far and what is still missing in research about the way affective reactions interact with, and influence decision making. Second, to offer new

¹ The terms, “emotion” and “affect”, at least in the psychological literature, can refer to different things (Winkielman et al., 2005). Nevertheless, they are used interchangeably, both in the published literature, and in common parlance. These and several other conceptual issues and differences will be touched upon in later chapters. For now, in the interest of a less complicated introduction, both terms will be used to denote affective reactions.

insights into this burgeoning field. The hope is that the first challenge will be addressed by critical reviews that will aim both to highlight current knowledge, but also to identify avenues where knowledge needs to be expended. The hope is that the second challenge will be addressed by the empirical research conducted in the course of the thesis. The empirical studies conducted for this thesis focus on two topics. The first and main topic concerns the question of whether and how multiple affective reactions, relevant to the decision at hand, combine to concurrently impact the decision? The second topic deals with the mechanisms of this impact, aiming to identify the mediators between an affective reaction and the decision. These topics will receive a proper and much more extended introduction later on.

For now, I believe it is important to provide the reader with some instances of background information when it comes to where emotion and decision making stands, as a field. Just based on everyday (life) experiences/observations, there are many questions that can come to mind when thinking about emotions and JDM. How do emotions factor into decision making? Are all emotional reactions equally important in all decision-making situations? With what certainty, if any, can we predict choices when affective reactions are implicated in decision situations? These questions evoke a myriad of possible research avenues and assumptions. One might imagine that there is a solid research corpus already developed which has looked at them. However, as it will be argued in the first couple of pages here, the cross-sectional field of affective reactions' impact on JDM is in, highly productive, but early stages (Lerner et al., 2015; Loewenstein & Lerner, 2003). This type of argument tends to be thrown around a lot when people provide historical backgrounds to their areas of interest, what with pretty much every field in the psychological domain being, relatively, in its early stages. We are a young science, to say the least. However, for the recency of the emotion and decision making field, people have some data-driven arguments. For instance, Lerner et al. (2015, supplemental material) conducted an analysis of the number of articles that contained the terms “emotion/affect/mood and decision making” and found that since the 1980’s, research has begun to incorporate affective factors, but only recently can we see an actual increase in the literature. From 2004 to

2007, the yearly work on emotion and decision making doubled. It also grew again from 2007 to 2011, increasing by an order of magnitude from 2001 to 2013.

One of the consequences of this is that studies in this area have largely been focused on obtaining interesting effects while the understanding behind these effects has been somewhat superficial. An example of such an interesting effect is a recent finding that something like a happy mood induction can increase gambling and one's susceptibility to framing (Stanton, Reeck, Huettel, & LaBar, 2014). Effects like these are compelling, but there has been little attention given to the details explaining them. Furthermore, too narrow of a focus can leave the field open to gaps and to a lack of theoretical advancement (Volz & Hertwig, 2016). In the following sub-section, I look back at the historical role of emotion and affective reactions in JDM. This will help in fleshing out the relative recency of the field. Then, in a subsequent sub-section, I will argue that this recency contributes to a decidedly narrow focus which can lead to the emergence of various gaps that need to be addressed. Once identified, two of these gaps will then be re-formulated as the topics that are of main empirical interest in this thesis.

A (very) short historical look at emotion and JDM

Given its high relevance and saliency in everyday life, the question of how emotion impacts and factors in JDM has been sporadically broached before. Going back to early stages of scientific development, in philosophy for instance, Aristotle first described the tendency for anger to influence behavior in a global and undiscerning way (Nicomachean Ethics). Similarly, other philosophers tried to catalogue and argue on the effects of emotion or passions on JDM (cf. Solomon, 1993). Interestingly enough, in economics, the discipline that has historically been more focused on the rational components of JDM, it was Adam Smith, in his book "A theory of moral sentiments" who explicitly talked about and highlighted the role of emotion to influence decisions (Smith, 1759). However, it speaks volumes that this particular work by Smith has been wildly disregarded in economic teachings. This mainly stems from the long-held view that purely cognitive processes and rationality were enough to effectively understand and model human decision making (Shafir & LeBoeuf, 2002). Some authors go so far as to say

that ever since the epistolary exchange in 1654, between the French mathematicians Pascal and Fermat – which some consider to be the beginning of the systematic study of decision making (Hacking, 2006) – scholars have shown very little interest for the impact of emotions on JDM. In psychology, one of the factors for this most likely lies in the dominance of behaviorism from the 1940's to around 1975, where B.F. Skinner, behaviorism's greatest champion, actively discouraged research on emotion: “The emotions are excellent examples of the fictional causes to which we commonly attribute behavior” (Skinner, 1953, p. 160). Afterwards came the “cognitive revolution”, which was an incredibly productive time for decision science, spurring insights and empirical findings that are still being discussed and improved upon today (Gilovich & Griffin, 2010; Slovic, Fischhoff, & Lichtenstein, 1977). But, the role of emotions was thoroughly disregarded during this period as well. Looking back, even to more recent events, this has led to some serious failures. Take, for instance, the failure of rational choice models to predict and explain the worldwide economic crisis that began in 2008. Paul Krugman, a Nobel Laureate in economics argued that neoclassical economic theory and the models that it espoused, had experienced a failure (Krugman, 2009, September 2. issue of the New York Times). However, there was at least one leading economist that was not shocked. Robert Shiller predicted the housing market crash and said that it would be because of “irrational exuberance”, which he identified and presented as an emotional phenomenon (Shiller, 2000). Once the “cognitive revolution” diminished in its dominance, there was finally a strong return to the study of emotion (Gilovich & Griffin, 2010). But the relative youth of the field is quite visible.

Recency and gaps in the literature

The argument that is presented in this section is that the relatively recent increase in research, concerning the area of emotion and JDM, has contributed to a somewhat narrowed focus which left several gaps in the literature. These gaps can, in turn, have a significant impact on the field's development. For instance, in “The emerging field of affective science” (Gross & Barrett, 2013), the authors are conspicuously aware of this. They argue that while the field exponentially grows, there is danger of a growing diffusion in approaches and theoretical

propositions that can lead to disregarding some basic questions. Therefore, given the relative recency of the interest in emotions and their influence on JDM, there were bound to be some shortcomings that have appeared in this rapidly expanding literature.

A recent review by Volz and Hertwig (2016) has identified some general issues. For instance, one is that the emotional processes in question tend to remain unspecified and they tend to be portrayed in generic terms. They are often called “emotional associations”, “impulses” or “responses”, all without a firm terminological basis. Additionally, the same terms are sometimes used for different emotional qualities (e.g. full blown specific emotion vs. mood) by different authors. Gigerenzer (2008) similarly critiques the inability of some theoretical constructs as being too ambiguous and relying on *labels* of emotion, rather than formal definitions from which precise predictions can be derived. Researchers also have a tendency to only manipulate a single one of these emotional processes in search of interesting effects on the decision (Blanchette & Richards, 2010). Rarely is there talk of multiple sources of affect being active at the same time (Västfjäll et al., 2016). Furthermore, the many underlying concepts and processes remain unmodified with barely any new theoretical development. For instance, the affect heuristic approach (Finucane, Alhakami, Slovic, & Johnson, 2000) has essentially remained unchanged and unchallenged in the last sixteen years since its inception (cf. Townsend, Spence, & Knowles, 2014). On the flip side, some classic findings, like the study by Schwarz and Clore (1983) that spurred the “mood as information” theory have been met with failures to replicate (Feddersen, Metcalfe, & Wooden, 2012; Lucas & Lawless, 2013). Another inconsistency is where authors implicitly support a dual nature of emotions with no work being done on bridging this duality. Specifically, some studies show that emotions can help and lead to better decisions (e.g. Mikels et al., 2010), while others show that emotions are an “enemy” of rationality, leading the decision maker astray (e.g. Sunstein & Llewellyn, 2003). Finally, Lerner, Han, and Keltner (2007) add several areas in which work on emotional impact on JDM can be expanded. This requirement for expansion ranges from the obligation to clarify

the role of mixed emotions (Larsen, 2017), how individual differences factor in the mix, all the way to a surprising lack of research on how positive emotions impact JDM.

Therefore, while the field is growing at an accelerating rate, it is far from maturity. The relative conceptual vagueness, the narrow focus on a single emotional process, the lack of theoretical development, all of which has been so conducive to the explosion of work in the domain of emotion and decision making, has led to thought-provoking results, but it has also left room for some gaps to creep up. In this thesis, therefore, an attempt is made to stay conscious of all the pitfalls and critiques leveled at the intersecting field of emotion and JDM, while focusing on *two* topics. These topics represent gaps that have not been previously addressed in the literature (or have not been addressed sufficiently) and their elaboration represents this thesis main contribution to the field. They will be discussed in much more detail in Chapter 4. For now, in this introductory section, I will only provide the reader with some preliminary information about them, since there are several concepts that need to be fleshed out before, in the forthcoming chapters.

Thesis topics

i. Combination of affective reactions – an arithmetic of affect

Authors often perform experiments where a single affective reaction is manipulated (i.e. induced) and its impact is observed on a particular judgment or choice. While this approach has been extremely fruitful for the field, we can also speculate and imagine that, in decision making situations, there are often multiple sources of affect which might induce two or more affective reactions. And yet we know very little on how the resulting affective reactions might actually impact decisions. This seems like a fairly serious gap since two, or more, affective reactions could arise in everyday situations quite easily. One thing that might occur is that the multiple affective reactions combine and in concert, impact the decision. However, not much is known, if indeed a combined impact does happen, how it happens (i.e. what rule it follows) and whether this resulting combined feeling can ultimately impact the decision? I first hypothesized about

such a combination of affect at the start of this thesis, in early 2014, and recently some theoretical work on this topic has also been proposed by others (Västfjäll et al., 2016). Västfjäll and his colleagues conclude their theoretical paper by stating that the idea of combination of multiple affective reactions is in need of empirical investigation and they frame the issue as an “arithmetic of emotion”. This “arithmetic” refers to the assumption that this combination should follow some basic set of rules. However, there are conflicting propositions to what might happen in decision situations where two or more affective reactions are evoked. Assertions have been made which state that feelings can combine to impact the decision and that some have already shown it (e.g. Hsee et al., 1999), but, as I argue later on in Chapter 4, these claims have severe limitations and cannot actually be said to demonstrate a type of combination. On the other hand, some other features of affect in a JDM context imply that a combined impact is not possible (e.g. "affect-as-spotlight" by Peters, Västfjäll, Slovic, et al., 2006). Concerning the “arithmetic”, assumptions have been such that sources of affect might be averaged or added (Anderson, 1981) with some propositions favoring a different type of arithmetic (Olsen & Pracejus, 2004; Forgas, 2011; Leon & Anderson, 1974), but this arithmetic rule also remains to be elucidated. Finally, no previous attempts have been made to look at multiple affective reactions’ impact in an *actual* decision context, meaning that the topic is treading on before uncharted ground.

The topic’s importance can easily be gleaned at when one takes a closer look at decision situations. For instance, most decision setups consist of several important features under consideration which can evoke some affect, although to different degrees (Dhar & Wertenbroch, 2000) and since people rely on their affective reactions to make decisions (Damasio, 1994; Epstein, 1994) these affective reactions’ impact on the decision should be better understood. A much more in depth discussion on this topic’s importance, background, and relevance is provided in Chapter 4. For now, I highlight that researching how multiple affective reactions impact the decision could help us make better predictions about decisions, it could help us better understand the underlying features of affective influences (i.e. are specific

sources of affect more important), and it could increase our understanding of affective processing in general.

ii. Mechanisms (mediators) of the affect-decision relationship

As argued above, some procedural aspects of the way emotion impacts JDM have not received proper attention. Because of this, the second topic states that, if the (combined) affective reaction does impact the decision, it would be opportune to understand the mechanism behind it. As such, this topic is focused on looking at the mediators of the affect-decision relationship. This topic is heavily dependent on understanding some crucial issues within the emotion and JDM field like different types of affect and various theoretical approaches, all of which will be discussed in the coming chapters. Therefore, I will only present a bare-boned description of this topic here, with the aim that the reader will be more equipped to follow through with this topic in chapter 4, after they have read the preceding discussions. In short, three possible routes, or pathways, concerning this mediation have been proposed in the literature thus far. The first is that it is actually felt affect that is the only mediator (Bechara, 1997), meaning that people rely on the actual evoked feeling to guide their choice. The second is that it is only expected or anticipated emotions that are a significant mediator (see more about different types of affect like immediate and expected in Chapter 2). This means that people rely on the cognitive expectations about how they might feel once the outcome of a decision is known (Loewenstein & Lerner, 2003; Mellers, 2001). The third, and final, is that there is a multi-step process at play, where felt affect might impact some other decision attribute or a feature, like a person's expectations or certain cognitive evaluations (Loewenstein, Weber, Hsee, & Welch, 2001). Previous research has not looked at all potential mediators at the same time (e.g. using multiple mediation models) to ascertain which one is a better fit. Many authors, like Cavanaugh, Bettman, Luce, and Payne (2007) have highlighted the need to understand the mechanisms behind the affect-decision relationship, but the research results so far have been rather disparate. Similarly, Rick and Loewenstein (2008) also underlined the need to understand the complex interplay of various types of emotions in the production of decision-making

behavior, alluding to the fact that a more complex mediating mechanism might be at play. Again, a more thorough discussion on the importance of this topic along with an extensive background is provided in Chapter 4. For now, I highlight that consistently measuring several potential mediating measures, related to the three proposed pathways, and comparing them in a multiple mediation model, would help us broach the road to new theoretical conceptualizations of the mechanism that mediates the affective impact on the decision.

Overview and thesis structure

The thesis will be divided into 6 chapters. Chapter 1 will focus on JDM research in general – the various movements within the field, the major developments, and future directions. While the chapter's focus will be general, it will nevertheless be geared towards helping us understand how the field came to incorporate and start research on the role of emotions and affect in JDM. After that, Chapters 2 and 3 will focus explicitly on the impact of emotion and affect on JDM. The emotion and JDM literature can be quite impenetrable given its recency and the simultaneous development of many definitions, approaches, and types of emotion (i.e. ways in which emotion enters into decision making). My main aim in these chapters is therefore to bridge the discrepant approaches and find a common thread where possible, while at the same time, providing some useful and well-placed critique. Chapter 4 will go into more detail concerning the two main topics that are the crux of this thesis. There, more background research from the literature will be provided and specific assumptions concerning the empirical studies will be presented. Chapter 5 will present the experimental studies that were conducted (a total of 8 studies). Finally, in Chapter 6, the general discussion and the conclusion will be presented.

Chapter 1

Judgment and Decision Making, a Research Paradigm in Flux

The field of judgment and decision making (JDM) is marked by constant fluctuation and developments that continue to spur insights into an interesting area of human behavior. With these insights, the field continues to grow and expand into several theoretical and practical areas. So, what is JDM, and more precisely, what is it about? The focus of JDM research is on how people (including other organisms and machines) combine desires (utilities, personal values, goals, ends, etc.) and beliefs (expectations, knowledge, means etc.), to choose a certain course of action. By extension, the defining template for a decision consists therefore of: i) courses of action (choice options and alternatives); ii) beliefs about objective states, processes, and events in the world; and iii) desires, values or utilities associated with the outcomes of each action-event combination (Hastie, 2001). Additionally, the subject area of JDM is strongly intertwined with many contrasting disciplines that have, over the years, had a major role in its development (e.g. economics, psychology, and mathematics). Given this, it is important to emphasize that the study of JDM is not a specialized subtopic of social or cognitive psychology, of economics or of applied mathematics. Rather, in its most basic sense, it is the study of everyday thoughts and behaviors, of thinking and deciding.

This chapter will seek to present a focused overview of this research. The goal will not be to generally familiarize the reader with the field, but to capitalize on its advancements. Thus, I will focus on where the field came from, what are some of its scientific highlights, and where the field is going. Most importantly, this chapter should provide a suitable backdrop to the main interest in this thesis – the impact of emotions on JDM and it should illustrate the JDM paradigms used in research thus far. Consequently, some findings and theoretical propositions will be given more space than others. This is quite natural as some areas of JDM study have been more productive and they left a more significant mark (e.g. the *heuristic and biases* paradigm). However, I will try to be inclusive and mention findings and theories of a smaller

scale that have not received greater attention. These sections in the chapter will be labeled as *interim* contributions.

Before moving on to the presentation of JDM's contributions, one thing that needs to be cleared is a conceptual differentiation that often goes missing when discussing JDM. I am referring here to the actual differences between what constitutes a “judgment” and what constitutes a “decision”. While they do come in a package, these two concepts diverge. People's thoughts about themselves and the social world – e.g. their self-perceptions, attitudes, and assumptions about social groups – are *judgments*. People's behaviors or choices of action – e.g. their conformity to group norms, their failure to intervene in emergency situations, or their romantic relations – are *decisions* (Van Boven, Travers, Westfall, & McClelland, 2013). This does not however mean that these two concepts should be considered separately. Research in JDM is continuous and has looked at both these concepts interchangeably. However, it is useful to hold this difference in mind.

An introductory and historical perspective of JDM

In general, the JDM research track can roughly be divided into four periods. The first period (1954-1972) is considered to be the start of a systematic approach to the field. Its highlights are still central to the field to this day. From Edwards' (1961) introduction of microeconomic theory for psychologists, to the setup of the dichotomy between the normative and descriptive perspectives (most notably, this dichotomy is still a centerpiece of JDM). The second period (1972-1986), also known as the “cognitive revolution in JDM”, is marked by developments in the heuristic and biases approach and by the introduction of prospect theory (Kahneman & Tversky, 1979; Tversky & Kahneman, 1973). In the third period (1986-2002), we finally see the implementation of emotions, motivations, and culture into JDM. Alongside this, one can observe a wider spread of JDM ideas to fields such as social psychology, marketing, and economics. The fourth period (2002-2014) is the start of multidisciplinary research in JDM. People look towards applications in business, medicine, law, and public policy (see, Keren and Wu (2015) for a fully historical account of JDM).

An expositional account of JDM usually starts with some sort of evocation of Bernoulli's (1738/1954) famous paper: “Exposition of a New Theory of Measurement of Risk”, which has introduced the notion of diminishing marginal utility². Some accounts also start with the equally famous book by Bentham (1879): “An Introduction to the Principles of Morals and Legislation”, which has proposed some dimensions of pleasure and pain, two major sources of utility. However, neither of these works had much psychological discussion. Therefore, several authors suggest that a more natural starting point for the field’s inauguration, at least from a psychological perspective, would be Edwards' (1954) article, “The Theory of Decision Making”, published in the *Psychological Bulletin*. The issues raised in this paper like riskless and risky choice, subjective probability, and the theory of games, are still actively discussed. Alongside this seminal work, Savage's (1954) “The foundations of Statistics” and Luce and Raiffa's (1957) “Games and Decisions” cover the three major theories that have dominated the field since its beginnings: utility theory, probability theory, and game theory.

But, all of these classic papers serve an illustrative purpose. Ever since the early days of JDM, one fundamental dichotomy has been present – that between the normative (what should people do) and the descriptive (what are people actually doing). As it stands today, the early approaches framed their theories, almost exclusively, in a normative way. This normative perspective is also reflected in the more recent term of “*homo economicus*”. The term gets thrown around a lot, but in essence it is used to describe an imaginary person that makes decisions based purely on rational, and deliberate thinking. However, so many descriptive accounts of the way people *actually* make decisions have shown that the normative approaches were, not only distorting the view of how they actually make choices, but also setting up impossible assumptions about how we (humans) approach and understand choice.

² Briefly, diminishing marginal utility implies that changes of the absolute value of wealth are decreasingly impactful as they become more extreme. That is, the difference between \$0 and \$10 is much higher than a difference between \$1000 and \$1010.

The axiomatic JDM

Nowhere are these normative principles so clearly described as in the axiomatic theories of JDM, which have marked the early days of the field. JDM research has copiously borrowed principles and notations from mathematics and later from economics, in order to model human behavior. This is why most of the normative theories are based on so called axiomatic systems. These systems offer a set of conditions (i.e. axioms) that are necessary and sufficient for a particular theory. In turn, these axioms were taken to be true and as such were perfectly in line with a normative way of thinking. One such example of thinking was when probability theorists developed an *expected value* principle that was to help guide behavior in gambling decisions. It was, however, soon realized that people often choose options with unfavorable expected values. We can use the example of the St. Petersburg paradox to illustrate the sub-optimality of choosing options with unfavorable expected values. The paradox involves the following game:

You pay a fee to play the game in which a fair coin is tossed repeatedly until a tail appears, ending the game. The pot starts at \$1 and is doubled every time a head appears. You win whatever is in the pot after the game ends. Thus, you win \$1 if tails appear on the first toss, \$2 if a head appears on the first toss and a tail on second, \$4 if a head appears on the first two tosses and a tail on the third, \$8 if a head appears on the first three tosses and a tail on the fourth, and so on. Therefore, you win 2^{k-1} dollars if the coin is tossed k times until the first tail appears.

So, what would be a fair price to pay for entering the game? Reasoning purely mathematically (or in terms of expected value), we should first compute the expected payout: 50% of \$1, 25% of \$2, 12.5% of \$4, and so on. The expected value of this gamble is therefore infinite. Any player should thus be willing to pay almost any price offered. However, does anyone really do this? Of course not. In fact, few people are willing to pay more than \$10 (Shafer, 2006).

Bernoulli (1738/1954) steps in to resolve some of these issues with the concept of diminishing marginal utility (mentioned above). Now we get the concept of *expected utility* (not expected value) and the St. Petersburg paradox is resolved. There are four axioms of expected utility theory that define a rational decision maker: i) *completeness* – assumes that an individual has well defined preferences and can always decide between two alternatives; ii) *transitivity* -

assumes that as an individual decides according to the completeness axiom, she also decides consistently; iii) *independence of irrelevant alternatives* – assumes that two gambles mixed with an irrelevant third one will maintain the same order of preference as when the two are presented independently of the third one; iv) *continuity* – assumes that when there are three lotteries (A, B, and C) and the individual prefers A to B and B to C, then there should be a possible combination of A and C in which the individual is then indifferent between this mix and the lottery B.

However, examples of divergence from these axioms have also been observed and another paradigmatic shift was imminent. This time from expected utility theory to the similarly axiomatic *subjective* expected utility (SEU) theory (von Neumann & Morgenstern, 1947). In SEU, for instance, one might be offered a choice between one of two lotteries. The first lottery has a 1/3 chance of winning \$600 or else \$0. The second lottery has a 2/3 chance of winning \$300 or else \$0. SEU holds that people choose an alternative as if they were maximizing a utility function of the alternative at hand. Meaning that a hypothetical decision maker would be indifferent between the two lotteries because they both have the same expected value of \$200 (i.e. $\$200 = 1/3 * \$600 + 2/3 * \$0 = 2/3 * \$300 + 1/3 * \$0$). This is normatively very appealing but, spoiler alert, it does not really hold up when we look at how people actually behave. In similar fashion to Bernoulli, the economist Maurice Allais formulated, what is now known as the Allais (1953) paradox to demonstrate the failure of SEU. In it, everyone makes a pair of choices that violate the SEU axioms. The Allais paradox is probably one of the most famous choice examples in all of JDM research³ and its impact at the time of its proposal cannot be overstated. It goes as follows – consider the choice between:

³ It is a peculiarity of the Nobel prize winner (1988) Maurice Allais that he was often reluctant to translate his work in English and his famous paper, in which he introduced the paradox, is most often reproduced in French. As a result, his work was taken into consideration only after translating it in English, years after it was initially released. In a sort of tribute to him, here is the original title of his work: *Le Comportement de l'homme rationnel devant le risque: critique des postulats et axiomes de l'école américaine*.

A: 10% chance of winning \$5000 or else nothing
B: 11% chance of winning \$1000 or else nothing

Most people prefer A since the expected outcome is so much higher than B. But, consider a different choice:

C: 89% chance of \$1000; 10% chance of \$5000, 1% chance of nothing
D: \$1000 for sure

Here, most people prefer D, even though C has a higher expected value. This choice violates expected utility theory, but the choice of A over B is also inconsistent with predictions. This is because C is equal to A, plus an 89% chance of winning \$1000, and D is equal to B, plus an 80% chance of winning \$1000. Because the 89% chance of winning is a “sure thing” in options C and D, the decision maker has an 89% chance of winning \$1000 no matter which option is chosen. Thus, the overall pattern of choices is in violation of the “sure-thing” principle and a violation of SEU (Savage, 1954; Slovic & Tversky, 1974). Allais’ example is just the most famous one. There are many other examples that have been shown to violate SEU (Allais, 1953; Ellsberg, 1961; Slovic et al., 1977). These new “paradoxes” were enough to put a significant dent in the veracity of SEU and the axiomatic approach, which caused people to lose confidence in SEU’s ability to predict choices.

Interim – other important contributions #1

Before I move on to the heuristic and biases approach and the cognitive revolution in JDM, let me first highlight some other findings from this early period. For instance, the topic of *probability learning* was extensively studied in the 1950s and the 1960s, when researchers found that people have a tendency towards probability matching (Grant, Hake, & Hornsath, 1951). Probability matching happens when, in a set of options with positive and negative outcomes, where the negative outcomes are observed 30% of the time and the positive 70% of the time; people using a probability matching strategy will choose the negative option, around 30% of the time and the positive option, around 70% of the time. This interesting peculiarity of an interaction with probability was also found in non-human animals (Herbranson, 2012). Another important finding and fruitful research area was the issue of *preference reversals*. This

is a pattern where people prefer gamble A to gamble B, but nevertheless priced B to be higher than A. For instance, imagine you are asked to pick between two separate gambles of practically the same expected value. One, lottery A, has a high chance of winning a small prize (e.g. 9/10 chance to win \$5, 1/10 chance to win \$0). The other, B, has a lower chance of winning a larger prize (e.g. 1/10 to win \$45, 9/10 chance to win \$0). You choose the A bet. However, when asked to price each of the two lotteries (i.e. set the price at which you would be willing to sell each game if you owned it), you set a higher price for the gamble, indirectly showing a preference for B over A (Lichtenstein & Slovic, 1971). Finally, game theory, signal detection theory, information theory, and decision analysis all represent areas of the field that psychologists have contributed to in the early days of JDM. These areas are vast and still continue to receive attention. Their scope is much too large for any single overview, but the interested readers can familiarize themselves with these areas in other reviews (see, Luce & Raiffa, 1957; Shannon & Weaver, 1949; Swets, 1961; von Winterfeldt & Edwards, 1986).

Bayesian JDM

The Bayesian reasoning approach deserves a special section since it dealt with intuitive judgments and was a direct precursor to the heuristic and biases era. It was aimed at understanding whether people's estimates and intuitions are compatible with the Bayesian probability model⁴. More precisely, researchers wondered whether the Bayesian model can serve as a descriptive model of human probabilistic reasoning (Edwards, 1968)? Research in this domain has led Peterson and Beach (1967) to describe "man as an intuitive statistician". Later on, however, it was Edwards that concluded that people were in fact conservative Bayesians. People revise probabilities in light of new information in ways that are similar to Bayes' theorem, but they do not revise the probabilities as far from the prior probabilities as much as they should. These initial ideas in the Bayesian approach to JDM have proven useful

⁴ Bayesian probability is the interpretation of the concept of probability where instead of as the frequency of an event, probability is interpreted as representing a state of knowledge or as a quantification of personal belief (Cox, 1946).

and inspirational for two Israeli psychologists, Amos Tversky and Daniel Kahneman (although others like Paul Slovic and Sarah Lichtenstein also had a strong impact), who later ushered in the heuristic and biases approach, which can be considered as the most influential in all of JDM.

The JDM renaissance

The 1970s and 1980s saw the introduction of a third perspective besides the normative and descriptive one – *the prescriptive*. Bell, Raiffa, and Tversky (1988, p. 9) have suggested that while normative is equated with what people ought to do and the descriptive is equated with what people actually do, the prescriptive is concerned with: “How can real people – as opposed to imaginary super-rational people without psyches – make better choices in a way that does not do violence to their deep cognitive concerns?” This type of thinking has ushered in the “cognitive revolution” which produced two main ideas: prospect theory and the heuristic and biases approach. Heuristics and biases have gathered such a significant traction that it can be said that people now associate the JDM field with these ideas. Incidentally, these ideas are also directly responsible for the role that JDM now plays in social psychology. For instance, in the chapter on the history of social psychology in the *Handbook of Social Psychology*, Ross, Lepper, and Ward (2010, p. 16) say: “The work of two Israeli Psychologists, Daniel Kahneman and Amos Tversky, on heuristics and judgments...began to make its influence felt. Within a decade, their papers in the judgment and decision making tradition were among the most frequently cited by social psychologists, and their indirect influence on the content and direction of our field was ever greater than could be discerned from any citation index.”

Prospect theory

Prospect theory is concerned with choices between different gambles, or “prospects”, where various outcomes are associated with known probabilities. As such, it is a theory where the decision maker has complete information about the qualities of the choice she has to make. The genius of the theory is in the two functions that describe the process by which people make decisions: the value function and the probability weighting function.

The value function. The value function describes the utility associated with various potential outcomes. This function has three features. First, according to established notions of utility from Bernoulli, it is assumed that people exhibit diminishing marginal sensitivity to extreme outcomes (remember that the difference in utility between \$0 and \$10 is much larger than the difference between \$1000 and \$1010). Second, people usually have some neutral reference point from which they value outcomes as gains and losses. They do not have some absolute state of wealth from which they draw from. If you, for instance, are valuing your car as a seller, you are essentially considering giving up the car as a loss, relative to the reference point of owning the car. In contrast, somebody who is valuing the car as a buyer, they consider it as a gain from the relative reference point of not having the car in the first place. The same car is therefore evaluated differently depending on the person's reference point. Third, this value function is steeper for losses than for gains. This is the classic loss aversion effect predicted from prospect theory where people tend to assign higher value to things when they are evaluating them as losses, compared to when they are evaluating them as gains.

The probability weighting function. This function describes the decision weight of various probabilities. It also has three important features. First, people weigh certain probabilities (i.e. 0% and 100%) more heavily than uncertain probabilities (i.e. those between 0% and 100%). Prospect theory therefore predicts that people are more sensitive to changes in probability that move away from certainty, e.g. from 0% to 10% or from 100% to 90%, than they are sensitive to changes that are within the area of uncertainty, such as moving from 10% to 15% or from 90% to 85%. Second, probability weighting tends to be regressive for most probabilities, so that the difference in the weight of 70% and 65% is actually less than 5%. Third, people tend to overweight extremely small probabilities and underweight extremely large probabilities.

Prospect theory easily explains the Allais paradox. The effect of certainty in probability weighting (which makes the 100% chance of winning, more impactful than 99% chance of winning), along with the regressive tendency for most probabilities (which makes the 10% seem

nearly identical to 11%) explains that when faced with the A, B, C, and D alternatives, people's choices are inconsistent between A versus B, and C versus D. It is examples like these where prospect theory really shines. It is a great descriptive model of the way people actually behave when making decisions. Given its popularity and predictive ability, it remains the most descriptively useful theory of how people make risky choices.

The ultimate power of any theory lies in its ability to offer testable predictions which can offer new insights. Here again prospect theory has great applicative power. The well-known framing effect, first shown with the "Asian disease" problem, is an excellent example of an effect predicted from prospect theory (Tversky & Kahneman, 1981). It was essentially shown that when options were framed as a mortality (i.e. a loss), rather than a survival (i.e. a gain) – even though it concerned the same number of people – decision makers overwhelmingly choose the risk seeking option. Conversely, when the options were framed as a gain, their choices were overwhelmingly risk avoidant. The explanation using prospect theory is that by framing the choice options differently, one can change the neutral reference point and also change the decision behavior. Prospect theory can also explain and predict behavior in situations that do not involve risk. One such example is the endowment effect – the amount that a person is willing to accept in order to give up something (e.g. sell it) is greater than the amount that the person would be willing to pay for that same thing (Thaler, 1980). Because prospect theory predicts that losses loom larger than gains, the endowment effect is logical, i.e. from the seller's perspective, the transaction is viewed as involving a loss.

Prospect theory has two major flaws though. First, it is primarily useful for situations where all the dependencies of the choice are known to the decision maker. This means that the value of the outcome, and the associated probabilities are always fully provided. However, this is in contrast with many situations where few details are known – i.e. decision making under uncertainty (see, Gigerenzer & Goldstein, 2011). Second, prospect theory describes what people do, more so than it describes *how* they do it. In other words, it remains silent on psychological processes. An alternative theory that does not disregard psychological processes

is “reason-based choice”. It simply suggests that people make decisions based on the reasons they bring to mind when they contemplate decisions (Shafir, Simonson, & Tversky, 1993). People choose the option that is favored by the balance of reasons for and against that option. Since prospect theory is somewhat silent on psychological processes, some authors conclude that this is the reason why it has been less influential in social psychology (Van Boven et al., 2013). A nice overview of all the various different proposals and critiques of prospect theory can be found in Machina (1987) - see also Mishra (2014), for a more recent integrative attempt at expanding and extending prospect theory. It is worth mentioning that prospect theory has also been updated to include affective reactions towards outcomes that are high vs. low in affect (Rottenstreich & Hsee, 2001). For instance, Kahneman (2011, p. 287) has stated that the subjective value function can be considered a proxy for feelings, which govern choice: “Humans described by prospect theory are guided by the immediate emotional impact of gains and losses”. This is an area with considerable potential for theoretical development and some attempts were made to model this feeling function (Charpentier, De Neve, Li, Roiser, & Sharot, 2016).

Interim – other important contributions #2

Around the same time when prospect theory was developed, there was interest in another important area: mental accounting. It appears that rather than regarding all of their wealth as fully fungible (i.e. replaceable or mutually interchangeable), people compartmentalize their wealth into a series of “mental accounts” that they must segregate or integrate (Thaler, 1980). Additionally, there has been research in multi-attribute decision making, where choice requires balancing and prioritizing a number of conflicting objectives (Huber, 1974). Research on intertemporal choice similarly started receiving a lot of attention at that time and is still very active. One of the major findings from this area being that impatience tends to decline over time – i.e. hyperbolic discounting (Thaler, 1981). A whole different approach to JDM was also offered by Fischhoff and Beyth-Marom (1983); the hypothesis testing approach. This is a JDM framework that has implications for a number of stages of

hypothesis testing: generation, testing, and evaluation. Finally, cognitive psychologists started introducing process tracing methods aimed at understanding the processes underlying JDM.

Heuristics and biases

To researchers in JDM, at some point, it became clear that people are not good intuitive statisticians when they are dealing with uncertainty. People do not really perform fast probability calculations when making decisions. It also became clear that how people value things, is impacted by miniscule changes to the choice settings (e.g. framing, etc.). As a result of this realization we now have a whole field of JDM that is focused on heuristics and biases that people exhibit. In short, intuitive predictions and judgments are often mediated by a small number of distinctive mental operations, which are called *judgmental heuristics* (Kahneman & Tversky, 1996). Using heuristics, people answer seemingly difficult questions about target attributes, by answering with more easily substituted attributes. The heuristics and biases program started in the 1970s with the presentation of the three most famous heuristics: representativeness, availability, and anchoring (Tversky & Kahneman, 1974) and two famous biases: the confirmation, and the hindsight bias. Interestingly, this research program has left its mark on the intersection of emotion and JDM. For instance, one of the most popular approaches to emotion and JDM is the affect heuristic⁵, whose core principles grew out of the overall heuristics and biases approach (Finucane et al., 2000). I will explain these heuristics and biases in short paragraphs. Notably, I will not go too much into detail since these effects have been studied extensively and the interested reader is encouraged to take a look at other, much more in-depth discussions (Gigerenzer & Gaissmaier, 2011; Gilovich, Griffin, & Kahneman, 2002).

Representativeness. People often judge the likelihood that an object belongs to a particular class of objects by assessing how much that object resembles, or is representative of, that class of objects (Tversky & Kahneman, 1974). Estimating the likelihood or frequency by representativeness can produce violations of base rates and of simple logical rules of

⁵ The affect heuristic will be more thoroughly described in chapter 3.

probability. The famous example of the representativeness heuristic is the Linda problem (Tversky & Kahneman, 1983).

Availability. The availability heuristic describes people's tendencies to judge the likelihood of events based on the ease with which instances can be brought to mind (Tversky & Kahneman, 1973). This ease is naturally not the same as the likelihood of these instances actually happening. Therefore, judgments based on this heuristic can deviate from normative rules of probability. Availability is also used as a natural explanation for many other biasing phenomena like illusory correlation and the overestimation of small risks.

Anchoring. People start from a judgmental anchor and they adjust toward the target from that anchor to yield their final estimate. A striking example comes from Tversky and Kahneman (1974). Their participants were asked to estimate the value of one of two equivalent equations: " $8*7*6*5*4*3*2*1$ " or " $1*2*3*4*5*6*7*8$ ". Under time pressure, participants gave higher responses when the expression began with the larger number than when it began with the smaller number. Anchoring has been described as a "meta-heuristic" in that it describes the sequential operation of two mental operations. First, we have the anchor as an intuitive response, and second, we have the subsequent adjustment i.e. a more careful and systematic estimate.

Confirmation bias. One of the most famous psychological concepts is confirmation bias, where people tend to "test" hypotheses by seeking confirmatory, rather than disconfirming information (Rottenstreich & Tversky, 1997). This tendency has an adverse effect on discovering whether an estimate is incorrect. This bias consists of several processes: restriction of attention to favored hypotheses, preferential treatment of evidence supporting existing beliefs, overweighting positive confirmatory evidence, and seeing what one is looking for (Nickerson, 1998).

Hindsight bias. This is a tendency to view events in hindsight as more likely to have occurred than when they are viewed in foresight (Fischhoff & Beyth, 1975). Early explanations focused on memory distortion, in terms of memory impairment and biased reconstruction of

pre-outcome judgments (Blank & Nestler, 2007). Recently, evidence has emphasized the motivational and self-regulatory mechanisms as underlying this bias (Wann, Grieve, Waddill, & Martin, 2008).

Finally, in light of recent problems concerning replicability (Open Science Collaboration, 2015), it must be added, that these effects (i.e. the heuristics and biases mentioned above) are among the most highly stable and replicable effects in the psychological literature. For instance, in the Many Labs project (cf. <https://osf.io/wx7ck/wiki/home/>) anchoring and framing effects had the strongest replicability scores and the highest effect sizes of all the other effects tested.

Fast and frugal – the adaptive toolbox

The heuristic and biases approach is not without its critics. The most vocal and controversial is the “ecological” approach led by Gerd Gigerenzer. He postulates that models of heuristic cognition focus on situations in which people need to act fast (something that is rarely a concern for logical models of the mind), the probabilities or utilities are unknown, and multiple goals and ill-defined problems prevent logic or probability theory from finding an optimal solution (Gigerenzer & Goldstein, 2011). In this view, the mind resembles an adaptive toolbox with various heuristics tailored for specific classes of problems – just like hammers and screwdrivers in a handyman’s toolbox. This approach differs from the one espoused by Kahneman and Tversky, in that Gigerenzer argues for the evolutionary adaptive advantage of certain heuristics. In a nutshell, the argument is that Kahneman and Tversky focus too much on biases and deviations from the rational model, while Gigerenzer says that heuristics are adaptive and if followed, they might even lead to better decisions. The goal for the ecological perspective is to determine the environmental structures in which a given heuristic is successful, and to design heuristics and/or environments that teach and improve decision making in fields such as health care, law, and politics.

Most importantly, this approach is more focused on designing computational models of heuristics that make precise predictions and can be tested experimentally via computer

simulations. Given this, Gigerenzer considers that much of the research on heuristics relies merely on *labels* such as representativeness, availability, and affect (heuristic) and that “...without a formal definition, common-sense labels can account for almost everything.” (Gigerenzer, 2008, p. 21). Because these are mere labels, these heuristics cannot provide us with concrete predictions nor can they be modeled in a way that uses the strict rules of a mathematical language. Therefore, for Gigerenzer, heuristics like representativeness, anchoring or affect are not *actual* heuristics. He has identified ten *real* heuristics that are part of the adaptive toolbox (see, Table 2. in Gigerenzer, 2008, p. 24): the recognition heuristic, fluency heuristic, take the best, tallying, satisficing, 1/N, the default heuristic, tit-for-tat, imitate the majority, and imitate the successful.

This research stream has been controversial with some suggesting that the work mischaracterizes the heuristics and biases program⁶. For instance, Kahneman and Tversky (1996) state that Gigerenzer’s critiques often neglect empirical work that would not go into his favor (accusing him, ironically, of confirmation bias), that it focuses too much on single examples, and that it relies too much on the philosophical differences of subjective (in a Bayesian sense) and frequentist interpretation of probability. Others have also pointed to significant boundary conditions of Gigerenzer’s heuristics (see, Hogarth & Karelaia, 2006). However, the arguments of the ecological perspective can be useful for other JDM researchers studying heuristics. Specifically, Gigerenzer has a point when he says that a little more rigorous language can improve understanding of common heuristics like availability and/or the affect heuristic. But the most vigorous debate is still whether heuristics can be adaptive and whether the rational model is the best. Even Kahneman has recently suggested that gut reactions can

⁶ The series of debates that transcribed in the 1990s between Gigerenzer, Kahneman, and Tversky, are a difficult read. The authors (especially Gigerenzer) sometimes dissect fairly obscure probability theory to the point that it becomes ineligible for non-mathematicians. I would therefore not advise anyone to actually go too deeply into this for its scientific significance, but rather, if you are so inclined, for its anecdotal richness. Furthermore, it can be somewhat humbling to see these titans of the field get into quite petulant critiques with vicious attacks, all the while being seduced by the most mundane of arguments.

sometimes be useful in decision making situations (Kahneman & Klein, 2009). As with everything, a sensible mix of these two approaches would be most beneficial for JDM researchers.

Current development directions of the JDM field

So far, in this chapter, I have covered some of the major findings and theoretical approaches in JDM. The field has gone from being dominated by mathematical models and economists, to one informed by social and cognitive psychology, even neuroscience. This shift in domination has left the door open for people to start speculating on how other factors, chief among them affective reactions, might impact decisions. Without research breakthroughs like prospect theory, Bayesian probability (or thinking of humans as intuitive statisticians), and the heuristic and biases approach, which have shown the fallibility and malleability of people's decisions, it would not have been possible for social psychologists to start explicitly introducing affective reactions into JDM. But, how is the field evolving? While the insertion of emotion is one way the field is moving forward, in this paragraph, I offer some other examples of the field's evolution?

One, rather inescapable direction in which the field of JDM is evolving, is the increased reliance on neuroscience and neuroscientific methods. Paralleling the argument that JDM research has largely ignored the impact of emotions, Damasio, Damasio, and Christen (1996) argued that neuroscience had overlooked decision making as much as it had overlooked emotion. This is no longer the case, with a growing sense that biological data can inform JDM research by shedding light on its component cognitive and emotional processes (Sanfey, 2007). Furthermore, research in neuroscience and JDM is moving decisively to an ever more complete mechanistic model of human decision making (O'Doherty & Bossaerts, 2008). Research in the neuroscientific area of JDM is therefore very much active. However, it is also still rather disparate with large emphasis on some topics (e.g. loss aversion, fairness, and moral judgment) and a lack of emphasis on others (e.g. probabilistic judgments) (Phelps, Lempert, & Sokol-Hessner, 2014).

Further development is most certainly with research on shaping real world decisions, especially in the area of policy and public health. This involves an interdisciplinary approach between psychology, economics, and policy research. Recently, the ideas of behavioral economics and behavioral interventions such as nudging people into making better and more informed decisions, are receiving increased attention (Thaler & Sunstein, 2008). There is even an entire journal, developed in 2017, devoted to this, called the “*Journal of Behavioral Economics for Policy*.” What is meant by the term behavioral intervention? These are interventions with features that reflect behavioral science insights aimed at actively changing targets’ cognitive, social, and informational decision context, in order to influence targets’ behaviors. Unlike the classic economic approach, these interventions involve much more than just financial incentives (Amir et al., 2005). These types of interventions are increasingly popular and research in JDM is benefiting immensely from the ecological validity and large sample sizes which are emblematic of such experiments.

Given the spread of JDM research to more applicative areas, the field is also becoming more focused on developing decision aids and support systems. For instance, more work on how information is presented (Elwyn et al., 2006) and on educating the public how to interpret base rate probability functions concerning a disease, is being implemented (Fiedler, Brinkmann, Betsch, & Wild, 2000; Reyna, Nelson, Han, & Pignone, 2015). The application of JDM findings seems to be impeccably suitable for these types of endeavors.

Limitations for the JDM field

In terms of more basic research endeavors, JDM scientists have long neglected to devote more attention to the psychological mechanisms and processes that are important for decision making. Indeed, it is striking how little attention this aspect has gotten with a larger focus being on obtaining effects, rather than on providing explanations of the behind-the-scenes processes that lead to these effects (Hastie, 2001; Volz & Hertwig, 2016). No matter the research paradigm that is scrutinized, the psychological processes behind them must be illuminated if we are to have any profound understanding of JDM.

Similarly, it can be argued that JDM research should take advantage of the many tools that allow researchers to access large numbers of participants online. Too often, JDM findings are constricted by the participants available for laboratory experiments. This “laboratory paradigm” can often lead to, ironically, biased JDM findings, given the unique properties of the decision setting and the subjects involved (Ramsey, Thompson, McKenzie, & Rosenbaum, 2016). The decision-making behavior of these participants can be quite different from a much wider selection of participants that differ in other variables (e.g. age, education, etc.). Take, as just one example, the completely different behavior of a large number of participants obtained online on problems of moral decision making, to those participants that were recruited in a university setting (Tinghög et al., 2016). Dan Goldstein, the current president of the society for judgment and decision making (SJDM) has also recently argued for a “cohort approach” to decision making research, imploring researchers to survey swaths of people using online tools in order to get an actual picture of decision making behavior across economic games, moral dilemmas, and various other decisions. Therefore, in the future, one should see researchers dispensing with the “traditional” small sample approach for a larger and more “global” one.

Finally, JDM has been driven by a model that imagines a rational person who behaves as if she were a gambler, selecting the most advantageous option available from the decision situation. This gambling paradigm has been fruitful for JDM researchers in many ways. Its simplicity conveniently describes the essence of many risky decision problems. Gamble decisions are also easily measurable meaning that they can be easily quantified. Another important facilitating factor is that participants usually have no problem in understanding gamble-like situations. This makes it much easier on researchers since they do not have to come up with simplified ways of presenting decision problems. Gamble decisions are also fairly straightforward to model. However, the use of the gamble paradigm has its problems. First, in a gamble situation we assume that any risky decision can be translated into a choice between gambles, which is not always the case. Second, questions concerning ecological validity have been disregarded. “Real-life” situations are not usually so neatly packaged into a gamble-like

situation. Third, this gambling paradigm also assumes that maximizing utility is the ultimate goal of every decision maker – and that simply may not be the case. Thus, JDM researchers should work towards extending and surpassing the gambling paradigm for the sake of the validity of decision making findings.

Concluding remarks on JDM (Feeling the emotional burden)

JDM is a dynamic field. One can argue that it has followed a classed Popperian path. Theories have been proposed and summarily falsified by descriptively more adequate ones, each time showing the irrationality of the human mind when it comes to decision making. But why study decision making in the first place? Why is it important to understand how people make choices? In the introduction, I mentioned that the study of JDM is akin to the study of thinking, everyday thoughts and behavior. I believe that herein lies the importance of the research conducted in the domain of judgment and decision making. We now know, for instance, that people are impatient when it comes to monetary outcomes (e.g. present bias). We know that people value their own property more and avoid giving stuff away (e.g. endowment effect, loss aversion). We know that people's decisions can be impacted by simple changes in the wording and the structure of the problem (e.g. the framing effect). We also know that people's cognitive systems can get easily depleted and constrained (e.g. numerous heuristics and deviations from rational behavior). All this makes us more informed on how to structure this knowledge towards the more practical (e.g. decision aides, nudges, behavioral interventions, etc.). And speaking of the more practical side, nearly every aspect of our daily life involves tradeoffs related to the domain of JDM. We are confronted with risks that range from the insignificant (deciding on whether to drink a day old expired carton of milk), to the highly consequential (deciding on which medical treatment to take). We are at the mercy of biased whims given the proneness of our rational system to take the quicker route (i.e. heuristics). We choose and are stuck with certain choices, in some cases, for a significant portion of our lives (e.g. taking out a loan to buy a house or choosing your spouse). And we are

expected to make the best choices, all the time, every time. Studying and understanding JDM can lead to developing tools that can help people navigate this incessant barrage of demands on their decision-making capabilities. It can help design choice environments that are conducive towards better decisions. And, it can illuminate the properties of our own decision capacities so that we can be more aware of our own decision processes.

However, despite this wide cover area, the field can be very narrow-minded. Notice how decision scientists have, since their early days of the field, had a predictable course in their approach: a model is proposed that is attractive at first – people start offering examples that violate it - a previously disregarded feature is introduced and the cycle begins again. Keren and Wu (2015) suggest that the JDM field, as it is today (2015-2016) is again nearing a post-paradigm crisis. The topics of the field are broader but some research is not linked well enough. It is too unstructured to be able to contribute to a coherent whole. In a sense, JDM research should aspire to be more cumulative, it needs to go beyond the gambling paradigm, it should focus on implications for real world behavior, and finally, it should be more focused in understanding fundamental psychological processes that govern decision making.

Coming full circle now, one psychological process that was conspicuously disregarded for its impact on decision making, are emotions. For instance, the gambling paradigm, mentioned above, has blatantly disregarded the emotional aspects often associated with decisions (Zajonc, 1980). Similarly, the heuristic and biases program has only considered cognitive deviations from the rational model, explicitly ignoring the deviations that may possibly be due to affective reactions. In effect, our understanding of decision making has been severely limited by this non-inclusion. The next two chapters will focus exclusively on the role that emotions and affective reactions have on JDM.

Chapter 2

Emotion, Judgment, and Decision Making – Emotional Qualities and Types of Emotion

Emotion, Judgment, and Decision Making (EJDM for short), as argued in the introduction, is a relatively recent, highly vibrant, but oftentimes inaccessible field. At its face, multiple concepts from the affective sciences are employed alongside multiple concepts from JDM, which can be jarring for many researchers. Moreover, EJDM research is still very much in its early stages of development meaning that there are several competing theories thrown around at the same time, and new empirical findings are cropping up relatively quickly. To make sense of this, in chapters 2 and 3, I will attempt to present an accessible overview of this research field. Chapter 2 will have two major sections with a focus on two distinct issues: i) a section focused on definitions of terms used to denote various emotional qualities like mood, affect, and feeling (these terms are usually used interchangeably in research even though they have different expressive and psychological functions); and ii) a section on clarification and a thorough classification of the types of emotion like *immediate* and *expected* (types of emotion are important for the second topic of this thesis). Types of emotions are an important categorical concept in EJDM and one way of understanding different types is as ways in which emotion *enters* into decision making.

Afterwards, Chapter 3. will focus on various theoretical approaches to EJDM that incorporate different emotional qualities and different types of emotions. What will be highlighted are some of the staple effects obtained in empirical research on EJDM, alongside similarities and differences between the approaches. Together, these two chapters should provide the reader with enough background to easily move on to the discussion of the two main topics of this thesis in Chapter 4. Further, the two chapters should illustrate where EJDM currently stands and what are some of its major limitations.

Emotions enter into JDM

In the previous chapter, I have illustrated how the JDM field has evolved over time. By taking into account deviations demonstrated in empirical findings where normative approaches were violated, JDM research has progressed significantly. This progression is epitomized in the fast and paradigmatic turnover of various theories. Examples of this include updated thinking from approaches that espoused pure rationality to descriptive models like prospect theory, and onward to cognitive biases and heuristics. As decision research progressed, people started to look at how emotions impact judgment and decision making. Current thinking is that emotions can have both an adverse (Rolls, 2013), but also a functional and adaptive role in regulating cognition and decision making (Huntsinger & Ray, 2015). However, as I have argued in the introduction of this thesis, this was not always the case. Emotions, and their impact has long been disregarded in studies of decision making.

For instance, the earliest presidential letter of the Society for Judgment and Decision Making, that can be found online, dates from 1996. It was written by the then president of the society, Barbara Mellers (SJDM Newsletter, 1996). In it, she describes the “big topics” that the field has been dealing with since its inception (e.g. the violation of fundamental principles and axioms when deciding, the disregard of the most basic rules of statistics and probability, biases and heuristics, and so on), but she also emphasizes how the members of the society, and the field in general, have lost their way, deploring specifically the lack of research on emotions and their impact on JDM. Perhaps the most surprising disregard of emotions comes in Tversky and Kahneman’s (1974) treatment of errors that people make (i.e. the heuristic and biases approach). After all, the irrationality that they attributed to failing cognition had previously been blamed on the antagonistic relationship between rationality and emotions (Elster, 1996).

The reasons for why JDM researchers have disregarded the role of emotions are probably multifaceted and highly subjective (see the *Introduction* for a small discussion on this very issue). Because of this, it is not opportune to discuss them at length, given that it would require a thesis of itself. At this point, though, it is safe to say that emotions are no longer

ignored. Many psychological scientists now assume, and would go so far as to say that emotions are, for better or for worse, one of the drivers of decisions in life (Ekman, 1992; Keltner, Oatley, & Jenkins, 2014; Lerner & Keltner, 2000; Loewenstein et al., 2001). Furthermore, some do not view emotion and cognition as opposable or mutually exclusive constructs, suggesting rather that they are fully integrated and only minimally decomposable (Pessoa, 2008). Other modern theories view emotions and cognition as interrelated (Frijda, 2007) thus opening the door to the idea that they may play a significant role in cognition, including higher cognitive functions.

Emotional qualities

According to English and English (1958), emotion is virtually impossible to define, except in terms of conflicting theories. Fantino (1973, p. 281) similarly remarked: “Unfortunately, emotional behavior has not been scientifically studied with the same breadth and depth as many other fields in psychology. One reason for this dearth of knowledge and lack of agreement about emotion is the problem of defining what emotion is.” One popular definition of emotion comes from Keltner and Gross (1999, p. 468): “We define emotions as episodic, relatively short-term, biologically based patterns of perception, experience, physiology, action, and communication that occur in response to specific physical and social challenges and opportunities.” This definition is by no means the only one, but it serves an illustrative purpose in demonstrating the complexities associated with what an emotion (or emotional reaction) entails. Barring this, however, the JDM inclined researcher is never really interested in defining emotion in a global sense (whether this is good or bad remains to be seen as it can leave researchers without a more thorough understanding of the underlying phenomenon). Rather, the JDM researcher is more interested in how the varying emotional qualities factor into the JDM process. It is therefore important to provide clear definitions of emotional qualities.

What is meant by emotional qualities? Most often than not, in the EJDM literature, researchers are, for instance, manipulating *mood* and looking at how it impacts choice. Or, they are, again through some manipulation, evoking *feelings*, *affective reactions*, *arousal*, *anger*, *fear*, etc., and looking at their impact on choice. These various facets of emotional experience

are encompassed by the expression “emotional qualities”. Problematically, however, these terms are often used indiscriminately and little to no thought is devoted to defining each of them specifically. This can lead to confusion and faulty usage across a number of research articles.

This insight is not something new. For instance, it was noticed early on that the terms “affect”, “emotion”, “mood”, and “feeling” are used interchangeably in empirical work (Kleinginna & Kleinginna, 1981). This can lead to various theoretical discrepancies when talking about emotional impacts on JDM. An example of this is demonstrated by (Haidt, 2002, p. 56). He discusses the relation between the “Affect Infusion Model” (Forgas, 1995) and the social intuitionist model (his own model) and writes: “...there appear to be large differences in how the affect infusion model and the social intuitionist model explain the role of affect in moral judgment. These differences vanish, however, once it becomes clear that the two models are using the term affect in very different ways. If the affect infusion model were renamed the mood infusion model, there would be no apparent contradiction.” This illustrates how some basic properties of these terms should be defined and used consistently. I provide some clear demarcations for the terms that will be used in this thesis. Rather than providing new definitions, and just unnecessarily adding on to an already wide array of terms, I will rely on the ones that are already provided in the literature, specifically by Winkielman et al. (2007). These authors offer a parsimonious clarification:

- i) *Mood* refers to a low intensity, diffuse, and relatively long lasting state that is primarily differentiated on valence. It is essentially a form of pre-activated emotion and is not initially connected to the decision event at that particular moment (Schwarz & Clore, 2003). It is defined as a residual affective state, whereby it is a long-lasting emotional experience elicited by the previously appraised event (Wyer, Clore, & Isbell, 1999);
- ii) *Affect* can function as an umbrella term for all states, but typically refers to states that are primarily differentiated on valence and arousal (Russell, 2003). It is a generic term, but in the literature, and in this thesis, it is defined as a specific quality of “goodness” or “badness” experienced as a feeling state (with or without consciousness). In a sense,

it is more semantically related to the word feeling⁷;

- iii) *Emotion* is also used as an umbrella term, but often refers to an intense and relatively brief state with qualitatively differentiated phenomenology (e.g. within negative states, one can differentiate between fear, anger, sadness, and disgust, which are quite specific and carry specific information with them);
- iv) *Valence* refers to the hedonic dimension of a state ranging from positive to negative;
- v) *Arousal* typically refers to a hedonically undifferentiated state of general activation (i.e. non-specific arousal), but is also used to refer to the activation dimension of emotion, (ranging from high to low).

Throughout this thesis, “emotion” and “affect” will be used as umbrella terms – there is simply no way around it, as it is standard practice by so many researchers. However, when specifics of these terms are meant, this will be explicitly highlighted. What is meant by specifics? For instance, in some areas of EJDM, researchers have looked at the way high-intensity emotions like fear, anger, or happiness have impacted decision making. These are “specific emotions” and should not get confused and subsumed with the general term of emotion. Similarly, in other EJDM areas, researchers have looked at how subtle reactions that vary on valence and arousal impact decisions. These are usually referred to as “affective reactions” or “feelings”, and should not be confused with the general term of “affect”⁸.

Now that I have provided some structure concerning emotional qualities, it is important to highlight that EJDM takes a look at emotion through the lens of ways in which they enter

⁷ One might wonder how affect is different from evaluation? One’s explicit or implicit “liking” for some object, person, or position is viewed as an evaluative judgment rather than an internal feeling state. As Russell and Carroll (1999, p. 3-4) say: “By affect, we have in mind genuine subjective feelings and moods (as when someone says, ‘I’m feeling sad’), rather than thoughts about specific objects or events...”

⁸ Indeed, in the empirical section of this thesis (Chapter 5), I will mostly refer to “affective reactions” since we have manipulated subtle reactions which were differentiated on valence.

into decision making. The ways in which emotions enter into decision making have been termed “types of emotion”.

Types of emotion

Nearly every general review that looks at the impact of emotions on JDM, is structured around types of emotion. Types of emotion provide a clever categorization for approaching EJDM and they can help researchers broach new empirical ground. Despite their general use, confusingly, there is no consensus on a specific and unified types-of-emotion categorization. Some authors have gone into much more detail with their categorizations (e.g. Loewenstein & Lerner, 2003), incorporating many important findings from affective science and JDM. Others have a more restrained approach, presenting simple categorizations that try to encompass a lot of different conceptual differences (e.g. Cohen, Pham, & Andrade, 2008). Types of emotion are important for this thesis as they will be referred to extensively later on, and in relation to the second thesis topic specifically. The challenge for this section, therefore, is to try and present a coherent picture of where the field stands when it comes to types of emotion, and to introduce the reader to this important concept in a straightforward way. To address this challenge, I take a look at five recent reviews that have explicitly written about types of emotion, going back to 2003 and I try to tease out some commonalities. Several complex models and terms will be presented and it can be difficult to follow along. Because of this, I have created a summary table of each type of emotion (Table 1 on the next page) from these reviews. Additionally, I dedicate a paragraph to each review to elucidate specifics of each categorization. To the best of my knowledge, no recent (i.e. in the last decade and a half) general review of EJDM has been intentionally left out.

Table 1. Use and descriptions of types of affect in five recent reviews of emotion and JDM.

| Reviews | Types of Emotions | | | | |
|--|---|--|--|---|---|
| <p>1. Loewenstein & Lerner (2003) – The role of affect in Decision Making</p> | <p>Expected emotions - predictions about the emotional consequences of decision outcomes. Not experienced as emotions.</p> | | | | |
| | <p>Immediate emotions - experienced at the time of decision making.</p> | <p>Direct impact - not mediated by changes in expected emotions or in cognitive processing.</p> <p>Indirect impact - by altering the decision maker's expectations of the probability or desirability of future consequences.</p> | <p>Low levels of intensity - an "advisory" role.</p> <p>High intensity - can overwhelm cognitive processing</p> | <p>Immediate emotions experienced by a decision maker reflect the combined effect of the factors: anticipatory influences, and incidental influences.</p> | <p>Anticipatory influences. Thinking about future consequences produces affect.</p> <p>Incidental influences - unrelated to the decision.</p> <p>Dispositional (trait).</p> <p>Situational (state).</p> |
| <p>2. Cohen, Pham, & Andrade (2008) – The Nature and Role of Affect in Consumer Behavior</p> | | <p>Integral affect - affective responses that are genuinely experienced and directly linked to the object of judgment or decision.</p> <p>Incidental affect - affective experiences whose source is clearly unconnected to the object to be evaluated.</p> <p>Task-related affect - affective responses that are elicited by the task or process of making decisions.</p> | <p><u>Feelings due to exposure to object.</u></p> <p><u>Representation of the object.</u></p> <p>Internally generated.</p> <p><u>Mood effects on consumer behavior.</u></p> <p><u>Dispositions and temperament.</u></p> <p>Contextual stimuli</p> | | |
| <p>3. Rick & Loewenstein (2008) – The Role of Emotion in Economic Behavior</p> | <p>Expected emotions - anticipated to occur as a result of the outcomes associated with different actions.</p> <p>Immediate emotions - experienced at the moment of choice.</p> | <p>Integral emotions arise from thinking about the consequences but experienced at the moment</p> <p>Incidental emotions - experienced at the moment of choice, but unrelated to the task at hand.</p> | | | |
| <p>4. Vastfjall & Slovic (2013) – Cognition and Emotion in Judgment and Decision Making</p> | <p>Pre-decisional affect - influences the decision before it is made.</p> <p>Post-decisional affect - experienced affect when the outcome of the decision is known.</p> | <p>Immediate affect is affect experienced in the present due to sunny weather or winning \$50 – notice that immediate affect can be both pre-and post-decisional.</p> | <p>Expected affect are expectations about affective reactions to future outcomes, such as thinking of possible regret If one receives outcome A and the unattained outcome B turns out to be better.</p> <p>Integral affect is related to the decision task (e.g. the anticipated unhappiness with the outcome of a gamble).</p> | <p>Incidental affect consists of affective influences that are unrelated to the decision task, e.g. good mood because it is a sunny.</p> | |
| <p>5. Lerner, Li, Valdeso, & Kassam (2015) – Emotion and Decision Making</p> | | <p>Integral emotions are emotions arising from the judgment or choice at hand.</p> <p>Incidental emotions are affecting decisions that should be unrelated to that emotion.</p> | | | |

Table 1. can seem a bit daunting given the sheer size of all the information that is presented in it. However, I believe it is an important visual illustration of how different authors have approached the concept of types (which is ostensibly very important in EJDM) in markedly different ways. Below, I look at each review specifically.

Review 1.

Loewenstein and Lerner (2003) present a thorough categorization of types. They first divide them into two basic forms: i) *expected emotions*, which are predictions about the emotional consequences of decision outcomes. As their name suggests, they are cognitive expectations about emotions that will be experienced in the future; and ii) *immediate emotions*, which are actually experienced at the time of decision making and often drive behavior into directions that are different from those dictated by evaluations of possible consequences. Immediate emotions are further separated into those that can exert a: i) *direct* impact, which are those that are *not* mediated by changes in expected emotions or in cognitive processing; and ii) *indirect* impact, where emotions alter the person's expectations about the probability or desirability of future consequences, or by changing the way that these consequences are processed. Immediate direct emotions are further demarcated at: i) *low or moderate levels of intensity* where they usually have an "advisory" role; and ii) *high intensity* where they can overwhelm deliberative decision making. Finally, immediate emotions reflect the combined effects of two factors: i) *anticipatory influences*, which stem from thinking about the future consequences of the decision at hand and ii) *incidental influences*, which encompass all factors that are unrelated to the future consequences of a decision. Incidental influences can further be demarcated as: i) *dispositional*, e.g. if someone has a tendency to react in a particular way; and ii) *situational*, e.g. lingering, incidental moods or emotions when the object of a subsequent decision bears no relation to the source of one's emotion, but the emotion still impacts the decision.

Specifics of review 1. This is by far the most developed categorization. There is however, no mention of integral emotions which are included in every other review (integral emotions being those that are related to the decision at hand). Also, this is the only review that presents a distinction between direct and indirect immediate emotions. An example of direct impact is when emotions or moods, for instance, impact behavior without altering the person's perceptions of decision attributes like probability and outcome values. An example of an indirect impact is when immediate emotions impact on choice is mediated by, for one, changes in expected emotions and two, changes in the quality and/or quantity of information processing. Additionally, the terms "anticipatory" and "incidental" are presented as *factors* of immediate emotions, not, like in other reviews, types of emotion themselves. Finally, this is the only review that differentiates incidental emotions as dispositional and situational.

Review 2.

Cohen et al. (2008) review the impact of emotions on JDM from a consumer behavior perspective. They differentiate between three types of affect: i) *integral affect*, which refers to affective responses that are genuinely experienced and directly linked to the object of judgment or decision. Affective responses are integral to the extent that they are elicited by features of the object whether these features are real, perceived, or imagined; ii) *incidental affect*, which refers to affective experiences whose source is clearly unconnected to the object to be evaluated; and iii) *task-related affect*, which lies somewhere between integral and incidental and refers to affective responses that are elicited by the task or the process of making judgments and decisions. For instance, the emotional stress of having to choose between two very attractive offers, would be considered task-induced affect. Separately, later on in their review, Cohen et al. introduce a division of integral affect between: i) *anticipatory*, which are actual feeling experiences that arise during the decision process in the course of evaluating a target object and ii) *anticipated*, which is the same as expected emotions they just use a different word for some reason.

Specifics of Review 2. In this review, the definition of integral affect technically includes both immediate and expected affect. However, immediate affect does not have to be integral as defined in other reviews. In this review also, incidental affect is a type of emotion in and of itself, unlike in Review 1, where it was a factor of immediate emotions. Most importantly, this is the only review that introduces task-related affect. However, it is not clear why and indeed how, task-related affect is different from integral affect? One reason for why the authors introduce this type of affect separately, could be because their focus in the review were consumer situations. People usually have to choose between several competing options as consumers and it could be such a staple behavioral process in consumer research that it warranted the authors to define it as eliciting its own type of affect. To be fair, task-related affect is *not* just the creation of these authors. Others (although not in general reviews of EJDM) have espoused similar views. For instance, Rottenstreich and Shu (2004) speak of *process-induced feelings*, which are feelings that arise from the process of making a decision. Concomitant evidence about such process-induced emotions can be observed in studies where adding options to a choice set may make the process of choosing harder to cope with, and may discourage the decision maker, or even leave her worse off (Dhar, 1996; Shafir & Tversky, 1992). Finally, in this review, anticipatory emotions are defined as immediate emotions without referencing that they arise from thinking about the future consequences, as in all other reviews.

Review 3.

Rick and Loewenstein (2008) take a look at types from the perspective of economic behavior. Their categorization includes: i) *expected emotions*, which is similar in definition to the one from Loewenstein and Lerner; and ii) *immediate emotions*, which are emotions experienced at the moment of choice. They further subdivide immediate emotions into: i) *integral*, which arise from thinking about the decision consequences and ii) *incidental*, which are emotions that are experienced at the moment of choice, but that arise from dispositional or situational sources, unrelated to the task at hand.

Specifics of Review 3. This review defines integral emotions as arising from thinking about the consequences. This definition makes integral emotions sound like anticipatory affect as defined in other reviews. Incidental emotions are again defined as a type of emotion, unlike a factor important for immediate emotions as in Review 1. This is the most subdued categorization of any of the other reviews with the least number of categorizations.

Review 4.

Vastfjall and Slovic (2013) offer a comprehensive categorization while also introducing a dimensional way of looking at types. First, they demarcate between two types of emotion: i) *pre-decisional affect*, which influences the decision before the decision is actually made; and ii) *post-decisional affect*, which concerns the experienced affect when the outcome of the decision is known. They further differentiate between: i) *immediate affect*, defined as affect experienced in the present, due to sunny weather or winning \$50; and ii) *expected affect*, which are expectations about affective reactions to future outcomes, such as thinking of possible regret if one were to receive outcome “A” and the un-obtained outcome “B” is better. Finally, they propose a division between: i) *integral affect*, which is affect that is related to the decision task; and ii) *incidental affect*, which consists of affective influences that are unrelated to the decision task and can only be pre-decisional.

Specifics of Review 4. In this review, types of emotion can actually overlap and authors introduce an interesting, three-dimensional way of looking at them. One can think about types of affect as being along three dimensions: time of decision (pre- vs. post-decisional), time of affect (immediate vs. expected), and affect-decision relationship (integral vs. incidental). This dimensional categorization of types is not mentioned in other reviews. Finally, they are also the first to introduce post-decisional affect as a distinct type. Fairly few theories have dealt with this type of affect (Loomes & Sugden, 1986; Mellers, Schwartz, & Ritov, 1999) and none of the other reviews mention it specifically.

Review 5.

Finally, Lerner et al. (2015) present a small-scaled categorization of types of emotion by, explicitly, differentiating two: i) *integral emotions*, which are emotions arising from the judgment or choice at hand; and ii) *incidental emotions*, which pervasively carry over from one situation to the next, impacting decisions that should, from a normative perspective, be unrelated to that emotion – a process that they have termed *carryover* of incidental emotions.

Specifics of Review 5. It is somewhat misleading to say that Review 5 focuses solely on two types of affect. The authors actually present a general model of decision making that attempts to account for both traditional (rational choice) and emotional inputs to JDM. They call it the emotion imbued choice (or EIC, Lerner et al., 2015, Figure 2. p. 815) model. In it, they include **expected emotions** and they ultimately differentiate between **current emotions** (i.e. emotions felt at the time of the decision) and **incidental influences** (e.g. mood, weather, carryover effects). Thus, upon closer examination, their review is surprisingly inclusive. Finally, this is the only review to introduce five potential sources of current emotions: i) characteristics of the decision maker, like chronic anxiety or depression can modulate current emotions (same as a dispositional incidental type of emotion); ii) characteristics of choice options that can directly impact current feelings (same as Cohen et al. (2008) claim that integral affective reactions are elicited by features of the object); iii) predicted emotions can have an anticipatory influence on current emotions; iv) contemplating the decision can directly cause frustration (same as task-related affect from Cohen et al. (2008) and process-induced feelings from Rottenstreich and Shu (2004)); and v) incidental emotions can carry over and impact current emotions.

Differences in types-of-emotion presentation and the impact on research

The five reviews presented above, gives us an overhead perspective on how various authors have discussed types of emotion. Different authors have approached the issue of types in somewhat different ways. Sometimes these differences are subtle like when integral emotions are defined as anticipatory emotions in one review, but anticipatory is just a factor, or part of

immediate emotions in another review. Other times, the differences are obvious like how detailed the categorizations of types are in separate reviews. While it is important, in and of itself, to illustrate these differences, it is also necessary to illustrate how they can have a degrading impact on the field. One might assume that, at the surface, this lack of consistency may not be that relevant. Perhaps these categorizations do not have that much influence on the research direction of EJDM? Contrary to this assumption, I argue that divergences in the literature *can* have unsuspecting consequences and that a more unified approach to types of emotion can even lead to new research hypotheses.

For instance, a more consistent and focused approach to types of emotion forces the researcher to be precise with the use of terms for emotional qualities. If one is focused on integral emotion, mood should not be manipulated since it is relatively long lasting and it is essentially a form of pre-activated emotion, unrelated to the decision situation (Wyer et al., 1999). Further, types like “task-related” or “process-induced” are only mentioned by some authors. However, if they are presented side-by-side, in a comprehensive review of types, researchers could come to the idea of comparing them experimentally in order to find boundary conditions and features that differentiate them in relation to the decision.

Also, the many definitions of integral emotion (e.g. anticipatory or those arising with contact to the decision stimuli), that are usually found in separate reviews, could be looked at together, to identify whether they have different impacts on the decision. For instance, perhaps there is a difference in how integral emotions that are anticipatory, and those that arise from the decision stimulus, impact choice? Questions like these could illuminate different facets of integral emotion. Finally, some reviews suggest that types of emotion can overlap in a certain way (i.e. in Review 4, Vastfjall & Slovic, 2013). One can therefore look at the same emotion, but with different properties in relation to the decision. For instance, regret can be both expected and post-decisional. This means that the same emotion could be classified differently in its relation to the decision situation, thus allowing researchers to look at that emotion’s different properties in relation to decision making.

Types of emotion in this thesis

First of all, an important thing that needs to be said here is that the goal of this overview is not, and cannot, be to present a *new* categorization of types of emotion. For one thing, there is still not enough research into different types of emotion so that any definitive cutoffs and exclusions can be made. Furthermore, it is also not possible to claim that any of the different types presented above are wrong or that they do not warrant to be included into a specific (i.e. unified) categorization. All the types described above are still plausible ways with which emotion can enter into JDM and presenting a new categorization would, without more research and empirical testing, just add to the confusion.

Despite this, while there are differences in the way types are presented (as established by the different reviews above), one can identify some common features. These commonalities will be relied upon in this thesis. Thus, in this thesis, I will rely on the following distinctions when it comes to types:

- i) emotional impact can differ on whether it occurs before or after the decision, i.e. it can be **pre- or post-decisional**.
- ii) it can further differ on whether it is **immediate or expected**. This distinction is founded on the phenomenological quality of feeling. “Immediate” refers to actually felt at the time of decision making. “Expected” refers to not felt cognitive expectations about possible emotions after consequences of outcomes are known.
- iii) finally, it can differ in its relation to the decision, i.e. whether it is **integral or incidental**. It is integral when it relates to the decision, decision attributes or to the decision situation, and it can come about through *anticipatory* ways – thinking about possible outcomes – or through *elicitation* by an actual object or stimulus, e.g. when a task related to a decision is described in a pleasant or unpleasant way. It is incidental when it is not relevant for the decision at hand, e.g. a person is in a good mood because of an unrelated event or when they are angry about something that has nothing to do with the decision, but these states end up impacting the decision.

These distinctions seem to be relevant across all the various reviews I have looked at and, by extension, across the various disciplines that the reviews were focused on (e.g. psychology, economics, consumer behavior). Furthermore, because it is highly intuitive, I will rely on the dimensional distinction of types from Review 4 (Vastfjall & Slovic, 2013). That is, types of emotion can be thought of as being along three dimensions: time of decision (pre- vs. post-decisional), time of affect (immediate vs. expected), and affect-decision relationship (integral vs. incidental).

Concluding remarks on emotional qualities and types of emotion

Because the field of EJDM comes with certain specifics given that it is a *mélange* of emotion research and JDM research, at the start, it was necessary to provide some conceptual clarifications concerning two important EJDM issues: emotional qualities and types of emotion. In the first section, I provided some basic definitions of differing emotional qualities like mood, affect, emotion, valence, and arousal. These terms get thrown around a lot in EJDM literature since most empirical work tends to focus on manipulating one of the emotional qualities and looking at its impact on decision making. As we have seen, these terms were in need of being associated with clear definitions and demarcations since authors have a tendency to present them indiscriminately, which can lead to some confusion. Next, in the second section, I have presented the concept of types of emotion which is a staple of reviews that look at EJDM. However, even though EJDM researchers structure their reviews around types of emotion, there are clearly differences in the way they do this. These differences can be subtle and, as argued above, can lead to discordance in the literature. Nevertheless, they are an important feature of the EJDM field and any work that aims to find out more about the impact of emotions on JDM must be conscious of the various types. Because of the fact that there is still not a lot of research concerning types of emotions, it was not possible to provide an updated categorization. Nevertheless, a useful framework of types was presented, one that has the most in common with other reviews. Now that we have a clearer picture of some concepts, in the next chapter, I take a look at the various theoretical approaches that grew out of EJDM research.

Chapter 3

Emotion, Judgment, and Decision Making – Theoretical Approaches

Moving on from emotional qualities and types of emotion, in order to truly familiarize ourselves with the field, it is important to take a look at some of the theoretical work within EJDM. This is especially important since this thesis does not subscribe to any one particular theoretical framework. The two main thesis topics and questions cross theoretical lines. But, in spite of this, an overview of theoretical approaches within EJDM is useful since several will be referenced throughout the empirical section of this thesis (Chapter 5), as well as in the general discussion. Therefore, the reader should be familiarized with them. Taking this into account, the theories presented below will be organized around types of emotion. Most of them are focused around a single type anyway, which makes it easier to structure them. I will start with the presentation of theories related to post-decisional emotions. Then, I will move on to presenting theories related to expected emotions. These theories are mostly the ones mentioned in the first chapter on JDM, since expected emotions are implicitly included in classical decision making approaches. Moving on, I will talk about theories related to incidental emotions, and finally, I will present theories related to integral emotions. The last part of this section will include a reflection on these theories and approaches, where they differ and what makes them similar.

Approaches related to post-decisional emotions

As mentioned in the section on types, emotional reactions can be post-decisional. Reactions to a decision outcome depend strongly on whether the outcome is compared with alternative outcomes or with other states of the world (Boninger, Gleicher, & Strathman, 1994; Gleicher et al., 1990). This type of thinking is called “counterfactual” and it refers to the mental simulation that compares the present state with other possible, but not obtained states. Research on outcome evaluation has consistently shown that people feel more strongly about an alternative (no matter if this alternative is positive or negative), if counterfactual alternatives

are salient (Gleicher et al., 1990). Counterfactuals can be divided into two: i) *upward counterfactuals* are those that improve reality (i.e. when people think how things could have been better), and ii) *downward counterfactuals*, which are those that worsen reality (i.e. when people think about how things could have been worse) (Landman, 1997). Importantly, counterfactuals are closely related to emotions, especially, post-decision emotions. A famous example of counterfactual thought impacting emotions was the study of Olympic gold medalists in 1992. Medvec, Madey, and Gilovich (1995) have found that bronze medalists, on average, display more positive affect when receiving their medals than silver medalists. An explanation for this could be that by just making the cut off (i.e. third place) the bronze medalists, elicit downward counterfactual comparisons. In comparison, just missing the cutoff (i.e. second place) elicits an upward counterfactual comparison. Thus, these counterfactual thoughts impacted and reversed the relationship between objective achievement and subjective satisfaction (Medvec & Savitsky, 1997). Concurrently, it has been shown that upward counterfactuals result in negative affect, while downward counterfactuals result in positive and this finding has been named the *affective contrast effect* (McMullen, 1997).

Regret theory and disappointment theory

Counterfactual thinking is relevant for the two most studied experienced (i.e. after the decision outcome is known, so post-decisional) emotions in EJDM: regret and disappointment. Both of these emotions are experienced in relation to unfavorable or undesirable outcomes i.e. after the decision. Regret is experienced when a chosen alternative turns out to be worse compared to a non-chosen one. Disappointment is experienced when the outcome chosen is worse, compared to the expected outcome (Zeelenberg, Van Dijk, & Manstead, 2000). Attempts have been made, early on, to incorporate these emotions into JDM. For instance, Savage (1951; 1954) proposed a minimax principle that prescribes selecting the option that minimizes one's maximum regret. This principle might be applicable in some context, but it has been critiqued on the basis that people would rarely focus solely on the worst outcome to the exclusion of everything else. A more plausible approach is when Loomes and Sugden (1982) state that

people adjust their utilities to incorporate these emotions and their *regret theory* captures the expected emotional reaction to an outcome when one learns that a different choice would have produced a better outcome. Additionally, these same authors have also incorporated the role of disappointment (Loomes & Sugden, 1986). *Disappointment theory* captures the emotional reaction to an outcome when one learns that another state of the world would have produced a better outcome.

Decision affect theory

Crucially, regret and disappointment are not the only experienced emotions that are relevant to EJDM. Barbara Mellers and colleagues, in their decision affect theory, have investigated the experience of elation and surprise (Mellers, Schwartz, Ho, & Ritov, 1997). Decision affect theory is a theory of post-decisional affect and is one of the most important attempts at modelling the impact of post-decision affective reactions in JDM. It is assumed that people become elated or rejoice when receiving a positive outcome and disappointed or regretful when facing a negative one. But, the experience of affect is amplified when outcomes are unexpected or surprising (Kahneman & Miller, 1986). Emotional experiences are enhanced by surprise, and the same outcome can feel very pleasant or very unpleasant, depending on the counterfactual comparison (Mellers et al., 1997). Moreover, it was found that people's emotional reactions to monetary outcomes depend on both the absolute value (say winning \$100), as well as the relative value of the outcome compared to counterfactual outcomes (Mellers, 2000). Decision affect theory can therefore be viewed as a synthesis of disappointment and regret theories that also incorporates the idea that people respond with greater emotional intensity to outcomes that are surprising, i.e. unexpected.

Conclusion on approaches related to post-decisional emotions. Post-decisional emotions can be considered to be the result of counterfactual thinking, i.e. comparing the present state with other possible states. Further, these approaches have been heavily centered on two emotions: regret and disappointment. These two emotional reactions have been synthesized in decision affect theory, which is exceptionally good at predicting the post-

decision satisfaction and emotional reaction with decision outcomes. Finally, because the emotional reactions in these approaches do not happen before the decision, thus having a lot less chance of directly impacting choice, these approaches have not received that much attention in the EJDM field, compared to emotions that occur before the decision (Lerner et al., 2015).

Approaches related to expected emotions

Expected emotions, as defined previously in the types of emotion section, consist of pre-decisional predictions about emotional consequences of decision outcomes. They are not actually felt, but are best described as cognitive expectations about possible future emotions (Loewenstein & Lerner, 2003). Essentially, most models of decision making, that can be painted as classic or consequentialist in nature (i.e. relying on the possible consequences of the decision), do not deliberately make assumptions about emotions, but they do it implicitly (von Neumann & Morgenstern, 1947). As such, expected emotions have been included in standard and dominant JDM models that I have touched upon in Chapter 1. For instance, the classic expected utility model, which has been upgraded and developed numerous times (Camerer, 1992; Rick & Loewenstein, 2008), just assumes that people attempt to predict the emotional consequences associated with alternative courses of action and then select actions that maximize positive and minimize negative emotions (Bernoulli, 1738/1954). It is important to highlight, though, that these are not actual felt emotions. Felt emotions have been disregarded in classical JDM theories. Thus, approaches that include expected emotions are classic JDM approaches that were already mentioned in Chapter 1. and therefore, they will not be discussed further.

Affective forecasting

As a natural progression from research on counterfactual thinking and expected emotions, a curious development that came about from expected emotions was that researchers began to wonder whether people are actually good at predicting their emotional states and how these predictions reflect on decision making behavior. As mentioned previously, expected emotions to future outcomes are conceived primarily as cognitive expectations about how one

would feel in the future. In JDM, it is assumed that people predict the emotional outcomes of different alternatives and act in accordance with a maximizing principle, i.e. maximize positive emotions and minimize negative emotions (Loewenstein & Lerner, 2003). The expectation of future good or bad emotions is assumed to be a motivator for efficient decision making (Zeelenberg, 1999). Normative models of JDM (e.g. von Neumann & Morgenstern, 1947; Edwards, 1954) assume that the only tastes that are relevant to decision making are those that prevail at the same time at which the consequences of decisions are experienced. Affective forecasting, on the other hand, finds that people make systematic errors when predicting their future tastes (Wilson & Gilbert, 2003).

Affective forecasting is defined as “people’s predictions about how they will feel in a particular situation or toward a specific stimulus” (Wilson & Klaaren, 1992, p. 3). For instance, Kahneman and Snell (1990) showed that people make errors when predicting their future liking for various situations or objects. They asked participants to make predictions of their liking of yogurt before and after having eaten it for eight days in a row. After that, participants indicated that their liking had increased, whereas they initially indicated that their liking would decrease. This presents a serious challenge for EJDM since, if people do not know what they will like in the future, or if they have incorrect intuitive theories about what they will like, they will end up with a bad decision. Loewenstein and Schkade (1999) have suggested three explanations for why people might miss-predict their future feelings: i) people might have wrong intuitive theories about hedonics. For example, failure to predict adaptation to negative events may stem from people’s lack of awareness of their psychological immune system (Gilbert, Pinel, Wilson, Blumberg, & Wheatley, 1998); ii) differential salience – people weigh events to which their attention is directed more highly than peripheral events; and iii) the hot-cold empathy gap – for instance, when people are in a “cold” state, they will have difficulties imagining or predicting how it would be like to be in a “hot” state (Ariely & Loewenstein, 2006; Loewenstein, 1996). What affective forecasting research is suggesting then, is that expected emotions can lead

people to make choices that are worse off for them, because they will fail to correctly predict their future emotional reactions.

Conclusion on approaches related to expected emotions. Expected emotions are implicated in classic JDM approaches and have been so from the early days of utility theory. These emotions are not felt per se, but are expectations about future emotional reactions and normative approaches to JDM just assumed that people make choices that would maximize their utility i.e. the choices that would result in the most positive affective reaction. One interesting development that came about from thinking in terms of expected emotions is affective forecasting where it was shown that people consistently miss-predict their own future emotions.

Approaches related to incidental emotions

The influence of current mood on risk perception and preferences is one of the most studied impacts that emotions have on decision making. It is assumed that mood and other incidental emotions can enter into decision making in three different ways: i) current mood may influence the content of people's thoughts. For example, participants in a positive mood may more easily come to think positive thoughts and recall positive memories (Forgas, 1995). This is more commonly known as *mood congruence* (Bower, 1981); ii) mood can influence processing capabilities. For example, happy people often tend to process information in a less elaborate and systematic way than people who are sad (Isen, 2000); and iii) people's current mood can also influence motivations to undertake certain actions (Andrade, 2005). Johnson and Tversky (1983) were the first to show the effect of incidental mood on risk perception. In their study, participants read newspaper stories that were designed to elicit either a positive or negative mood. They then estimated the fatality frequencies for various potential causes of death. Compared to participants that read positive stories, those who read negative stories had more pessimistic outlooks on the number of fatalities. Other evidence suggests that positive mood can lead to risk aversion in situations in which a potential loss is emphasized (Arkes, Herren, & Isen, 1988). Conversely, negative states like anxiety, depression, and fatigue have

been shown to lead to increased risk taking (Raghunathan & Pham, 1999). An explanation for this might be *mood maintenance* – people in a positive mood risk losing their good mood if the outcome is negative, so they tend to avoid risky situations.

Studies also suggest that mood can impact the nature of processing as well. Whereas negative emotions narrow attentional focus, positive emotions broaden attentional focus (Basso, Scheff, Ris, & Dember, 1996; Conway & Giannopoulos, 1993). Several papers have posited that negative emotions impact depth of processing with negative emotions triggering more systematic processing than positive emotions (cf. Schwarz & Bless, 1991). One possible explanation for this is that emotions serve an adaptive function by signaling situations that demand increased attention. Later studies invite a refinement of the original hypothesis that happiness decreases processing motivation. It was found that while happy moods increase and sad moods decrease reliance on general knowledge structures, happiness did not lower cognitive performance across the board (Bless et al., 1996). Even more recently, there are suggestions that specific emotions, rather than emotional valence in the form of moods, drive depth of processing.

Mood-as-information

It is assumed that people utilize mood as information which helps them interpret situations. Schwarz and Clore (1983) showed that a common heuristic that people use, when asked to make a global evaluation of objects, is to rely on current feelings rather than processing all the relevant information. This has been named the “how do I feel about it” heuristic and it is a prime example of how incidental emotions can impact choice. The original example used weather as a conduit for the incidental mood, with other authors extending the effect. For instance, economists have found a positive correlation between the amount of sunshine on a given day and stock market performance across 26 countries (Hirshleifer & Shumway, 2003). Similarly, stock market returns declined when a country’s soccer team was eliminated for the World Cup (Edmans, Garcia, & Norli, 2007). The view holds that current mood provides relevant information about the current situation and that it may be used to make judgments

about objects and the self. People also use their current feelings as a basis of judgment when they are perceived to contain valuable information or when they are misattributed as a reaction to the target (Schwarz & Clore, 1983). Finally, applied to decision making and simplified, if present affect happens to be positive, then the decision maker's evaluations of specific options are likely to be positive, with the opposite being true for negative affect (Schwarz & Clore, 2003; Wyer et al., 1999).

Some moderating factors exist for the mood-as-information perspective. When participants are made aware that their mood was brought about by something unrelated to the judgmental target, the effect of the mood disappeared (Schwarz & Clore, 1983). Pham, (1998) also showed that when participants believed that their feelings were not relevant to the decision, mood effects disappeared. Similarly, Albarracín and Kumkale (2003) show that people may not use affect as information when they deem the affect irrelevant or when they do not identify their affective reactions at all. The *affect infusion model* also predicts that the degree of affect infusion into judgments varies along a processing continuum. So much so that affect is most likely to influence judgment in complex and unanticipated situations (Forgas, 1995). Another assumption that gained popularity recently is that individuals with high emotional intelligence can correctly identify which events caused their emotions and therefore can screen out the impact of incidental emotions like mood (Yip & Cote, 2013).

Specific emotions and the ATF

A large part of the literature on EJDm has taken a valence approach focusing only on this dimension of affect. Mood, for instance, in the mood as information perspective, is differentiated only based on its positivity vs. negativity. However, valence cannot account for all influences of emotion on JDM. Evidence suggests that emotions of the same valence, for instance, anger and sadness, have a different impact on behavior. They are associated with different antecedent appraisals (Smith & Ellsworth, 1985), with different brain hemispheric activation (Harmon-Jones & Sigelman, 2001), facial expressions (Ekman, 2003), and central nervous system activity (Phelps et al., 2014). To increase the predictive power of specific

emotions and to take into account the fact that specific emotions differ in many ways, Lerner and Keltner (2000, 2001) proposed examining multidimensional discrete emotions with their appraisal tendency framework or ATF. The ATF has three assumptions: i) that a discrete set of cognitive dimensions differentiates emotional experiences (Scherer, 1999; Smith & Ellsworth, 1985); ii) that emotions serve a coordination role, automatically triggering a set of concomitant responses (physiological, behavioral, experiential, and communicative) that enable the individual to address problems or opportunities quickly (Oatley & Jenkins, 1992); and iii) that emotions have motivational properties that depend on both an emotion's intensity and its qualitative character. This also means that specific emotions carry specific "action tendencies" or implicit goals, that signal the most adaptive response. According to the ATF, these appraisal tendencies are goal-directed processes through which emotions exert effects on judgments and decisions until the emotion-eliciting problem is resolved (Lerner & Keltner, 2001). The ATF therefore predicts that once an emotion is activated; it can trigger a cognitive predisposition to assess future events in line with the central appraisal dimensions that triggered the emotion (see Table 1. In Lerner et al., 2015, p. 806). A classic and early example comes from Keltner, Ellsworth, and Edwards (1993) where they examined the effects of anger and sadness on causal attributions. Although both anger and sadness have a negative valence, appraisals of individual control characterize anger, whereas appraisals of situational control characterize sadness. Consistent with this hypothesis, incidental anger increased attributions of individual responsibility for life outcomes, whereas incidental sadness increased the tendency to perceive fate or situational circumstances as responsible for life outcomes. Tiedens and Linton (2001) also show that whereas emotions characterized by a sense of certainty (e.g. contentment and anger) lead decision makers to rely on heuristic cues, emotions characterized by uncertainty (e.g. worry and surprise) lead decision makers to scrutinize information carefully. Extending this, Small and Lerner (2008) found that, relative to natural state participants, angry participants allocated less to welfare recipients, while sad participants allocated more. This effect was eliminated under cognitive load, suggesting that allocations were predicted by differences in

depth of processing between sad and angry participants. Similarly, Lerner and Keltner (2001) show that fear and anger have opposite effects on risk perception and that appraisals of certainty and control moderated and mediated the emotion effects. This also extends to positive emotions where it has been shown that different positive emotions like gratitude and pride have different effects on decisions to help and task perseverance (Bartlett & DeSteno, 2006; Williams & DeSteno, 2008).

Conclusion on approaches related to incidental emotions. Early approaches to looking at the way incidental emotions impact JDM have mostly focused on mood with demonstrations of effects like mood congruence, mood maintenance and mood's effect on the nature of information processing. The mood-as-information perspective proposed that people use their current mood to provide information about the current situation in a sort of "how do I feel about it" heuristic perspective. Lately, however, researchers have also started to look at how specific incidental emotions can impact choice, with evidence suggesting that emotions of the same valence can have markedly different effects on JDM behavior.

Approaches related to integral emotions

Emotional reactions that are more integral to the decision also have a substantial impact on people's judgments and decisions. Various approaches have been put forth in this domain, some of which have received widespread attention. Most importantly, all of the approaches are similar in their reliance on integral types of emotion, meaning that the impact of the emotions that they are trying to model, usually stems from affective reactions that are either connected to the decision situation at hand, that arise from the decision stimuli, and/or are evoked by thinking of possible consequences of the decision.

At this point it is important to emphasize the relationship between mental imagery and integral affective reactions as these links are referenced directly in some of the approaches. Mental imagery refers to the ability to vividly think about or imagine certain states (Loewenstein et al., 2001; Vastfjall & Slovic, 2013). Several studies have shown a strong relationship between affective imagery and decision making (Slovic, Finucane, Peters, &

MacGregor, 2002). Researchers interested in this link have investigated both positive and negative imagery (Haney & Euse, 1976) as well as imagery of specific emotions (Lang, Kozak, Miller, Levin, & McLean, 1980). For instance, mental imagery seems to be an important aspect of the presence of anticipatory emotions. Studies show that people use different strategies to imagine different emotions, that some emotions are more easily imagined than others, that emotional imagery is accompanied by electrodermal and visceral responses, and, finally, that there are individual differences in emotional imagery (Gollnisch & Averill, 1993). Furthermore, Katkin, Wiens, and Ohman (2001) have shown that research participants who could utilize visceral cues (introspection) and detect heartbeats, actually developed gut feelings.

Other research has shown that when people are forced to mentally simulate future emotions, preferences may reverse as compared to when no mental simulation is used (Shiv & Huber, 2000). Therefore, the vividness and imaginability of an outcome appear to be important cue, both for the elicitation of anticipatory emotions, and their influence on decisions. In a very famous example, Johnson, Hershey, Meszaros, and Kunreuther (1993) showed that people were willing to pay more for insurance against “death due to terrorist acts” (the more vivid description) than for insurance against “all possible causes” (the less vivid description). All this points to the fact that an important determinant of integral affective reactions is emotional imagery.

Somatic marker hypothesis

It was shown that emotionally impaired patients who have sustained injuries to the ventromedial prefrontal cortex (vmPFC), which is a key area of the brain for integrating emotion and cognition, could not reach beneficial decisions on a specific type of task. This was the Iowa Gambling Task (IGT) where participants with vmPFC damage, repeatedly selected riskier financial options over safer ones, despite their cognitive understanding of the sub-optimality of their choices (Bechara, 1997; Damasio, 1994). Physiological measures of galvanic skin response suggested that these participants behave in this way because they do not experience the emotional signals – or somatic markers – that lead normal decision makers to

have a reasonable fear towards options that were high in risk. The somatic marker hypothesis can be regarded as a theory of anticipatory affect and it suggests that emotions may attach to actions and that those emotions may predict decision making. Thus, one of the central features of this theory is that emotion-related signals (i.e. somatic markers), which are indexed changes in the visceral state, such as changes in heart rate, blood pressure, gut motility, and glandular secretion, assist cognitive processing in implementing decisions (Reimann & Bechara, 2010). Damasio's work on the somatic marker hypothesis is also a prime example of how emotions can impact choice directly (i.e. without any mediation from more cognitive aspects of the decision). However, it is not without its critiques. For instance, Maia and McClelland (2004) claim that somatic markers are not really needed for decision making and that participants had more knowledge about the IGT than it has been presumed in the original papers. For other critiques see Dunn, Dalgleish, and Lawrence (2006)⁹.

Risk as feelings and the affect heuristic

Mental imagery and integral affective reactions have converged in approaches that initially investigated the relationship between affect and risk. It is generally thought that people perceive and act on risk in two fundamentally different ways. One more cognitive or rational and the other more affective and emotional. This extends to a classic “two modes of thinking” type of formatting that is exemplified in dual-process theories of information processing (e.g. Evans & Stanovich, 2013). The differentiation is that there is a fast, intuitive, and experiential *System 1* and a slower, more deliberative, and rational *System 2* (Kahneman, 2011). One of the main characteristics of the experiential system is its affective basis. Furthermore, reliance on affect and emotion is a quicker, easier, and more efficient way to navigate in a complex, uncertain, and sometimes dangerous world. In the early 2000s, researchers started to

⁹ So far though, the critiques have been sporadic and not very focused, leading to the endurance of the somatic marker hypothesis, at least in the type of task that the theory was usually applied to (Bechara, Damasio, Tranel, & Damasio, 2005). Recently however, when the task changed (i.e. using a balloon analogue task (Lejuez et al., 2002), instead of the IGT), authors could not find evidence to support the somatic marker hypothesis (Wright & Rakow, 2017).

increasingly think about how affective reactions can impact people's assessments of risk resulting in the development of two very popular approaches: the risk as feelings hypothesis (Loewenstein et al., 2001) and the affect heuristic (Finucane, Alhakami, Slovic, & Johnson, 2000).

Evidence of risk as feelings was present in early studies of risk perception (Lichtenstein, Slovic, Fischhoff, Layman, & Combs, 1978). The studies showed that feelings of dread were the major determinants of public perception and acceptance of risk for a wide range of hazards. The main assumption of the risk as feelings hypothesis is that responses to risky situations¹⁰ result in part from direct (i.e. not cortically mediated) emotional influences, including feelings such as worry, fear, dread, or anxiety. Usually, people are assumed to evaluate risky alternatives at a cognitive level, as in classic models of JDM. This means that risky evaluations are based largely on probability and desirability of associated consequences. However, the risk as feelings hypothesis proposes that feeling states respond to factors, such as the immediacy of a risk and also respond to probabilities and outcome values, in ways that are different from how these values enter into cognitive evaluations. Because of this, Loewenstein and colleagues (2001) argue that emotional reactions to risks can diverge from cognitive evaluations of the same risks.

The affect heuristic takes a similar approach to the impact of emotions on risk and judgment. Unlike the risk as feelings hypothesis though, in the affect heuristic, the affect can have an indirect role. For instance, a person's feelings about a certain risk can change how that person thinks how likely that risk is to apply to them. The idea stems from an initially glanced over finding. While risk and benefit tend to be positively correlated in the real world (i.e. the riskier something is, the more beneficial it usually is), in people's minds, they are usually negatively correlated. This significance of this was fully realized once it was made clear that this inverse relationship was linked to the strength of positive and negative affect associated

¹⁰ The hypothesis does not, however, relate only to situations of risk. As Loewenstein et al. (2001, p. 281) state in their discussion of the risk as feelings hypothesis: "Although the focus of this article has been on choices under risk, the basic theme can be applied to any type of decision, whether it involves risk or not."

with that activity (Alhakami & Slovic, 1994). This essentially implies that if people's feelings toward an activity are favorable, they tend to judge the risk as low and the benefits as high. Conversely, if the feelings toward an activity are unfavorable, people tend to judge the risks as high and the benefits as low (Finucane et al., 2000). The affect heuristic has expanded from these early findings, but it is plagued by very vague language used to explain it. For instance, Slovic, Peters, Finucane, and MacGregor (2005) argue that feelings that become salient in a judgment or decision depend on a multitude of characteristics of the individual and the decision situation. Individuals differ in the way they react affectively and in their tendency to rely on experiential thinking (Gasper & Clore, 1998; Peters & Slovic, 2000). They further go on to say that decision situations differ regarding their evaluability i.e. their affective salience (Hsee et al., 1999). These differences result in the affective qualities of a stimulus image to be "mapped". It is then proposed that an individual's "affect pool" contains all of the positive and negative markers associated (consciously or unconsciously) with the images. People then consult or "sense" the affect pool in the process of making a decision. Finally, they suggest that using an overall, readily available affective impression can be easier and more efficient than weighing the pros and cons of various reasons or retrieving relevant examples from memory.

Little thought, however, is given to what constitutes the "affect pool" and how people "sense" it in the process of making judgments. Nevertheless, the story behind the affect heuristic, like the concept itself, makes intuitive sense. A lot of findings have been presented as being in line with this type of affective reasoning. For instance, Denes-Raj and Epstein (1994) showed that, when people were offered a chance to win \$1 by drawing a red jelly bean from an urn, they often chose to draw from a bowl that contained the greater absolute number, but smaller proportion, of red beans (e.g. 7 in 100) than from a bowl with fewer red beans, but a better objective probability of winning (e.g. 1 in 10). Inconsistent with rational choice, Denes-Raj and Epstein suggested that their participants simply felt more positive towards the bigger bowl and thus decided to pick it. Similarly, Slovic, Monahan, and MacGregor (2000) questioned seasoned forensic psychologists and clinicians about various likelihoods that a

certain patient would commit a violent act after being discharged from the hospital. Interestingly, when the patient's risk of violence was described in terms of frequencies (e.g. of every 100 patients similar to Mr. Jones, 10 are estimated to commit an act of violence) rather than as percentages (e.g., a 10% chance of committing an act of violence), more refused to discharge Mr. Jones. The idea is that the representations of risk in terms of frequencies led the clinicians to imagine frightened images of violent patients and these affect laden images likely induced a greater perception of risk. The affect heuristic has further been implicated in simple gamble studies (Bateman, Dent, Peters, Slovic, & Starmer, 2007) as well as morality judgments and estimates of prosocial behavior (Slovic, Finucane, Peters, & Macgregor, 2010).

Integral affect and affective reactions seem to also have a peculiar effect on the way people comprehend probabilities. This is most clearly presented by Sunstein and Llewellyn (2003) in a paper where they argue that people's emotional reactions are the main reason people fear terrorist attacks so much, even though the probability of such attacks happening are minimal. Rottenstreich and Hsee (2001) further demonstrated that decision makers react strongly to a small probability of a highly affective event (i.e. they value the event highly), but they are insensitive to increases in that probability (i.e. its evaluation is not much higher, despite its greater probability). Their participants were willing to pay almost as much for a 1% chance, as a 99% or 100% chance to receive an affect-rich outcome (e.g. meet and kiss your favorite movie star). All the while, they would pay substantially less for the small possibility versus the large possibility of a relatively affect-poor outcome (e.g. \$50 in cash). Thus, in the affect-poor outcome, people were sensitive to the probability of the outcome, whereas for the affect-rich outcome, they were not. This insensitivity is in line with the risk as feelings hypothesis. As Loewenstein et al. (2001) have noted, one's images and feelings toward winning the lottery are likely to be similar whether the probability of winning is 1 in 10 million or 1 in 10 thousand. This also raises questions about probability-outcome independence, one of the fundamental implications of prospect theory. By positing separate functions for the evaluation of outcomes and probabilities, prospect theory assumes that the impact of a given probability is a function

of that probability but not the outcome to which it is attached. In contrast, what the paper from Rottenstreich and Hsee (2001) seems to suggest is that this probability-outcome independence does not hold true for outcomes that have different affective valuations.

Similarity of approaches related to integral affect

Looking at some of these approaches, it is noticeable that they overlap in a few ways. This insight is not something new. For instance, Lowenstein and his colleagues addresses this in a general sense: “The risk as feelings hypothesis is similar to the somatic marker hypothesis, the affect as information perspective, and the affect heuristic in drawing attention to the important role played by affect in decision making...” (Leowenstein et al., 2001, p. 270). Attempts at differentiation can be stretched quite thin and be highly technical. The difference between the risk as feelings hypothesis and the affect heuristic is based on a complicated argument relating to the direct vs. indirect impact of affect. In addition to this, the risk as feelings hypothesis is, conceptually, similar to the somatic marker hypothesis. However, the proponents of the somatic marker hypothesis also present minute differences. Their main argument being that the risk as feelings concept does not go into detailing the different roles played by diverse brain regions (Reimann & Bechara, 2010). Interestingly, the affect heuristic and the how do I feel about it heuristic are similar as well, although they do differ in the type of emotion that they model. The affect heuristic deals more with integral affective influences while the how do I feel about it heuristic is related more to incidental influences. However, once this is taken into account, the approaches are conceptually basically the same in their proposition.

Conclusion on approaches related to integral emotions. Integral emotions have produced popular approaches that remain in use to this day, almost in an unchanged manner. From the somatic marker hypothesis, which has left an impact, both on psychology and neuroscience, to the risk as feelings hypothesis and the affect heuristic which have taken a closer look at risk, these approaches can be applied to a lot of different situations of affective impact on JDM. However, one key limitation is that a lot of these approaches are overtly very similar,

and there has not been a lot work dedicated to extending and enriching some of the theoretical propositions.

Concluding remarks on theoretical approaches to EJDM

Despite the relative recency in studying the impact of emotions on JDM, several high-profile theoretical approaches have been proposed in the literature. These can most easily be differentiated according to the type of emotion that they focus on. For instance, the mood as information perspective is related to incidental influences (mood specifically), as is the appraisal tendency framework (the ATF relates to specific emotions rather than diffuse moods). Somatic marker hypothesis, the affect heuristic, and the risk as feelings hypothesis, on the other hand, relate to integral and anticipatory types of emotions, while decision affect theory and regret/disappointment theory relate to post-decision emotions. The theoretical approaches have provided suitable backdrops for some seminal findings in the EJDM literature.

However, most often than not, the various approaches are presented in isolation (i.e. without much reflection on other theories). It means that they are still characterized by diffusive, often vague positions, and that they share considerable similarities with other theoretical approaches (cf. Volz & Hertwig, 2016). These similarities are most visible for the approaches that relate to integral affective influences. Additionally, there is even similarity among theories that subscribe to integral and incidental affective influences. For instance, the affect heuristic and the how do I feel about it heuristic are overtly similar in some of their procedural propositions. Future research should therefore be aware of the similarities between the theoretical approaches, and EJDM researchers should push towards a more unified field perspective - one where theoretical approaches should be pitted against each other, and where it would be of significant interest to develop a strong and useful general theory of EJDM. As it stands now, the various theoretical approaches lack precision. The affect heuristic for instance, uses language that is beautifully vague allowing it to pretty much explain (away) every affective phenomenon that an empirical finding is presenting. Thus, as Fiedler (2004) has remarked, theories should be formulated in precise terms, controversies should be the rule rather than the

exception, and empirical constraints derived from theories, their domains, and boundary conditions, should be explicit, and commonly shared.

With the end of this chapter, the reader should have a better sense of where the EJDM field stands, what are some of the conceptual issues related to definitions of emotional qualities and types of emotion (Chapter 2) and what are the various theoretical approaches that the field relies upon (Chapter 3). In the next chapter, I will take a closer look at the two topics that are the main interest of this thesis.

Chapter 4

Main Topics – Extending the EJDM Literature

As presented in the introductory section, this thesis concentrates on two topics within the EJDM field. The first topic concerns the impact of multiple affective reactions on the decision, while the second topic concerns the mechanisms (i.e. mediators) of the affect-decision relationship. Importantly, these two topics (in particular the first one) have received, scarce, if any, attention in the previous literature on emotion and decision making. The main goal of this chapter is to extend, in much more detail, the rationale of why I have based my thesis on these two topics. Specifically, the attention in the following paragraphs will be on the background of the topics, on identifying potential reasons for why the topics have been disregarded thus far, and looking at how the previous literature informs these research areas. Finally, in the process of presenting these two topics, I will heavily rely on terms, definitions, and categorizations mentioned previously, specifically in Chapters 2 and 3. At the end of this chapter, the reader should get a sense of the main contribution this research will be making and how it is aimed at extending knowledge in the EJDM field.

Multiple Affective Reactions and Decision Making – Topic 1

Imagine a person that is deciding what to order in a restaurant. The waiter has just told them that they serve this person's favorite dish. As a result, the person has just received an induction of positive integral affect. Closely after that, the person is given a menu in order to continue their order. However, the menu is old and a bit greasy from constant use. As a result of this event, the person has received an induction of negative integral affect. In the scenario, the individual has to make a decision while confronted with two different affective reactions of differing valence. Several questions and assumptions can be made. For instance, will both of the affective reactions have an impact on the decision? The later negative affective reaction could diminish the first positive one, resulting in an overall less pleasant affective reaction, which could impact the decision? However, maybe only one of the affective reactions will

actually impact the decision? The person could conceivably only rely on a single affective reaction to serve as a guide for their decision? The former example might be quite glib so let's think of a more applicative one, from a different decision domain. For instance, imagine a person that could be deciding how much money they are willing to spend for a certain activity. The activity is described as consisting of a task that the person must perform (i.e. a decisional action) and a reward that the person can win (a potential outcome). Imagine that the task is such that it evokes a less pleasant integral affective reaction and that the reward is such that it evokes a pleasant integral affective reaction. There is no other explicit information given about the properties of the activity and again, in this scenario as well, the person is confronted with two different affective reactions of differing valence and they have to make a decision. The same questions and assumptions apply. Will both the task and the reward affectivity impact the decision, indicating a type of (affective) combination of the two affective reactions, or will one observe a different process? We know that people rely on affective cues to make decisions (e.g. Slovic et al., 2010; Kahneman, 2011), however, since there are multiple affective cues active at the same time, we do not know in what way affect will impact the person's decision in these examples. Crucially, in both of these examples, the two affective reactions stem from targets that are relevant to the decision, making the evoked affective reaction integral. Thus, the evoked affect is relevant for choice and is not in the background (i.e. it is not incidental).

These and many other examples can be made, which epitomize instances where a decision situation might evoke two, or even more, affective reactions. And yet, while there is plenty of research devoted to showing how a single affective reaction impacts the decision (indeed, pretty much all the examples provided in the previous chapter, in relation to the theoretical approaches have manipulated a single affective reaction and looked at its impact on the decision), unexpectedly, there is a noticeable lack of research concerned with how two or more affective reactions would impact the decision.

The focus on immediate integral affect

It is necessary to focalize our approach. This is prudent at least in these initial efforts aimed at looking at the combination of affective reactions since there are many possible ways in which emotions can enter into decision making (cf. types of emotion in Chapter 2). Specifically, the type of affect manipulated in the empirical section of this thesis will be integral. More precisely, an attempt will be made to demonstrate and elucidate the combination for multiple *immediate integral* (i.e. related to the decision) affective reactions. I focus on integral affect primarily because of its direct relation to the decision. By definition, integral affect is elicited by perceiving the decision target or with a mental representation of the decision target, i.e. whether it is a feeling due to exposure, representation, or internal generation (Slovic et al., 2010; Cohen et al., 2008). Because of this, one could argue that it is more important for decision making than other types of affect (e.g. incidental). Integral affect arises from the decision at hand and it strongly and routinely shapes decision making (Damasio, 1994; Greene & Haidt, 2002). For instance, integral affect helps us categorize experiences along a good-bad dimension (Kahneman, Wakker, & Sarin, 1997). Furthermore, the primary function, usually attributed to these integral reactions, is to guide adaptive approach-avoidance actions as well as, collaterally, to winnow down large choice sets into smaller numbers of options for a better evaluation (Hastie, 2001). Additionally, research in decision making suggests that integral affect plays, not only a key role in choice, but also may be the common currency used to allocate value to decision options (Peters, Lipkus, & Diefenbach, 2006). Integral affective reactions are, in addition, far more readily accessible when making decisions than other types of emotion. For instance, Verplanken, Hofstee, and Janssen (1998), demonstrated that participants responded more rapidly to their integral feelings about attitude objects, than their cognitive thoughts about attitude objects. Similarly, Ortony, Clore, and Collins (1988, p. 156) classify integral affective responses as “more immediate, more spontaneous, and less affected by accessible cognitive processes than almost all of the other emotions.”

Compare this, in contrast, to incidental affect, which is usually described as “background” affect (Volz & Hertwig, 2016). In keeping with this, Waters (2008) suggests that integral affect influences risk judgments in a direct way, while incidental affect influences risk judgments in an indirect way. Västfjäll et al. (2016) even argue that when integral affect is activated and strong, incidental affect has little possibility to influence the overall affective reaction. Initial support for this has been found in a study by Västfjäll, Peters, and Slovic (2008). In the study, participants were first introduced to negative or positive mood (i.e. incidental affect) and were then asked to donate money either to a target which should have elicited intense integral affect, or to a target which elicited less intense integral affect. The results showed that positive mood participants donated more than negative mood participants, but only when the target elicited less intense integral affect. Therefore, because of its immediacy and relevance for the decision, the focus in this thesis will be on integral affect.

The combination of affect in decision making

There have been hints in theoretical papers that researchers should take a closer look at the combination of affect and emotion. Neumann, Seibt, and Strack (2001, p. 727) have suggested that “...whenever a new affective stimulus is encountered, the resulting affective feeling is a function of the valence and intensity of the feelings present at the time of the encounter, and the valence and intensity of the affective feeling elicited by the new stimulus.” Bechara (2011, p. 88) also wrote that: “The effectiveness of the emotion integral to the decision-making process depends on the strength of the unrelated emotion that exists in the background.” One could also argue that some economic models, which take the “more is always better” approach, have implicitly been suggesting affective combination. For instance, a stalwart assumption that follows from an economics approach is that the addition of a positively valenced stimulus to a context that is already positively valenced, *should* increase approach and preference tendencies for that stimulus, i.e. more goods is always better (Hull, 1943; Young, 1936). Even in Bentham’s terms, individuals are predicted to choose the option with the highest

overall utility, where utility is conceptualized as being positively related to the number of positive outcomes (Bentham, 1879).

Researchers were therefore thinking in terms of affective combination, but to date, the question itself has not been properly tested and developed. It also needs to be said that, fairly recently, Västfjäll et al. (2016), in a theoretical review paper, have proposed, anew, that researchers should take a look at this combination and have similarly dubbed this proposition as the “arithmetic of affect”, paving the way for more extensive future research. Although, they mostly focus on the interaction that integral and incidental affect might exhibit. Besides these theoretical suggestions, the question of affective combination has not received a lot of attention amongst EJDM researchers. This lack of attention, in the decision-making domain, in my opinion, represents a serious gap in the literature. To be more precise, not looking at whether and how affective reactions can combine to impact the decision, neglects several important factors that relate to decision making. Specifically:

i) As mentioned above, given the many forms with which emotions can enter into decision making (i.e. types of emotion), there are many possible avenues in which a combination could arise. Just looking at integral affect, two immediate integral affective reactions could combine, or, an immediate and an expected affective reaction could also combine. This multitude of possible ways in which combination could arise makes it a vital research direction.

ii) It is justified to think that multiple affective sources are present when making a decision. Decision situations consist of multiple stimuli and Slovic et al. (2005) suggest that salient qualities of both real and imagined decision stimuli evoke images which are tagged with affect. Additionally, some form of core affect is always present, and is thus implicated in processes ranging from the acquisition of preferences to influencing complex decision making (Russell, 2003; Winkielman, Berridge, & Willbarger, 2005). In addition, Trampe, Quoidbach, and Taquet (2015), by tracking emotions in everyday life using a smartphone application, have also found that emotions are ubiquitous in everyday life and that multiple emotions can exist

together and distinctly in a number of decision making situations. Finally, it has been proposed that most decision options under consideration evoke some affect, although to different degrees (Dhar & Wertenbroch, 2000).

iii) Since there can conceivably be many affective sources in a decision-making situation, this can have a strong impact on the decision. It is well known that affect is a powerful cue for many important factors relevant to making a decision, factors like value, liking, or taste (Leiserowitz, 2006; Rottenstreich & Hsee, 2001; Van't Wout, Kahn, Sanfey, & Aleman, 2006). Thus, multiple affective reactions could impact a higher number of factors which are relevant for the decision. Furthermore, research has shown that emotion allows decision makers to compare and integrate values for multiple, diverse factors (Cabanac, 1992). Therefore, multiple affective sources, in combination, could impact decision factors more strongly, efficiently, and directly.

iv) Finally, researching the presence of multiple sources of affect could reflect a more ecological (i.e. real-life) picture of situations in which people usually make decisions, compared to situations in the lab, where only a single affective manipulation is present. In the “real-world”, one would be hard pressed to isolate situations where only a single information source is present that could pose a significant impact on the decision. Decision situations are complex and they consist of multiple pieces of information, which could conceivably be tinged with affect (Goldstein & Hogarth, 1997; Luce & Raiffa, 1957).

Lack of research on combination

One reason for a lack of research in affective combination may be because studies on the impact of emotions on JDM have usually stuck to a very simple but effective formula, i.e., manipulate *one* affective reaction and look at the effect on the decision. This may partly be out of simple convenience. Smaller and stricter manipulation designs are easier to interpret if one is interested in obtaining a curious effect. For instance, one only manipulates the emotion of hope and later observes a clear effect on the decision (e.g. that more hopeful individuals are less risk seeking; Reimann et al., 2014). Manipulating two or more affective reactions would

require a more complex design, making sure that two (or more), not one manipulation check(s) are successful (i.e. that multiple affective reactions have been induced), and controlling for order and contrast effects.

Another reason may be related to the confusion concerning the definitions of the emotional qualities and the lack of consensus on types of emotion (cf. Chapter 2). One possible way of looking at combination could have been to observe the impact of incidental on integral affect (or vice versa), but due to the lack of clear demarcations and definitions, most authors have had a loose approach to these issues. For instance, there are examples where authors would manipulate mood in one experiment and integral affect in the second, speaking as if they were one and the same type of affective reaction (e.g. Pham & Avnet, 2009). Additionally, as Västfjäll et al. (2016, p. 2) observe: “Research on integral and incidental affect has been separate with integral affect research seldom considering participants’ incidental mood states.” As a result of this omission, EJDM research could have indirectly been held in the dark when it comes to studying affective combination. There are some exceptions to this, as some authors did look at both integral and incidental emotions at the same time, but none of these exceptions are experimental in nature. For instance, Peters and Slovic (2000) measured mood both before and after a card game task with gains and losses, which could evoke integral affective reactions (similar to the Iowa Gambling Task in the somatic marker hypothesis). Their main finding was that self-report measures of affective reactivity, administered 2 to 8 weeks earlier in pre-screening sessions, related in predicted ways to choices in a laboratory task. They failed to take into account the integral affective reactions which might have been evoked by the game card task. In a similar fashion, Västfjäll, Gärling, and Kleiner (2004) had their participants fill in a mood measure (incidental emotion) and afterwards they were exposed to descriptions of affect-eliciting situations (integral emotion) with their task being to describe how they anticipated they would feel in each of the situations. They found that current mood, prior to experiencing emotional reactions, affects preference for these reactions, but there was again somewhat of a

failure to consider the two types of emotion together i.e. what their combined impact might have been.

Looking at previous literature - speaking of combination where none is found

Looking at some previous empirical work, one can find examples where people have indirectly been arguing that a type of affective combination was occurring. Primarily, this argument is focused on work in preference reversals in a joint vs. separate evaluation paradigm. Even Vastfjall et al. (2016), who, most recently, have suggested that researchers should look into the arithmetic of affect, mention this type of work as an example where a combination of affect could be implied. One might then ask themselves, why are we looking at the possibility of affective combination, if it has already been shown? As you will see, I argue that these studies are not actually examples of combination because of several limitations.

I will first provide a prototypical example of this research paradigm. This one example extends to other similar findings in this paradigm. For instance, relying on evaluability theory, (Hsee, 1996a) observed a preference reversal in willingness to pay for two consumer products. Participants were asked to assume that they were a music major looking for a music dictionary in a used book store. They were provided information about, and indicated their willingness to pay, for either both, or one of the following dictionaries: 1) a dictionary with 20.000 entries with a torn cover, otherwise new, and 2) a dictionary with 10.000 entries and new. When participants looked at the dictionaries together (i.e. in joint evaluation), dictionary 1 received higher willingness to pay. When the two dictionaries were viewed separately (i.e. one person viewed dictionary 1, and another person viewed dictionary 2), it was dictionary 2 that received higher willingness to pay. One could then argue that the fairly unpleasant information about the torn cover has somehow diminished the overall value of dictionary 1 in separate evaluation, indicating a possible combination. However, one would be hard pressed to talk about combination in this instance¹¹ because of several limitations. *Limitation 1:* The results are more

¹¹ The example in Vastfjall et al. (2016) is similar and I provide it here verbatim: “Hsee et al. (1999) asked respondents to state the amount they were willing to pay to purchase each of two

easily explained with the evaluation hypothesis. In separate evaluation, most participants would not know how to evaluate the desirability of a dictionary with 20.000 (or 10.000) entries, i.e. they do not know if 20.000 entries is something positive or not. It could, for instance, be that this number is really low for a music dictionary. In contrast, even without something to compare it to, people would find a defective dictionary unappealing and a new one more appealing. Thus, it is not so much that people were combining, they were simply ignoring one piece of information. *Limitation 2:* Furthermore, participants could have simply been focusing on the negative piece of information, since negative values usually have a stronger impact on evaluation than positive ones, i.e. the negativity bias (Ito, Larsen, Smith, & Cacioppo, 1998; Rozin & Royzman, 2001). Thus, since there was no negative information associated with dictionary 2, people evaluated it more highly. *Limitation 3:* One cannot be sure if there was any involvement of affect, since it was neither measured, nor presumed to be involved, in any of such paradigms. Therefore, speaking of *affective* combination is purely speculative. *Limitation 4:* There was also no comparative condition which could provide an actual test of combination. More specifically, the comparison was between a condition where two pieces of information were present i.e. dictionary 1, and a condition where one piece of information was present, i.e. dictionary 2. A more relevant test of combination would be to compare conditions with the same number of pieces of information that varied in their affective quality. Presented as such, the results of these paradigms just show that two pieces of information are evaluated differently (i.e. less valuable) than one piece of information. A likely explanation for this is the phenomenon of “bundling” in economics. A number of studies have shown that people would pay less for items valued as a unit because bundled items are often less expensive than those that are sold separately (Guiltinan, 1987; Schmalensee, 1984; Soman & Gourville, 2001).

sets of dinnerware. Set S contained 24 pieces, all in good condition. Set J contained all of the same pieces plus 8 more, all in good condition, along with 16 other pieces that were broken (40 total). In single (separate) evaluation, respondents were willing to pay more for set S, though it was the inferior option, apparently devalued by the broken pieces. But in joint (side-by-side) evaluation, respondents were willing to pay more for Set J. Thus, in separate evaluation, negative affect appears to reduce positive affect through averaging.”

Limitation 5: Finally, any remarks about combination do not hold since in the joint condition, people did prefer dictionary 1 compared to 2. Had the negative information (i.e. torn cover) actually combined with the positive information (i.e. 20.000 words) and lead to lower valuations, we would expect that people would still pay less for dictionary 1.

There are other forms of the same study used in the example above, all in the joint vs. separate paradigm (Kralik, Xu, Knight, Khan, & Levine, 2012; Yadav, 1994), all pointing to the same thing (see Hsee et al., 1999 for a review). However, they all fall prey to the same limitations because of which one cannot reasonably talk about affective combination. A more relevant example can be found in one study in the prosocial domain that indirectly addressed limitation 3 because there was actually a measure affect. Västfjäll, Slovic, and Mayorga (2015) used the same logic as in the joint vs. separate evaluation paradigm, and showed that donors pay attention not only to relevant information (children who can be helped), but also incorporate feelings from normatively irrelevant information (e.g. children who cannot be helped) when the information is brought to their attention. One group of participants saw a picture of a child that can be helped, while another group of participants saw that same photo, alongside several photos of children that cannot be helped. Ratings of “warm glow” - a good feeling associated with giving aid - were higher when only one child was presented. They propose that the irrelevant negative feelings associated with those not able to be helped appeared to blend with the good feelings for those who can be helped. However, this study only deals with Limitation 3 from the previous example (i.e. affect was measured) and all the other limitations are still present alongside some others, making us doubt that combination was observed. The results are again more easily explained by the evaluation hypothesis, there is a danger of a negativity bias being followed, and there was again no comparable condition also with another piece of information. In addition to those previous limitations, there was also no measure of actual donation (i.e. decision behavior), the dependent variable was a measure of “warm glow” - a good feeling associated with giving aid. Thus, we do not know if this diminished warm glow would have any effect on the donation. Additionally, participants were explicitly told that some

children cannot be helped¹² and were then asked to report their warm glow. Thus, it could be that participants were simply responding as expected to this situation, thinking that there were obviously children that cannot be helped, therefore I should not feel that good about helping.

Previous examples, therefore, while on the surface seem to indicate a type of combination of affect, when looked at closely, cannot convincingly be said to demonstrate it. Most of the rhetoric so far, in presenting Topic 1, has been implicitly geared towards the possibility that a combined impact of affect is supposed to be observed when multiple affective reactions are present. However, it is also necessary to entertain the option, that a combined impact may not, in fact, be observed. In that regard, there are several features that justify this assumption. As we know, integral affect is a powerful cue for many important factors relevant to making a decision. These factors including valuation, liking, or taste (Leiserowitz, 2006; Rottenstreich & Hsee, 2001). It is conceivable to hypothesize that dependent on the source in the decision situation, one integral affective reaction will have more weight than a different one. For instance, if one integral affective reaction is associated with the factor of valuation, compared to a different one, which is associated with a less important factor, participants should rely only on the affective reaction associated with the more important factor. Thus, we would not observe a combined impact on the decision. Additionally, if for instance, as in the “how do I feel about this” heuristic (Schwarz & Clore, 2003), people consult their feelings to make their decision, and one integral affective reaction is more relevant as an informational guide to the decision process, then one might expect that the second integral affective reaction will be ignored, thus leading to no combination. Furthermore, integral affect can also serve as a “spotlight” (Nabi, 2003; Peters, Västfjäll, Gärling, & Slovic, 2006) in that an affective reaction could focus the decision maker on new information and this new information (rather than the

¹² Here are the instructions from the study (emphasis mine): “These are seven children in need of aid. The child on the left, Ofelo, is facing starvation and is in immediate need of food. The six children on the right are facing ill health from waterborne diseases and are in immediate need of clean water and medicines. Suppose that you are now given the opportunity to donate money to a trusted aid organization to help Ofelo (the child on the left). *Unfortunately, you can only help Ofelo and not the other children, for whom aid may not be available.*”

feeling) is used to guide the judgment. Again, this could also lead to non-combination since one affective reaction could “spotlight” the decision maker to new information, leading them, in the process, of disregarding the other affective reaction. Thus, there is also reason to believe that a combination between multiple integral affective reactions is not possible.

With conflicting accounts in the literature and some shaky assumptions about previous observations of combination, the main contribution of this research lies in an attempt: first, to directly look at the possibility of affective combination in a decision setup akin to a JDM setting (i.e. the task-reward situation), second, to address several limitations of previous studies that have been used as examples of combination (i.e. directly manipulate and measure affect), third, to compare adequate conditions to indicate differences, if any, in combination (e.g. comparing a ++ condition with a +- or a -- condition), and fourth, to look directly at combination in a JDM context by actually requiring participants to make a decision.

Arithmetic of affect

The “arithmetic” part refers to the assumption that if a combined impact of affect on the decision is observed, that this combination should follow some basic set of rules. For instance, a form of arithmetic is averaging and it could be that emotional reactions combine in a form of averaging, thus describing the combination rule. A pleasant and a less pleasant affective reaction might result in a moderate affective reaction, compared to when two pleasant affective reactions combine. Another possible arithmetic is addition, or the combination rule might be better described by some curious contrast effects. For instance, it might depend which affective reaction is the strongest. These rules (i.e. this arithmetic) need to be elucidated in researching the combination.

Thinking that affective reactions would combine using some set of arithmetic rules is not that unusual. A combination of stimuli in the form of rules has been looked at in many other fields in psychology. For instance, research in “cognitive algebra” suggests that many cognitive processes are expected to follow simple algebraic rules (Anderson, 1979). Additionally, sensory psychologists, for instance, also refer to the summation of loudness, or brightness (Birbaum

& Elmasian, 1977). In the following section I will present several potential arithmetic rules that could describe the combination of affective reactions.

Averaging

Taking a look at the literature, there are indications, using other types of stimuli (that may or may not have been tinged with affect), that combination happens through some form of an averaging arithmetic. In the domain of social psychology, specifically, in impression formation research, relying on the integration theory, it has been shown that adding information that is moderately desirable to information that is highly desirable, leads to less positive judgments and evaluations (Anderson, 1981; Weaver, Garcia, & Schwarz, 2012). For instance, Anderson (1965) found that a set of two moderate and two extreme adjectives produces a less extreme response than the set of 2 extreme adjectives alone. The results are therefore inconsistent with the fact that subjects form their impression by adding the stimulus values. It is more consistent with the fact that they average the stimulus values. In fact, the evidence in the early stimulus combination literature leans quite heavily to the averaging rule. Anderson (1974) states that in virtually every case the integration process has been shown to follow an averaging, rather than an adding rule. Some indication of averaging that actually has an affective quality has been observed in the work on life events. For instance, Seta, Haire, and Seta (2008) have obtained results showing that individuals responded to the average level of positivity and preferred less (versus more) positive events, supporting the averaging model of life event integration.

Addition

The adding-type process does undoubtedly occur in some tasks and is based on finding parallelism in the data (e.g. imagine two lines in parallel on a graph indicating two main effects in a factorial design). Essentially, it means that there should not be a significant interaction (Anderson, 1979). For instance, Leon, Oden, and Anderson (1973) did a study where children and adults were asked to judge the naughtiness of a child who threw a stone in multiple story versions. In each story, the child's intentions differed (malice, aggression, or accident) and the

amount of damage differed. The data, both for children and adults, indicated parallelism, which suggests an additive rule in moral judgments: naughtiness = intent + damage. Another example is Shanteau (1970), who tested the additive model in a sequential decision-making task. The participants in his study were shown sequences of red and white lights and after each successive light they either estimated the proportion of white lights in the population (estimation), or they judged the probability that the population contained more white than red (inference). The results of their judgments supported addition with the data representation favoring parallelism (i.e. no interaction between estimation and inference). Related more to the affective domain, Neumann et al. (2001), for instance, suggested that congruent valences should add together, whereas incongruent valences should cancel out. They named this the additivity-of-affect hypothesis suggesting the combination of affect can also occur in the form of an adding arithmetic.

Multiplication

The multiplying model predicts that the data would observe a linear fan pattern with diverging straight lines. Shanteau (1974) showed that when subjects were asked to judge the worth of a lottery tickets that had the probability of winning a certain object marked on them, with each data point representing the subject's judged value, the data followed a linear fan pattern. Similarly, Oden (1977) had subjects judge the truth value of compound statements that either or both of two winged creatures was a bird. The answer requires that the truth value of the two components in each pair be integrated to form the truth value of the compound. Again, there was a linear fan pattern which suggested a multiplying rule. However, it is worth mentioning that the relevance of the multiplying model, even though it has some empirical support, is debatable. Indeed, the multiplying model has been described only as an "*as if*" model, with a closer conceptual analysis indicating that the underlying psychological processes do not actually involve any multiplication (Anderson, 1979).

Alternative arithmetic perspectives

A number of other perspectives have been proposed in situations where there are multiple stimuli that vary in their pattern, affect, and presentation. These perspectives are not

arithmetic rules per se, but can be considered plausible patterns, or rules, in situations of combination. For instance, the “*peak-end rule*” (Fredrickson & Kahneman, 1993) states that the global affective response to a particular event is a combination of the peak level of affect experienced, as well as of the affect encountered in the last portion of the event. Kahneman and colleagues have shown that participants often neglect the duration of a situation and concentrate on the episode’s peak and end intensities. So, for example, a very negative situation may be perceived as more negative when it ends abruptly than when it lasts longer and the additional duration is only moderately negative (Fredrickson, Kahneman, Hayes, & Knopoff, 1993; Redelmeier & Kahneman, 1996). Additionally, Chowdhury, Olsen, and Pracejus (2008) found that when an advertisement contained several positive images, the most extreme image determined the overall response (i.e. how the ad was evaluated). Another type of perspective would be *contrast effects*. For instance, Olsen and Pracejus (2004) found that the type of information that people receive at the end of a communication has a strong impact on their reactions to it. Specifically, ending a communication about diabetes on a positive note had a more positive influence on both the positive affect that participants reported and their perceptions of hope, than did ending the communication on a negative note. Interestingly, this contrast effect was not evident when positive information was followed by negative information. These types of contrast effects are prevalent in expectancy-contrast theories (Helson, 1964; Sherif & Sherif, 1967) which imply that an object can be assessed quite differently in isolation than when it is in the context of other objects.

Before I move on to the conclusion, one might be wondering whether the findings from the joint vs. separate evaluation paradigm, which I have critiqued as not actually showing a combination, could be said to demonstrate an averaging type of arithmetic? Going back, they show that the addition of fairly unpleasant piece of information decreased the overall willingness to pay, when combined with a fairly pleasant piece of information. Therefore, one might assume that the participants have somehow averaged their overall impression (e.g. similar findings in Hsee et al., 1999). Noticeably, even Vastfjall et al. (2016) seem to think that

these types of experiments represent averaging. However, again, this type of conclusion cannot be made. This type of result (if one could actually speak of combination, see the limitations mentioned above), i.e. that the overall evaluation is lowered when the negative piece of information is presented alongside the positive piece of information, does not actually distinguish between averaging and addition. This is because the added information is always of negative quality. Thus, no matter if it is addition or averaging, if the negative piece of information (which is evaluated at say a value of “-1”) is presented alongside the positive information (which is evaluated at say a value of “5”), the result would be the same [$(5+(-1))/2 = 2$ and $5+(-1) = 4$], i.e. both of the arithmetic’s would lead to a lower evaluation. Therefore, these experiments cannot be said to provide any additional information on which type of arithmetic, an actual combination of affective reaction, would follow.

Concluding remarks on the combination of affect

The question of affective combination (i.e. whether multiple affective reactions combine to impact the decision) in a decision-making context and the form of arithmetic which this combination espouses, has long been disregarded in EJDM research. While there have been no direct empirical attempts at demonstrating that affective reactions combine, authors did provide hints that such a research stream is possible (e.g. Neimann et al., 2001; Bechara, 2011; Vastfjall et al., 2016). On a different note, some findings claim that a combinatorial impact has been observed. However, these findings are replete with several limitations and ultimately cannot be said to demonstrate combination. In addition, assumptions of non-combination are equally plausible. If, however, a combination is observed, findings from related research on information integration, cognitive decision making, and psychophysics, give solid foundation in speculating that the combination might follow one of the arithmetic rules presented i.e.: averaging, addition, or multiplication (notably though, it is highly unlikely that it follows multiplication since most of the evidence seems to point that this type of rule is more conceptual and does not involve an actual psychological process (Anderson, 1973d)).

While there are many possible ways one can approach the combination of affective reactions, in this thesis, I will focus on immediate integral affect. Specifically, multiple integral affective reactions will be evoked and their potential combination will be probed. This thesis will therefore aim to extend the EJDM literature by attempting to provide a direct empirical test of whether multiple integral affective reactions can combine and impact the decision, elucidating, at the same time, the arithmetic rule that could eventually govern this combination, and whether the combined feelings will have an effect on the decision. Research seems to be disparate and pertinent to different areas, so an attempt will be made to make sense of this interesting topic.

Finally, it is now possible to formulate the main question of Topic 1. Therefore, **Q1**: In decision situations with multiple sources of independent integral affective reactions (say a task and a reward): i) would we observe a combined impact of evoked affective reactions on the decision and, ii) which rule, if any, would this combination follow?

Mechanisms of the Affect-Decision Relationship – Topic 2

Continuing from Topic 1, which concerns multiple affective reactions and affective combination, one can assume that, if a type of (combined) affective reaction is observed, it should have a resulting effect on the decision. The impact of affect on the decision can be epitomized in the “affect-decision relationship” (i.e. the causal pathway that goes from the affective reaction to the decision). Looking at this relationship, we still do not know a lot about its mechanisms. More specifically, we do not know what are the precise mediators of the affective impact on the decision. This has been recognized before, with Volz and Hertwig (2016) arguing that there are many looming questions regarding the processes of this relationship, which remain largely undefined and unexplored. Looking at the previous literature a bit more closely, there are indications of three possible mediating pathways between affect and decision. So far, studies have not opposed all three possible pathways together (i.e. in a multiple mediation model) to see which one is more likely, i.e. which one is a better descriptive fit of the affect-decision relationship.

Pathway 1. The first pathway is that only actually felt affective reactions are a mediator. This thesis' concern is with integral affect and several previous research findings would suggest that the immediate integral affective reaction is the only mediator of the affect-decision relationship. For instance, the somatic marker hypothesis, proposed by Damasio and his colleagues, claims that integral affective reactions act as direct guides for people's decisions – even when people are not consciously aware of these affective reactions (Bechara, 1997; Damasio, 1994). Similar to this, findings from Schlösser, Dunning, and Fetschenhauer (2013) also seem to point to the importance of immediate integral affect. They showed that immediate emotions, related to the action needed to be taken for the decision (e.g. throw a dice in a gamble scenario), making these emotions integral, were an excellent predictor of the decision, compared to anticipated i.e. expected emotions. Additionally, in the risk as feelings hypothesis, Loewenstein et al. (2001) suggest that people's responses to risky situations (including decision making) result in part from direct (i.e. not cortically mediated) emotional influences. Furthermore, several authors proposed that the affect's impact, in general (i.e. not just in decision making situations) is more of a direct cause of behavior (Frijda, 1986; Izard & Ackerman, 2000).

Pathway 2. However, there are also indications that immediate integral affect is not the actual mediator. For instance, the second possible pathway is that expected integral affect, not immediate integral affect is the more important mediator of the affect-decision relationship. People often make decisions based on their prediction of what emotions they will experience (Pollai, Hoelzl, Hahn, & Hahn, 2011) and they try to maximize positive and minimize negative emotions (Loewenstein & Lerner, 2003). To support this assumption, a recent meta-analysis has looked at papers that have found current emotions (another word for immediate felt emotions) as guides for behavior and papers that have found expected emotions as guides for behavior (DeWall, Baumeister, Chester, & Bushman, 2016). Importantly, all the papers have looked at these two types of emotion separately. DeWall and his colleagues found that, of the papers that they looked at, expected emotions were more often significant mediators of the

affect-decision relationship, compared to current emotions. Indeed, 87% of the papers, that they looked at, had expected emotions as a mediator of the affect-decision relationship. However, it is telling that current emotions (as they call them) were also a mediator in several of the papers, which might indicate mixed results concerning the mediators. Additionally, in a recent paper, Charpentier et al. (2016), found that expected emotions were the best predictor in a gambling style choice setup, compared to experienced feelings and monetary value (however, it is important to highlight that they did not actually manipulate affect, they just measured it).

Pathway 3. Finally, there are some indications that the affect-decision relationship is mediated by a multi-step process. What exactly is meant by this? Some authors have suggested that there could be a form of serial mediation happening. For instance, people could experience emotional signals that lead them to re-interpret some other decision attribute, and this decision attribute, in turn, impacts the decision. This would, for instance, mean that the immediate affective reactions that were evoked by a feature or source related to the decision situation, could impact people's interpretations of the situation i.e. it was not immediate affect alone that mediated the relationship, but a series of steps that mediated the relationship. Indications for this have been present in the literature before. For instance, one possibility is that immediate affect impacts expected affect. Bechara et al. (1997) have suggested (although never explicitly tested) that somatic markers (i.e. immediate affective reactions) could lead people to have reasonable expected fear towards options high in risk. Another possibility is that immediate affect changes a cognitive interpretation of the decision. For instance, in the affect heuristic, people's feelings towards certain hazards (e.g. nuclear plants) change the way they see how beneficial vs. risky they are (Finucane et al., 2000). In similar vein, it has been suggested that affective reactions can change how likely people think something is to happen. For instance, an immediate affective reaction could impact subjective probability and cause people to think that they are less (vs. more) likely to be successful in obtaining a particular decision result, leading to less (vs. more) money invested (Loewenstein, 1996; Slovic, Finucane, Peters, & MacGregor, 2004). Rottenstreich and Hsee (2001) found that for affect rich outcomes (e.g. a trip), no amount

of real probability associated with the outcomes was enough to lead participants to change their betting behavior. A final possibility is that immediate affect could impact the interpretation of utility. For instance, Loewenstein, O'Donoghue, and Rabin (2003) found that affect can change the predicted utility for possible decision outcomes. Thus, in a sense, again in a multi-step process, immediate affect impacted the interpretation of utility, which, in turn, impacted the decision.

Theoretical grounding and terminology with the direct vs. indirect impact

The three possible pathways can be incorporated in the theoretical distinction of a *direct* vs. *indirect* impact, provided by Loewenstein and Lerner (2003) - see Chapter 2. Direct impact is one that is *not* mediated by changes in expected affect or in other types of processing. Thus, a direct impact would correspond to the first pathway presented above, where only the immediate integral affective reaction is a mediator of the affect-decision relationship. Indirect effects, on the other hand, are those that are mediated by, for one changes in expected emotions (this would correspond to the second pathway presented above), or two, those that are mediated by changes in the quality and or quantity of information processing (this would correspond to the third pathway, presented above). Thinking of the potential mediating pathways as *direct* vs. *indirect* distinction presents an easily verbalized theoretical grounding and it is worth noticing that Loewenstein and Lerner presented this distinction as early as 2003, but it was not explicitly referenced in other papers thus far.

Concluding remarks on the mechanisms of the affect-decision relationship

There are still a few inconsistencies and unknowns that remain to be elucidated when it comes to the mediators (i.e. the mechanisms) of the affect-decision relationship. On the one hand, it has been clearly shown that affect has an impact on the decision, but, on the other hand, this impact has been explained in three possible ways in the literature thus far. Authors differ in their propositions and previous work has not consistently measured different possible mediators at the same time, thus implicitly introducing confusion into this topic. Therefore, the second topic will aim at elucidating the affect-decision relationship for integral affective

influences. In this thesis, we can test the three possible pathways, in which the affect-decision relationship could transpire, by measuring both immediate and expected affect, as well as other decision attributes that could be impacted, like perceived monetary value or subjective probability (i.e. how likely vs. unlikely people think something is). Then a multiple mediation model could be constructed that could test all three potential pathways at the same time.

Therefore, there are three possible ways in which the affect-decision relationship could be mediated. Given these three possible pathways, a question concerning Topic 2 can be formulated: **Q2:** If and when (combined) affect impacts the decision, i) is this impact mediated by the actual felt immediate reaction, ii) the expected affective reaction, or iii) does the immediate felt affective reaction change a different attribute related to the decision, which, in turn, impacts the decision, in a form of a multi-step mediational process?

The reader should now, hopefully, have a better sense of the two main topics of this thesis. The next chapter will present the eight studies that were conducted in the pursuit of providing the answers to the two main questions in relation to Topic 1 and Topic 2.

Chapter 5

Studies – Empirical Tests of the Two Topics

In this chapter, I will present the empirical studies that were conducted with the general aim of addressing the two questions related to Topics 1 and 2. In order to recap, concerning the first topic, the question has two constituent parts. The first part is to test whether, under more controlled conditions, multiple integral affective reactions would actually combine to impact the decision? This is then inherently connected to verifying, if affective reactions do combine, whether the combination would follow a specific rule? The impact of multiple affective reactions on decision-making has not been looked at before and the track record of previous research on this subject matter is inconsistent. In addition, several limitations of previous work, which has ostensibly claimed to have been related at addressing affective combination, have been identified. For instance, there were no specific verifications of affective activity (i.e. affect was not actually measured), the study designs were not able to actually test (i.e. discern) combination (many confounding explanations are possible including evaluability, negativity bias, and bundling) and finally, their evaluative tasks were not in actual decision contexts (e.g. there was no clear judgmental target, no possible outcome or an inherent probabilistic assumption that comes with decision situations, and in some cases, there was no actual decision to be made). Looking at the potential rule that a combination might follow, previous research in other domains like psychophysics and impression formation has shown that stimuli can be averaged, summed, or multiplied, and there is reason to think that something similar might happen with affective reactions if they are combined. However, it must be said that most studies presenting these arithmetic rules have not directly looked at affective reactions (i.e. there was no rule verification in the affective domain), so the rule of affective combination remains to be identified. Further, in the studies that did concern themselves with arguably affective information (although this was not directly measured), where it was suggested that a type of averaging happens, their results are not interpretable in that way (Hsee et al., 1999; List, 2002).

This is because the second information presented in their paradigms, alongside the first positive information, was always negative. The addition of a negative piece of information would lead to lower evaluations no matter if the rule was averaging or addition. Additionally, other “rules” of combination have been proposed like the “peak-end rule” or a contrast effect (Fredrickson & Kahneman, 1993; Chowdhury et al., 2008; Olsen & Pracejus, 2004) which might be better at describing the combination.

Again, to recap, the second topic is focused on the possible mechanisms that mediate the affect-decision relationship. Affect has been shown to impact the decision, but it is still not clear what the underlying mechanisms (i.e. mediators) of this affect-decision relationship are. As mentioned, three potential pathways of the affect-decision relationships have been identified in the literature. The first is that the actual immediate affective reaction is the only mediator (Bechara, 1997; Damasio, 1994; Preston, Buchanan, Stansfield, & Bechara, 2007; Schlösser et al., 2013). The second is that the expected emotions are the only mediator, meaning that people do not actually rely on their feelings, but on the cognitive expectation of a potential feeling once an outcome is known (Charpentier et al., 2016; DeWall et al., 2016; Pollai et al., 2011). And the third pathway is a proposed *multi-step* mediating process, where the immediate reaction might impact the decision maker’s expectations (including expected affect), or it might impact some cognitive evaluation (e.g. it changes how likely people think something is), which in turn impacts the decision (Finucane et al., 2000; Loewenstein et al., 2003; Loewenstein & Lerner, 2003). The majority of previous studies have not included (i.e. measured) *multiple* potential mediators during the decision, in order to demonstrate which pathway is the best fit. Therefore, in order to definitively establish which of the three potential pathways is the one that arguably underlines the affect-decision relationship, it is necessary to simultaneously measure several mediators and test them, both in a single (only one mediator) or serial (one mediator impacts another) fashion, using multiple mediation techniques (see, Hayes, 2013).

As mentioned above, it is necessary to firmly establish this work in a decision-making context, since most previous work, tangentially related to combination, cannot be said to have

done this. There is therefore a need to develop a decision situation paradigm that will allow us to take into account all the limitations of the previous research, but that would also be, in the most important sense, conducive to testing the impact of multiple affective reactions. Furthermore, this paradigm needs to be firmly established in a JDM setting, thus making it comparable to previous research in this domain. With this in mind, in the following section, I present the paradigm which will be used in the main studies.

Decision situation (paradigm)

The way I have decided to approach these two topics is through integral affect. As argued in the previous chapter, integral affective reactions are more immediate, more spontaneous, and in all likelihood, much more important for decisions than incidental affective reactions (Ortony et al., 1988; Västfjäll et al., 2008). Therefore, an attempt was made to create a decision situation where two immediate integral affective reactions could be induced (i.e. evoked). These reactions had to come from sources that were related to the decision, in order to be integral. They also needed to have the property of being describable in different ways so that they could be manipulated to evoke affective reactions of differing valence (e.g. pleasant vs. less pleasant).

Most decision situations in classic JDM experiments were defined (i.e. developed) within the gamble paradigm (cf. Chapter 1, cf. Keren & Wu, 2015)¹³. For instance, consider the classic Allais (1953) problem where the decision consists of a choice between two options with some probability estimates attached, and the potential monetary rewards that they could win. Thus, decision makers are presented with two features: a choice (*an action that they must perform*) and they are presented with possible rewards (i.e. *consequences or outcomes of their decision*). Similarly, as I have mentioned in the section where I offered a short introduction of the JDM field (Chapter 1), the defining template for a decision consists of: i) courses of *action*

¹³ In Chapter 1, I provide a short critique of the gamble paradigm with many other authors suggesting that there is a need to go beyond this way of approaching JDM. However, in spite of this, it is still the most fruitful and arguably best way of approaching JDM research.

(choice options and alternatives); ii) beliefs about objective states, processes, and events in the world; and iii) desires, values or utilities associated with the *outcomes* of each action-event combination (Hastie, 2001). This same setup of a decision situation, with these two features, is used and tweaked in many other JDM paradigms, ranging from those rooted in the classically cognitive perspectives, to those in the emotion and JDM perspectives (Bateman et al., 2007; Tversky & Kahneman, 1974). In the affective domain, for instance, following this general two-part setup, Schlosser et al. (2013), have shown that the affective reactions associated with the actions that people must take to make a decision, like “throwing a die” or “keeping vs. betting a sum of money”, significantly predict the actual decision that people made. Similarly, the feelings associated with the rewards (i.e. consequences or outcomes of the decision) also significantly predict the decision (Baron & Hershey, 1988; Kugler, Connolly, & Ordóñez, 2012; Loewenstein et al., 2001).

In keeping with this general two-feature decision setup, I propose a game, or gamble-like decision situation, that will consist of a task (*the action that must be performed*) and the potential reward (*the outcome or consequence of the decision*). This situation mimics the setup that has been previously used in JDM and it consists of two pieces of information. These two pieces of information could be manipulated in their description to be made to evoke either pleasant or less pleasant affective reactions, thus allowing us to actually test whether we would observe a combination of affective reactions. Furthermore, these two pieces of information represent sources that are related to the decision, so any affective reaction that is evoked by their presentation is, by definition, integral to the decision. With this, the decision paradigm that would help us in testing the two main questions was chosen¹⁴.

¹⁴ The data, alongside the R scripts for each study is available at the following links ([Link1](#) for data; [Link2](#) for R scripts). In addition, at the end of this chapter, a summary table (Table 6) will synthesize all of the studies with the basic findings related to combination, whether the manipulation checks were successful, what the main decision behavior showed (alongside the effect sizes), and what was the significant mediation model (if applicable).

Pre-test

The success of the integral affect manipulation rests on whether the descriptions of the sources of affect in the decision situation (i.e. the task and reward) do indeed evoke the predicted affective reactions. For this reason, it was necessary to pre-test some of the stimuli that were aimed to be included in the main studies. For this pre-test, several possible tasks and rewards were presented to participants and their assignment was to evaluate each on the immediate affective reaction that they (presumably) evoke. Some tasks (rewards) were described in a pleasant (P) way, while others were described in a less pleasant (LP¹⁵) way. Overall, ten potential tasks and nine potential rewards were pre-tested. We went with a larger number of tasks (rewards) in order to have a wider selection of possible stimuli for the main studies. The tasks selected for the pre-test all consisted of an action that had to be done and which inherently carried some probabilistic information. The rewards were selected as possible outcomes and the main concern was to choose those that could be considered as believable outcomes of game-like decisions¹⁶. Furthermore, no decidedly negative tasks (rewards) were going to be used, only P and LP ones. It is our assumption that people would be reluctant to actually engage in decision behavior if they were presented with, for instance, a clearly negative reward (i.e. a clear potential for loss). Additionally, including purely negative affective information could spell problems for a test of the combinational rule. As I have critiqued in the previous chapter, presenting a positive, alongside a negative, piece of information would not allow us to differentiate between whether the combinatorial rule was actually averaging or addition, since both of these rules would lead to the same type of result (i.e. a lower affect). For these reasons, no purely negative tasks (rewards) were used.

¹⁵ The “P” and “LP” shortcuts for “Pleasant” and “Less Pleasant” will be used throughout this chapter.

¹⁶ Potential tasks and rewards were modelled after similar stimuli used in multiple previous studies (e.g. Bateman et al., 2007; Hsee & Kunreuther, 2000; Hsee & Rottenstreich, 2004; Pachur, Hertwig, & Wolkewitz, 2013; Pachur & Galesic, 2013; Rottenstreich & Hsee, 2001; Schlösser et al., 2013).

Method

Participants

Fifty-five (47 female, $M_{Age} = 21.11$ $SD_{Age} = 1.88$) psychology students from the University of Sarajevo participated in the pre-test, in exchange for course credit.

Procedure and materials

Participants completed the evaluations in dyads, in a large laboratory room (5m x 10m). They were separated and could not interact with each other. The session lasted about 10-15 minutes. Participants were instructed to view the tasks and rewards separately (i.e. to evaluate each as if they were looking at them in isolation). To control for potential contamination between affective reactions, half of the participants first evaluated the tasks, while the other half first evaluated the rewards. The appearance of the individual tasks and rewards was randomized. For each evaluation trial, participants were shown the descriptions of the tasks (e.g. “Flip a coin and in three tries try get the same side) and potential rewards (e.g., “Voucher for a romantic dinner”). Directly after the presentation of the tasks (rewards), they were asked to evaluate the immediate affective reaction that they evoked. For the measure of immediate integral affective reaction two unipolar scales were used. The unipolar scales were designed to provide a more precise measure of affect and its two dimensions, valence and arousal. Kron, Goldstein, Lee, Gardhouse, and Anderson (2013) have shown that measuring valence and arousal can be accomplished by asking two separate unipolar questions, instead of the usual bipolar way of measuring affective reactions. They demonstrate that by treating positive and negative valence as antagonistic (i.e. in bipolar measures), in a winner-take-all response, critical information may be lost that arousal ratings are needed to recover. Therefore, they conclude that, rather than there being distinct qualitative experiences of valence and arousal, the dissociation of the two may reflect how they are measured, more than what is being measured. They show that unipolar scales may simply be a better way of measuring affective reactions. This initial finding is later corroborated by showing that unipolar measures are a better predictor of physiological affective reactions (Kron, Pilkiw, Banaei, Goldstein, & Anderson, 2015),

compared to bipolar measures. In keeping with this finding, after every task (reward) description, participants were asked two questions: “*How pleasant does this task (reward) make you feel?*” and “*How unpleasant does this task (reward) make you feel?*” (0 = Not at all; 8 = Completely). The two questions were shown at the same time on the screen with the order (i.e. which one was shown above the other one) being randomized. Kron et al. (2013, 2015) show that a measure of valence can be obtained by subtracting the response on the unpleasant question from the pleasant one, while arousal can be obtained by summing the two up. Notice also that the wording of the question was also extremely important. Peters et al. (2006) suggest that a proper measure of actually felt immediate affect depends on accurate wording. They suggest that many authors ask the question awkwardly. For instance, a lot of authors ask “How do you feel *about* a certain stimulus” which does not actually measure the felt reaction, but more of an attitude. Peters et al. (2006) suggest that the question should be more reflective of the immediacy of the feeling, which is why we use the “make you feel” formulation, instead of “feel about” formulation in the questions concerning immediate affective reactions.

It is important to highlight that there was no special interest in the arousal dimension of the affective reaction in the pre-test, or indeed in any of the studies presented. Arousal represents the subjective state of being activated or deactivated (Lang et al., 1980). In measurement, arousal has been suggested to range from sleep, then drowsiness, through various stages of alertness to excitement (Russell, 2003). Even though arousal has been implied to impact decision making (FeldmanHall, Glimcher, Baker, & Phelps, 2016; Malhotra, 2010; Wichary, Mata, & Rieskamp, 2016), this particular dimension does not seem relevant for our goal of demonstrating whether we would observe affective combination. Our main interest here is with whether an affective reaction is actually evoked and whether it is combined, not with the range of the affective reactions activation. We do come back to arousal in the general discussion (Chapter 6), for a more comprehensive integration of this affective dimension.

Finally, after the evaluations, participants completed a measure of their mood, the Brief Mood Introspection Scale (BMIS; Mayer & Gaschke, 1988). The BMIS consists of 16 items

pertaining to affective states (e.g., sad, happy, lively, gloomy). Participants had to rate, on 4-point scale (1 = Not at all; 4 = Completely) the extent to which they felt each state at “that moment”. A BMIS score was calculated by summing the score on the 8 positive (e.g., Happy, Loving, Caring) with the reversed score on the 8 negative (e.g., Sad, Tired, Gloomy) adjectives ($\alpha = .85$)¹⁷. The higher the score, the more positive the mood. It was decided to measure mood since it can significantly interact with a person’s evaluations (Forgas, 2011; Schwarz & Clore, 1983) and as an incidental type of emotion, it could have an impact on the decision (e.g. Carpenter, Peters, Västfjäll, & Isen, 2012; Lucey & Dowling, 2005). Therefore, it was necessary to show that the immediate integral affective reaction evaluations were independent of any effect of mood, which could have been a confounding factor.

Results

Mood scores on the BMIS did not differ between the order conditions $t(53) = -1.09, p = .279, d = .30$. Thus, there was no effect of the order in which the tasks and rewards were evaluated on overall mood. The overall results show that the presented tasks and rewards did evoke predictable immediate affective reactions. The descriptions of the various tasks and rewards, alongside the mean and standard deviation values of the immediate affect evaluation are presented in Table 2. The tasks and rewards that were chosen to be used in the main studies are depicted in bold. Two tasks were chosen to be used in later studies because they, first had clearly different affective evaluations, second, they present actions that are easily imaginable, and third, they carry inherent probability information, echoing the JDM gamble setups discussed above. Furthermore, the two tasks are similar in their description varying only in one section which was designed to induce the immediate affective reaction (i.e. the box was filled

¹⁷ While the BMIS is a widely used tool, one can never be too sure that the measure one is using is of high validity. Therefore, it was verified if the measure did actually tap into the two positive vs. negative mood factors. Using a parallel analysis technique (O’Connor, 2000) to run a Monte Carlo simulation, two factors of the BMIS, as expected, were suggested for extraction. A factor analysis, using the maximum likelihood method of extraction, with an oblimin rotation, showed that the first factor consists of the 8 positive adjectives, while the second factor consists of the 8 negative adjectives fitting the proposed BMIS structure perfectly. Together these two factors explain 43.9% of the cumulative variance.

with cotton in the P condition, and filled with muddy water in the LP condition). In addition, neither the order of the evaluation, nor the participants' mood, did not have an impact on the first task (all $ps > .70$), nor on the second task (all $ps > .67$). The tasks did however differ between them, as expected, in their affective evaluation, $t(54) = -3.50$, $p = .001$, $d = .47$.

Table 2. Mean valence evaluations of immediate affective reactions elicited by the tasks and rewards. Tasks and rewards that were used in later studies are highlighted in bold.

| | Descriptions | Mean | SD |
|--|--|-------------|-------------|
| Tasks | Find an exit from a paper labyrinth. | 1.85 | 3.43 |
| | Find a red ball in a small box filled with several blue and red balls. The box is filled with muddy water. | .89 | 3.84 |
| | Flip a coin and in three tries try to get the same side. | 1.87 | 3.02 |
| | Find a red ball in a small box filled with several blue and red balls. The box is filled with soft cotton wool. | 2.71 | 3.02 |
| | Find matching symbols on a scratcher ticket. | 1.71 | 3.15 |
| | Copy a newspaper article in Finnish without making a mistake. | .38 | 3.98 |
| | Using a toy air gun, to hit a target that is 10 meters away from you. | 1.95 | 4.23 |
| | Try to hit the center of the target using a dart needle. | 3.63 | 3.26 |
| | Name as many European capitals in a certain time interval. | 1.25 | 3.85 |
| | Find as many differences between two ostensibly similar drawings | 3.47 | 3.05 |
| Rewards | A voucher for a romantic dinner in a clean, cozy, and intimate restaurant. | 6.76 | 1.68 |
| | A voucher for a meal at a local university cafeteria. | 4.37 | 2.62 |
| | Your University will pay for your student expenses the next school year. | 6.93 | 2.28 |
| | A trip to Varaždin. | 4.67 | 2.55 |
| | A set of mugs with the University insignia on them. | .38 | 3.62 |
| | A trip to New York. | 6.82 | 2.44 |
| | 1000 KM (around 500 euros). | 7.17 | 1.19 |
| A voucher for a romantic dinner in a noisy and shabby restaurant. | 4.84 | 3.13 | |
| Free flying lesson. | 5.07 | 3.14 | |

Five of the rewards were used later on in the main studies. The same reasons for the choice of rewards as for the choice of tasks were applied. In addition, just like the chosen tasks, neither the order, nor the mood, did not have an impact on the affective evaluations of the chosen rewards (all $ps > .05$). All the chosen rewards, between them, differed in their evaluation (all t 's > 4.25 , all $ps < .001$). There was no difference between the trip award and the intimate restaurant, nor between the local cafeteria and the shabby restaurant (all $ps > .43$), but these were never used in the same study.

Study 1

Following the decision setup that was discussed in the introductory section of this chapter, two tasks from the pre-test, one P and the other LP, along with two potential rewards,

one P and one LP, from the pre-test were chosen. These tasks (rewards) were implemented in a game-like decision scenario that participants were presented with. The design of the study therefore included one factor of task and another factor of reward, both of which varied in their description of pleasantness (i.e., in the affective reaction that they were designed to evoke). This design was aimed at testing whether we would observe a combined impact of the two affective reactions evoked by the task and the reward, on the decision.

We chose not to provide information concerning the likelihood of success in the task or how much the rewards cost, in order to increase reliance on affect. Numerous studies show that when other information is present (in particular information of a cognitive nature, relevant for the decision, like probabilities and monetary value), reliance on affect is diminished (e.g. Denes-Raj & Epstein, 1994; Pachur, Hertwig, & Wolkewitz, 2013; Van Gelder, De Vries, & Van Der Pligt, 2009). For one thing, this seems particularly true when information is pertinent to the decision (Pham & Avnet, 2004). Similarly, lack of information increases uncertainty and uncertainty has been shown to increase the reliance on affect in decisions (Rad & Pham, 2017). Furthermore, when other information is missing and the only salient feature is the feeling associated with a piece of information, it is presumed that the participants rely on the feeling (Luo & Yu, 2015; Slovic et al., 2004).

In addition to this basic design, two measures of affect were included in the study. This was the measure of immediate affective reaction (i.e., felt affect) and a measure of expected emotions. These two measures served as potential mediators to test the pathways of the affect-decision relationship. When put in the same mediation model, we can verify if only one of these measures is a significant mediator, or if there was a multi-step (i.e. serial) mediation model. Further, the measure of immediate affective reaction also served as a manipulation check, so that it was possible to confirm whether the tasks and rewards did actually evoke the same affective reaction as in the pre-test. Finally, because there is a need to control for otherwise present affect, mood was measured both before the participants were introduced to the decision situation and after they had made their decision.

Regarding the question of combination, it was expected that both the factor of task and reward would have a significant effect on the decision, indicating that the affective reactions have combined and that the resulting combined feeling influenced the decision. Regarding the potential mediating pathways, no specific expectation was set up front. If only the immediate (combined) affective reaction turns out to be a mediator in the affect-decision relationship, this can be designated as a direct impact and an example of the first pathway. Another possibility was that only expected emotions were a mediator, which would be an example of the second pathway. The third possibility is that immediate emotions impact expected, which in turn impact the decision. This last possibility would be an example of the third pathway.

Method

Participants

Seventy-seven undergraduates¹⁸ from the University of Bordeaux participated voluntarily in this experiment. However, due to a computer error¹⁹ the data from only 60 participants was recorded (55 female, $M_{Age} = 20.77$, $SD_{Age} = 3.97$). Participants were randomly assigned into a 2 (Task: P vs. LP) x 2 (Reward: P vs. LP) between subject design. Order of presentation of tasks and rewards was counterbalanced.

Procedure and materials

Participants were run individually in the laboratory of the psychology department at the University of Bordeaux. E-Prime was used for the rollout of the experimental procedure. After filling in a consent form, they first provided responses to the BMIS scale ($\alpha = .77$), which served

¹⁸ The initial sample size was determined by taking a look at some other effect sizes in the literature. Most notably, in those papers that used similar stimuli and were looking at decision making (see footnote 15, p. 99). Notably, in a lot of previous work (e.g. Finucane et al., 2001; Rottenstreich & Hsee, 2001) researchers simply did not report the effect size, nor did they report enough information to calculate the effect sizes. However, looking at some other work, effect sizes ranged from, $\eta_p^2 = .08$ (Pachur & Galesic, 2013) even up to $\eta_p^2 = .11$ (Hsee & Rottenstreich, 2004) and $d = .82$ ($\eta_p^2 = .14$) (Hsee & Kunreuther, 2000) for main effects and interactions. So, somewhere between 66 and 93 participants were needed to have 80% power, in a 2x2 design, to obtain an effect ranging from .08 to .14 (calculated using G*Power).

¹⁹ The numeric keyboard that participants used to input their answers switched off randomly for some participants due to an unknown computer bug. Therefore, for these participants, no answers were logged and they could not be used in the analysis.

as a measure of their pre-existing mood (i.e. before they were confronted with the decision attributes and made their decision). The BMIS measure was applied in the same way as in the pre-test. Participants were told that the study would require them to make a decision concerning their participation in a hypothetical game-like situation. They were told that they would receive information about the task associated with the game and the potential reward, which they could win. Dependent on the order of presentation, and based on the results of pre-testing, participants were presented with either the P task: “*A large box filled with gentle cotton wool is filled with a number of red and blue balls. Your task is to find the red ball.*” or the LP task, where the box was described as being filled with dirty mud. For the P reward, the reward of a *trip* from the pre-test was used. For the LP reward a redeemable voucher for the *local university cafeteria* was presented. Immediately after the presentation of the task (reward), participants provided their response to a measure of immediate affect, using the same two unipolar scales as in the pre-test: “*How pleasant does this task (reward) make you feel?*” and “*How unpleasant does this task (reward) make you feel?*” (0 = Not at all; 8 = Completely). The order of the two questions on immediate affect was randomized.

Before the participants made their decision, and after they responded to the immediate affect questions, they responded to a measure of expected affect with two unipolar measures: “*How pleasant (unpleasant) would you expect to feel if you were to win in the game?*” (0 = Not at all; 8 = Completely). The order of these questions was also randomized. For the independent variable (i.e. the decision), the participants were told to imagine that they were given 10 Euros and to decide how much of that sum they were willing to pay to get the opportunity to play the game. The average money paid, was the dependent variable. In addition, to make the decision seem more realistic, participants were told that the three offers would be chosen at random and that at the end of the research project those individuals would get the opportunity to try themselves out in a real version of the game.²⁰ Also, it was highlighted that if they were chosen

²⁰ This is a standard procedure in decision making and behavioral economics experiments (Harrison & Rutström, 2008).

and they failed at the task, they would lose the money that they decided to give (of course they did not actually lose any money, but this instruction served to make the decision seem more realistic, as stated above). Finally, after the participants made their decision, they completed the BMIS again ($\alpha = .79$). The idea here was to verify that the presentation of the task and reward, which were supposed to evoke immediate integral affective reactions, did not in any way change mood. In this way, we can be sure that any results we obtain are due to the immediate integral affect, and not incidental mood. Participants were debriefed at the end the study.

Results²¹

Mood and affective quality of task / reward

Mood. A 2 (Task: P vs. LP) x 2 (Reward: P vs. LP) x 2 (BMIS: pre- and post) ANOVA, with pre- and post- BMIS as a within subject factor, showed that neither of the two mood measures differed as a cause of task and reward, all F 's < 1 , $ps > .48$.

Immediate integral affect – task. As expected, a 2 (Task: P vs. LP) x 2 (Reward: P vs. LP) ANOVA showed a main effect of task, $F(1, 56) = 21.32$, $p < .001$, $\eta_p^2 = .28$, with P task producing more pleasant affective reactions ($M = 1.65$, $SD = 2.29$) than the LP task ($M = -1.72$, $SD = 3.30$). No other effects were significant, all F 's < 1.31 , $ps > .26$.

Immediate integral affect – reward. The same 2x2 ANOVA showed that there was no effect of reward on the immediate affective reaction evoked by the rewards (even though it could be interpreted as marginal, $F(1, 56) = 3.55$, $p = .06$, $\eta_p^2 = .06$ with the P reward producing more pleasant affective reactions ($M = 5.87$, $SD = 2.58$) than the LP reward ($M = 4.66$, $SD =$

²¹ Throughout the thesis, results of ANOVA's, that were not hypothesized (i.e. if they are unexpected) a priori, will be corrected for Type 1 error (i.e. for multiple comparisons). The probability of at least one Type 1 error in a 2x2 ANOVA is 14% and it goes up to 30% in a 2x2x2 ANOVA (i.e. $1-(0.95)^7=30\%$). For the correction, the Bonferroni-Holm will be used (Cramer et al., 2016). To correctly apply the correction one has to sort all p -values of an analysis in ascending order, from smallest first. Next, one computes the adjusted α level. For the smallest p value, α_{adj} equals α divided by the number of tests. In a 2x2 ANOVA, for instance, the α_{adj} equals $.05/3 = .01667$, for the second smallest p value, α_{adj} equals α divided by the number of tests minus 1 (i.e. $.05/2$), and so on. If the obtained p value is bigger than the α_{adj} , this effect is not significant. Importantly, this correction is most pertinent when detailed hypotheses about an observed effect have not been specified a-priori.

2.35). There was no effect of task nor an interaction between task and reward, all F 's < 1 , $ps > .74$.

Expected affect. A 2x2 ANOVA showed that there was no effect of either task or reward on expected affect, with no interaction, all F 's < 1.91 , $ps > .17$.

Affective quality of task / reward and impact on the decision

Unexpectedly, a 2x2 ANOVA revealed no effect of any of the two main factors, although the effect of the reward was approaching significance, $F(1, 56) = 3.54$, $p = .06$, $\eta_p^2 = .07$, with participants that saw the P reward deciding to give more money ($M = 5.90$, $SD = 2.65$) than participants that saw the LP reward ($M = 4.55$, $SD = 2.81$). All other F 's < 1 , $ps > .94$. In absence of an effect we did take a look at the correlations between the affective reactions of the task and the rewards, the pre- and post BMIS, and the decision, to gain a bit more insight. Perhaps tellingly, given the marginally significant effect, the only significant correlation was between the decision and the affective reaction associated with the reward $r(58) = .353$, $p = .006$. Finally, since the effect of the reward on the main decision was marginal, no mediation analysis was done.

Discussion – Study 1

The results of Study 1 concerning the manipulation checks showed that the immediate affective reactions evoked by the tasks were significantly different, but there was no difference in the immediate affective reactions evoked by the rewards (i.e. there was only a marginal effect, $p = .06$). This lack of manipulation success was surprising, since the two rewards should have differed based on the results of the pre-test. Second, and more important, there was no effect of the two factors on the decision (i.e., again, there was only a marginal effect of reward, $p = .06$). Thus, the results do not allow us to speculate on a possible combination. For the same reason, there was also no possibility to look at the mediating pathways for the affect-decision relationship.

Before moving on to the likely reasons why the specific results were obtained, it is important to address one question. Specifically, it is clear that the two rewards, when looked at

side-by-side, are clearly different in many other aspects besides the affectivity which they might evoke. However, it is important to highlight that the rewards were not presented side-by side to our participants. Rather, they were presented independently i.e. one person saw reward P, and reward LP was seen by a different person, making the participants not likely to actually compare them. Research on separate vs. joint evaluation corroborates this assumption (Hsee, 1998). For instance, Hsee and Rottenstreich (2004) presented a cash reward (as an affect-poor reward) and a music book (as an affect-rich reward) which differ in many, potentially important ways but, presented separately, they served their purpose of inducing an affect-poor vs. and affect-rich evaluation. Thus, when there is no direct opportunity to compare the two rewards, participants should rely on other features of the stimulus, which in this case was the affective quality.

Limitations. One possible reason for the lack of an effect on the decision could be the lack of success on the manipulation of immediate affect. However, this seems unlikely to be the reason since there was a significant (and quite substantial) difference between the immediate affective reactions to the tasks. One would expect that at least the affective reaction evoked by the tasks would have been an important factor which could have impacted the decision. Therefore, a more likely reason is that the sample of this study was simply too small to find a significant effect. The sample size in Study 1 was 60 participants, i.e. at least 20 persons per cell, which, by some accounts, should not be termed as a small sample size (Simmons, Nelson, & Simonsohn, 2011). However, it could be considered small for the effect we wanted to obtain (Simonsohn, Nelson, & Simmons, 2014). Therefore, it could just be that we did not obtain a combined impact of both task and reward affectivity on the decision, because the study was underpowered. For that reason, a larger replication study was attempted before all other conclusions concerning the quality of the tasks and rewards (i.e. their ability to evoke an adequate immediate affective reaction), or our decision paradigms ability to detect combination, could be made.

Study 2

Study 2 attempted to increase power so that an effect of combination on the decision could be observed. This study was similar to Study 1 with two changes. First, the number of participants was higher. The main assumption concerning the lack of effect of the task and reward on the decision is that the previous study was underpowered to actually detect an effect. Indeed, the effect of the reward was approaching marginal significance. Incorporating more participants should help us in observing an effect of combination on the decision. Second, concerning the verification of potential mediating pathways, in Study 1, participants only provided their responses to the affective measures of immediate and expected affect. However, the assumption made concerning the three potential pathways was that, at least in the third possible pathway, the affective reaction could also impact cognitive evaluations (Loewenstein et al., 2001). However, no actual measures of a cognitive evaluation were taken in Study 1. We only had affective measures. Thus, even if we had obtained an effect on the decision, we would not be able to fully address the question of mediation pathways. Therefore, to correct this, in Study 2, participants also provided their responses on a measure of subjective probability.

Subjective probability has been suggested, in previous work, as one of the cognitive decision attributes that immediate affect could impact in a multi-step mediation pathway (Schlösser, et al., 2013). For instance, if one takes a look at the work conducted for the affect heuristic, a possible interpretation of the effect of affect on the decision is that how pleasant (less pleasant) something feels could impact how likely a person thinks that something is to happen. For instance, Slovic and his colleagues (e.g. Finucane et al., 2000; Peters & Slovic, 2000) show how fear felt at the time of decision making, leads people to shy away from a risk. This means that people see the odds of negative events occurring as higher – an implication that immediate affect evoked by the imagination of a certain risk, could impact evaluation of subjective probability, which in turn could impact the decision. Similarly, Sunstein & Llewellyn (2003) demonstrated how people treat risks like terrorism, which evoke highly intense affective reactions, as being substantially more likely to occur. Again, the implication is that immediate

felt affect would be a mediator in the affect-decision relationship, but only in a multi-step process where the felt affect alters the subjective probability people assign to certain outcomes (Bateman et al., 2007). It is therefore important to measure subjective probability, as a cognitive decision attribute, alongside the measures of affect, in order to actually have an opportunity to verify the multi-step mediation pathway, as suggested by an indirect impact of affect (Loewenstein & Lerner, 2003; Slovic et al., 2004).

Method

Participants

One hundred and four²² (84 female, $M_{Age} = 19.84$, $SD_{Age} = 1.50$) Psychology and English Literature students from the University of Sarajevo, participated in exchange for course credit. Participants were run individually in the psychology laboratory at the University of Sarajevo. They were randomly assigned to a 2 (Task: P vs. LP) x 2 (Reward: P vs. LP) design. Order of presentation of tasks and rewards was counterbalanced.

Procedure and materials

The procedure mirrored that of Study 1 with two changes. First, the measure of pre-decision BMIS was omitted. The assessment of mood before the decision could inadvertently impact the decision and it could actually lessen the impact of mood by making participants more aware of it (Schwarz & Clore, 1983). The participants however still filled in the BMIS ($\alpha = .75$) at the end of the study (i.e. after the decision) as a measure of control. Second, as mentioned above (see the introduction of study 2), a question measuring subjective probability was included and phrased as: “*Independent of your decision, how likely do you think is it that you personally will be successful in this game?*” (see, Schlösser et al., 2013). The participants responded on a scale from 0% to 100%. The other aspects of the procedure were the same as in Study 1. Participants were debriefed at the end of the experiment.

²² Given the effect sizes used in the previous studies (see footnote 18, p. 107) a higher number of participants should allow us to observe an effect. Additionally, with the marginal effect of the reward of $\eta_p^2 = .07$, with this sample size we would have 80% to detect a similar sized effect.

Results

Mood, affective quality of task / reward, and subjective probability

Mood. Unexpectedly, a 2 (Task: P vs. LP) x 2 (Reward: P vs. LP) ANOVA showed that there was a main effect of task, $F(1, 100) = 6.86, p = .012, \eta_p^2 = .06$, with participants who saw the P Task being in less pleasant mood ($M = 40.75, SD = 1.91$) compared to participants who saw the LP task ($M = 41.71, SD = 1.76$). Because this effect was unexpected and it seems to go in a direction that does not make intuitive sense (i.e. participants feeling worse mood after seeing a P task) it was subjected to the Type 1 error correction which revealed that the effect does not remain significant, all other F 's $< 1, ps > .32$.

Immediate integral affect – task. As expected, a 2x2 ANOVA showed only a main effect of task, $F(1, 100) = 11.30, p = .001, \eta_p^2 = .10$, with participants who saw the P Task thinking that the task was more pleasant ($M = 1.68, SD = 2.79$) than participants who saw the LP Task ($M = -.42, SD = 2.42$). No other effects were significant, all other F 's $< 1, ps > .44$.

Immediate integral affect – reward. As expected, a 2x2 ANOVA showed a main effect of reward, $F(1, 100) = 20.12, p < .001, \eta_p^2 = .17$, with the participants in the P Reward group thinking that the reward was more pleasant ($M = 5.18, SD = 1.97$) than the participants who saw the LP reward ($M = 2.28, SD = 2.47$). No other effects were significant, all other F 's $< 1, ps > .48$.

Expected affect, subjective probability. A 2x2 ANOVA revealed no significant effects of any of the factors on the measures of expected affect or subjective probability, all F 's $< 2.77, ps > .10$.

Affective quality of task / reward and impact on the decision

Regarding our dependent measure, a 2x2 ANOVA showed a clear main effect of affective quality of the reward, $F(1, 100) = 44.74, p < .001, \eta_p^2 = .31$. Participants in the P reward condition decided to give more money ($M = 6.18, SD = 1.46$) than participants in the LP reward condition ($M = 3.90, SD = 1.99$) - see Figure 1. No other effects were significant, all other F 's $< 2.20, ps > .14$.

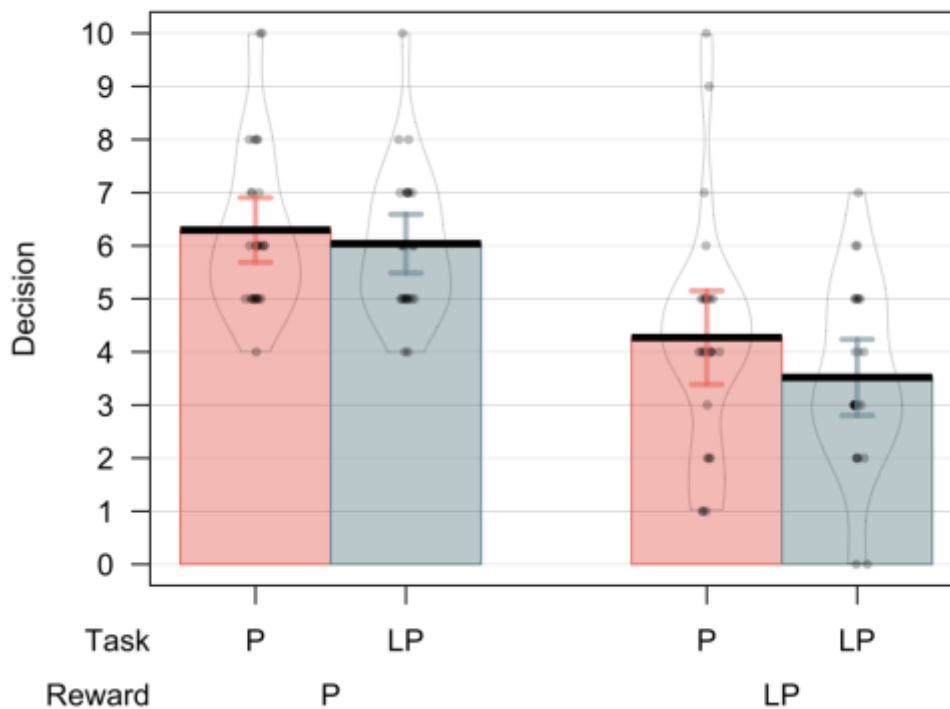


Figure 1. Decision on how much money to give, as a function of Task and Reward for Study 2. The figure shows the main effect of affective quality of reward on how much money participants decided to give to get the opportunity to play the game. The tails represent 95% confidence intervals. The raw data along with their distribution with the violin density graph – the wider the cone the more data is in that area – is also presented.

Mediation analysis

To explore the potential pathways we used the PROCESS macro (Model 6; Hayes, 2013), which allows for inserting multiple mediators that can both be tested as single mediators (e.g. that only the immediate affective reaction mediates between the IV and DV, or that only expected affect mediates between IV and DV), but also as serial mediators, i.e. the multi-step pathway, (e.g., that the immediate affective reaction impacts expected affect, or impacts subjective probability, which then impacts the decision).

Given that we did not find a main effect of the task, we constructed a mediation model in which the affective quality of the reward was declared as the IV and the mean amount of money that people gave to get the opportunity to play the game as the DV. The immediate affective reaction towards the rewards, expected affect, and subjective probability were inserted

as mediators. The model was set up with 10000 bootstraps, with a 95% confidence interval, as per the recommendation of Hayes (2013). The results of the analysis, unexpectedly, show that none of the hypothesized mediation pathways were a significant mediator between the IV and DV (see Figure 2).

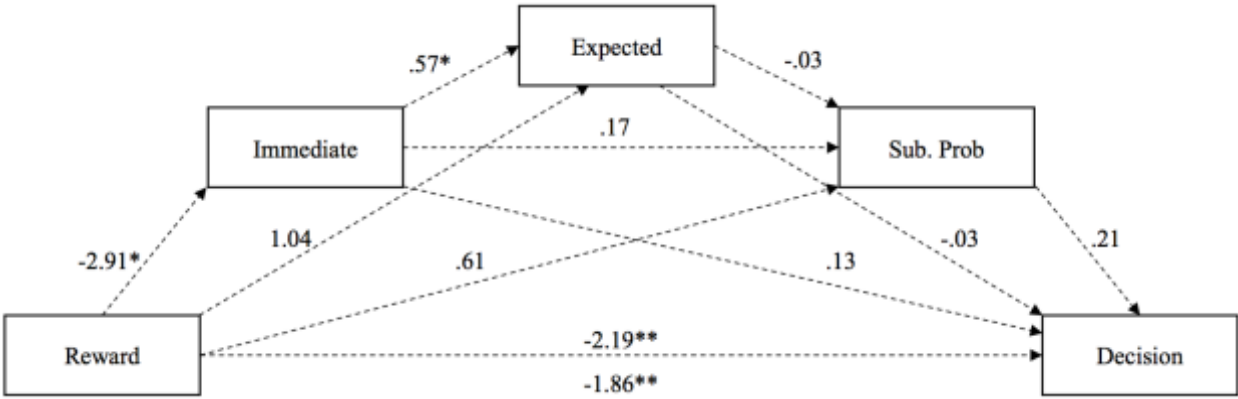


Figure 2. Mediation model for Study 2, containing all possible pathways including the regression coefficients. There were no significant mediation models (dashed lines represent non-significant mediation models)

Discussion – Study 2

The assumption that we would observe a combined effect of task and reward on the decision did not materialize. Instead, only the affectivity of the rewards impacted the main decision of how much money people would give to get the opportunity to play the presented game. Participants who saw the P reward decided to give more money in comparison to participants who saw the LP reward. This is all the more surprising given the fact that both the rewards and the tasks successfully induced the predicted immediate integral affective reaction, as confirmed by our manipulation check verification. These results would also seem to suggest that the marginal effects pertaining to the main effect of reward, obtained in Study 1, were probably in the right direction, but did not pass the statistical threshold due to a lack of power. Finally, the results would seem to lean more towards the fact that, in the decision setup we provided, a combined impact of two affective reactions on the decision is not possible.

Additionally, concerning the mechanisms of the affect-decision relationship, none of the included measures seem to have mediated the relationship between the reward and the decision. This was surprising given the strong effect of rewards on the decision. One would

expect that the immediate affective reaction associated with the rewards would be a strong cue for the decision. However, the mediation model failed at observing one of the discussed pathways.

Limitations. In spite of a successful induction of two distinct affective reaction, Study 2 failed to observe a type of combined impact of the affective reactions on the decision. Given that only the effect of reward affectivity was observed, one could argue that participants were somehow implicitly guided to be more sensitive towards the rewards. One reason for this might have been how the main decision question was operationalized. For instance, the question related to the decision could have led participants to only take rewards into account. However, this does not seem likely given that the participants were asked to decide how much money they would give for the *game*, meaning that there was no explicit attempt to make them focus on only the rewards of the game. By asking them to decide how much money to give for participating in the game, if anything, they were implicitly guided to take the whole situation into account, since the game consists of both the task and the reward.

Given the lack of combination, one might conclude that it is not possible to obtain. However, by some accounts, previously mentioned in Chapter 4, one is justified in thinking that the affective reactions should have combined to impact the decision. Therefore, there is a need to verify if the lack of combination was due to the fact that two affective reactions do not combine to impact the decision, or if it was due to some other, unforeseen, reason. Two possible reasons were identified that are worth testing. The first is that the affective reaction associated with the reward could have been more highlighted for the participants because these stimuli evoked a stronger (higher) affective reaction (in particular the trip was evaluated as evoking a highly P affective reaction) compared to the tasks. This assumption goes in line with some previous findings. For instance, in the risk as feelings hypothesis, Loewenstein, Weber, Hsee, and Welch (2001) argue that strong emotional reactions can totally engross an individual's decision making. This possible explanation is all the more interesting once you think about the fact that participants were entirely disregarding the LP task. Indeed, the task did evoke fairly

unpleasant immediate affective reaction, and yet participants did not factor in this information when making their decision.

A second possibility, that does not relate to the rewards specifically, is that the act of asking the questions about affect, immediately after the presentation of the tasks and rewards, might have inadvertently impacted the decision. For instance, Kassam and Mendes (2013) found that the emotional responses of participants were qualitatively different when they were asked to report on their emotions. It could be that asking the questions about affect caused participants to have different affective reactions, thus inadvertently impacting the results. For instance, asking the participants directly about their feelings concerning the task and rewards might have incidentally nudged them to only take rewards into account. In turn, nudging them towards the rewards lead to the lack of combination and only a main effect of reward. The next study aimed at addressing these two possibilities.

Study 3

In Study 3, in order to address the first concern mentioned in the discussion above, we decided to use different rewards, ones that would presumably evoke less strong (lower) affective reactions (in particular, the reward relating to the trip was no longer used). This was done in order to verify if the evoked affective reactions associated with the rewards used in the previous study were perhaps too strong, compared to the affective reactions associated with the tasks, which could have led to a lack of combination and only the main effect of rewards. Second, because there was a possibility that the questions asked immediately after the presentation of the tasks and rewards could have inadvertently impacted the decision, by focusing the participants on the rewards, no questions concerning affect were included in the study design. Subjective probability was also not measured since without the affect measures it would not be possible to verify the third mediation pathway. Since the main goal was to demonstrate a combined impact of task and reward on the decision, both of these interventions were applied in Study 3.

Method

Participants

Ninety-four²³ (65 female, $M_{Age} = 20.93$; $SD_{Age} = 1.68$) Psychology and Educational sciences students from the University of Sarajevo took part voluntarily in the study. Participants were randomly assigned to a 2 (Task: P vs. LP) x 2 (Reward: P vs. LP) between-subject design. Order of presentation of tasks and rewards was counterbalanced.

Procedure and materials

The overall procedure was similar to the one in Study 2, with two changes of significance. First, new reward stimuli were used. Specifically, relying on the results from the pre-test, participants in the P reward condition were shown a “*Redeemable voucher for the local university cafeteria*” (this reward was used as an LP reward in the previous two studies), while participants in the LP reward condition were shown “*You can win a set of mugs with the insignia of the University*” (the two rewards clearly differed in their affective reactions in the pre-test). Second, because we wanted to verify if the presence of the questions measuring the immediate and expected affective reactions could have inadvertently impacted the result (i.e. lack of combination observed in Study 2), participants were not shown these questions after the presentation of the tasks and rewards, nor before the decision. The rest of the procedure remained the same as in Study 2.

Results

Mood and decision

The 2x2 ANOVA conducted on the BMIS scores ($\alpha = .81$), as expected, did not reveal any significant effects (all F 's < 1 , $ps > .34$). The analysis of the decision showed, only a main effect of the affective quality of the task, $F(1, 88) = 5.71$, $p = .019$, $\eta_p^2 = .06$ (see Figure 3). Participants presented with the P task decided to give more money ($M = 5.65$, $SD = 2.42$) than

²³ A similar sample size was used as in Study 2.

participants presented with the LP task ($M = 4.36$, $SD = 2.51$). No other effects were significant, all F 's < 1.1 , $ps > .29$.

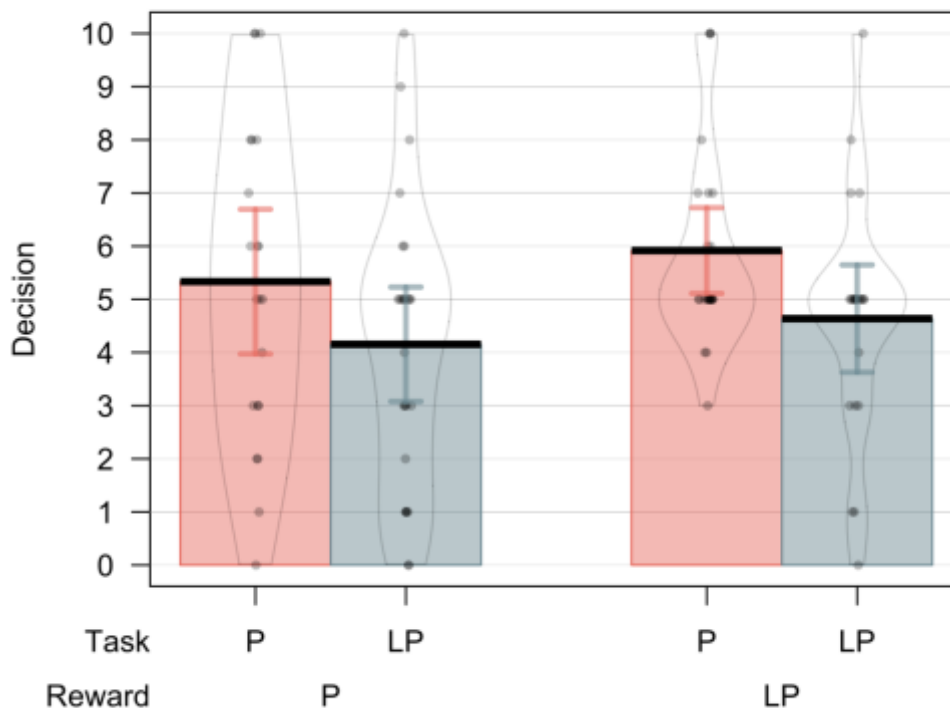


Figure 3. Decision on how much money to give, as a function of Task and Reward for Study 3. The figure shows the main effect of affective quality of the task on how much money participants decided to give to get the opportunity to play the game. The tails represent 95% confidence intervals. The raw data along with their distribution with the violin density graph – the wider the cone the more data is in that area – is also presented.

Discussion – Study 3

Important findings were obtained in Study 3. Primarily, there was again an effect on the decision, but this time it was due to the affectivity of the task. Participants that were presented with the P task decided to give more money, compared to the participants who were presented with the LP task. Again, however, no combination was observed. importantly, there was also a lack of an effect of the affective quality of the reward. This lack is surprising since we would expect that they would impact the decision given the difference in the affective reactions obtained in the pre-test for the two rewards used, and given the results obtained in Study 2.

Limitations. One possible reason for why there was only a main effect of task affectivity and not also the reward affectivity might have been because the affective reactions associated with the rewards were not strong *enough*, which could have lead the participants to rely on the affectivity of the tasks. Ironically, in our attempt to present rewards that might evoke less intense affective reactions, we might have inadvertently gone too far. Another possible reason for why there was no impact of reward could be that in this experiment (unlike in the pre-test), there was no affective difference between the rewards at all. However, since we did not ask any affect-related questions, given that the main goal of study 3 was only to obtain a combined impact of task and reward on the decision, there is no way to verify this. Additionally, it could be that the lack of questions was the culprit for this curious result. Finally, it could still be that none of these two possibilities are true, but that we did not have enough power to detect a combination. In both this and the previous study, around the same number of participants were used. In the previous study, the effect size for the main effect of reward was large ($\eta_p^2 = .31$), but the rewards in this study were changed.

In sum, the decision to present affectively less intense rewards and not ask affect-related question did not again lead to a combined effect of task and reward affectivity on the decision. There was only a main effect of the affective quality of task impacting the decision. These results, while interesting, come with several possible reasons for why they appeared, all of which will addressed in Study 4.

Study 4

In Study 4, a replication of Study 3 was attempted, but in a much more controlled setting. Most importantly, the presence vs. absence of the questions was experimentally manipulated. This allowed us first, to obtain information on the affective quality of the rewards and find out whether there was a lack of their effect on the decision because they did not evoke a strong enough affective reaction or because they did not differ affectively, and second, to verify if the effect observed in Study 3 was due to the feature of the changed rewards, or due to the absence of the questions. Finally, we also addressed an additional limitation identified in the discussion

of Study 2 in that there was a possibility that the studies 2 and 3 were again underpowered, so a much larger number of participants was recruited. This is even more important since the design of Study 4 would include three factors i.e. Task (P vs. LP), Reward (P vs. LP), and Question (presence vs. absence) and a much larger number of participants is needed. For that reason, participants were recruited online, using mTurk²⁴.

Method

Participants

A total of 581²⁵ participants (281 female, $M_{Age} = 34.86$, $SD_{Age} = 10.96$) participated in the study on mTurk in exchange for monetary remuneration of 20 cents (standard fee for mTurk for short studies). The participants were randomly assigned to a 2 (Task: P vs. LP) x 2 (Reward: P vs. LP) x 2 (Questions: present vs. absent) between-subject design, with the order of presentation of the task and reward being counterbalanced. Because the study was presented online, we relied on the LimeSurvey open source software to present the study in a web interface. Even though there are several positive sides to relying on mTurk participants, there is still danger that participants will satisfice (e.g., not pay attention to the instructions and/or rush through the study) since they are doing the study online. Therefore, all the participants had to pass an instructional manipulation check (IMC) at the start of the study. The IMC consisted of a long question that essentially told participants that they should respond with a “1”. The idea is that participants should be confronted with a long instruction and they should really read and understand it, in order to provide the correct response. This type of IMC has been shown to successfully weed out the participants who were not paying attention to the study at hand

²⁴ There has been some criticism of mTurk use in psychological experiments (for a recent critique see Stewart et al. (2015). Nevertheless, while some have criticized the platform, there has been positive work showing that mTurk participants are more attentive to the task at hand, representative of a wider population and that studies conducted using it, have a high degree of replicability and validity (Mason & Suri, 2012; Paolacci, Chandler, & Ipeirotis, 2010). Finally, (Hauser & Schwarz, 2016) show that mTurk participants perform better on attention checks than other subject pool participants.

²⁵ Initially, 330 participants were collected, but it was decided that this number is low for such a high number of factors. Therefore, without looking at the data, more participants were added. With this number of participants, we had 90% power to detect an effect as small as $\eta_p^2 = .02$.

(Oppenheimer, Meyvis, & Davidenko, 2009). It was decided upfront, before the data would be looked at, that all the participants that did not pass the IMC would be disregarded from the analysis. Selecting only for these participants resulted in a total of 543 participants (266 female, $M_{\text{Age}} = 35.19$, $SD_{\text{Age}} = 11.19$). All the rest of the analysis reported below will be conducted on this subset of participants.

Procedure and materials

The procedure was similar to the one in Study 3 with one major design change. The presence vs. absence of the questions was experimentally manipulated. The questions themselves remained the same as in Study 2. Additionally, there were two changes of a technical nature. First, because of a quirk in the LimeSurvey options, all the scales for the questions were from 1 (not at all) to 5 (completely), for the participants who did see the questions, instead of the 0 to 8 which was used in previous studies. Second, the participants could also now respond in decimal numbers for how much money they were willing to give (i.e. they could put \$2.5, or \$6.2, etc.). In the previous studies, they could only respond with whole numbers from 1 to 10. The assumption was that this would give participants the possibility to be more precise in their decisions. Participants were debriefed at the end.

Results

Mood, affective quality of task / reward, and subjective probability²⁶

Mood. A 2 (Task: P vs. LP) x 2 (Reward: P vs. LP) ANOVA on the BMIS scores ($\alpha = .86$) showed that no factors have impacted mood (all F 's < 1.76, $ps > .19$). That is, mood did not change as a consequence of any of the factors that were manipulated.

Immediate integral affect – task. As expected, a 2x2 ANOVA showed a main effect of the affective quality of the task, $F(1, 246) = 5.00$, $p = .026$, $\eta_p^2 = .02$, with participants who saw the P Task thinking that it was more pleasant ($M = .73$, $SD = 2.17$) compared to participants

²⁶ The results on the measures of mood, immediate and expected affect, and subjective probability, were only conducted for the subset of individuals that were presented with the questions (total N of participants that were presented with the questions was 265). Similarly, the mediation analysis was only done on this subset of participants.

who saw the LP Task ($M = .08$, $SD = 2.44$). No other effect reached significance, all F 's < 2.49 , $ps > .12$.

Immediate integral affect – reward. A 2x2 ANOVA revealed that there were no significant effects, all (F 's < 1.41 , $ps > .24$), which suggests that our manipulation of immediate affective reaction evoked by the reward was not successful (P reward $M = 1.54$, $SD = 2.0$; LP reward, $M = 1.27$, $SD = 2.03$).

Expected affect, subjective probability. There was an interaction between task and reward for expected affect, $F(1, 246) = 4.89$, $p = .03$, $\eta_p^2 = .02$, but given that this effect was unexpected and the high chance of a false positive, the Bonferroni-Holm correction was performed and it was shown to no longer be significant. There were no other significant effects of any of the factors on expected affect, or subjective probability, all F s < 1.70 , $ps > .19$

Affective quality of task / reward on the decision

For the main decision analysis, a quick visual inspection of the data showed that there were participants who decided to give more than the allowed \$10 for the decision. For instance, in one case, a participant wrote that they would give \$500 dollars. This could be a typo or a sign of failure to comply with instructions. Therefore, for the main decision analysis, all responses that were higher than \$10 dollars were excluded. A chi-square analysis was performed to verify if the excluded participants were evenly distributed across the conditions or if there was a significant number of them from a certain condition. This analysis showed that the participants were evenly distributed (all $ps > .33$). The number of participants after this exclusion was 510. A 2 (Task: P vs. LP) x 2 (Reward: P vs. LP) x 2 (Questions: present vs. absent) ANOVA on the decision variable showed, again as in Study 3, that there was only a significant main effect of the affective quality of the task, $F(1, 502) = 4.22$, $p = .04$, $\eta_p^2 = .01$. Participants who saw the P Task decided to give more money ($M = 3.91$, $SD = 2.84$) than participants that saw the LP Task ($M = 3.38$, $SD = 2.55$). Importantly, the presence vs. the absence of the affect-related questions did not seem to have an impact on the decision.

Mediation analysis

The same mediation analysis procedure was done as in Study 2. Precisely, the affective quality of the task was declared as the IV with the mean amount of money that people would give to get the opportunity to play the game being declared as DV. The immediate affective reaction towards the tasks, expected affect, and subjective probability were included as potential mediators. The model was again set up with 10000 bootstraps and with a 95% confidence interval. The mediation results show that the only significant mediator was the immediate felt affective reaction towards the tasks, $b = -.22$, $SE = .12$, 95% CI $[-.506, -.024]$ (see Figure 4). The results of the mediation analysis conform to the first mediation pathway, in that only the actual immediate affect was a mediator of the affect-decision relationship.

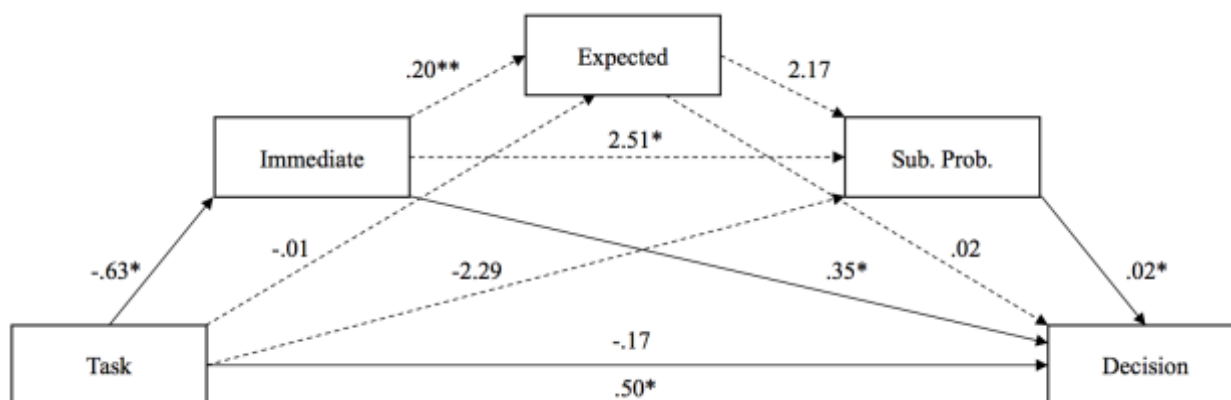


Figure 4. Mediation model for Study 4, containing all possible pathways including the regression coefficients. The only significant model is presented with full lines, which indicates that the first pathway, that immediate integral affective reaction is the only mediator.

Discussion - Study 4

The results in Study 4 echoed those obtained in Study 3. There was only a main effect of the affective quality of the task on the decision. The effect of the affective quality of the reward was not significant, indicating, once again, that there was no combined impact of both task and reward affectivity on the decision. Unlike in Study 2, where no mediation model proved to be significant, in this study we were able to successfully detect a mediation pathway. The mediation analysis, which tested all three possible pathways, showed that only the immediate felt affective reaction associated with the task was a significant mediator. These

results seem to conform more to the first pathway, given that both expected affect and subjective probability were in the mix (testing thus the second and the third pathway).

As already stated, there was no combined affective impact, only a main effect of task, just like in Study 3. However, in Study 3 it was not possible to discern the possible reasons for this effect. Luckily, Study 4 allowed us to verify why this might be. First, it was proposed that the affective reaction of the rewards was not adequately evoked i.e. that the affective reactions associated with the rewards were not strong enough, which might have led to a lack of an effect of reward. However, this does not seem to be case as the affective reactions associated the rewards in this study were again evaluated more strongly, compared to the affective reactions associated with the tasks (i.e., the valence reactions evoked by both the P and LP rewards were higher than the P and LP task), but there was no effect of the reward and indeed, no combination²⁷.

Second, it was proposed that the presence of the affect-related questions has somehow nudged the participants towards only focusing on the affective reaction of the one piece of information (the reward in Study 2 and the task in Study 3). However, the results show that the presence vs. absence of the questions did not moderate the affective influence on the decision.

Third, it was proposed that affective combination (i.e. a combined impact of task and reward) was not observed in the previous study because we did not have enough power. However, yet again, with a higher number of participants and 90% power to observe an effect as small as $\eta_p^2 = .02$, there was still no combination.

²⁷ This result also invalidates the assumption that tried to explain why only the main effects of the affective quality of the reward was obtained in Study 2 (i.e., no combination). It was hypothesized that this could be because the affective reactions associated with the rewards were much stronger than affective reactions associated with the tasks. In Study 4, we again saw that the affective reactions associated with the rewards were evaluated more highly than those associated with the tasks, and yet there was no effect of the rewards, and more importantly, no combination. However, the affective quality of the rewards in Study 4 did not differ, while in Study 2 it did. This means that it is not the strength of the affective quality of the rewards that lead to its impact on the decision in Study 2 but the fact that the rewards did not differ, affectively. We discuss this further below in the Study 4 discussion.

Finally, it was proposed that an effect of reward affectivity was not observed in the previous study because there was no affective difference between the rewards. The results show that this is the likely explanation. Indeed, there was no affective difference between the two rewards as showed by a lack of manipulation check.

Working model for explaining the lack of combination

We now have results from four studies and it is possible to speculate on a working model that could explain the lack of an affective combination that was consistently obtained. The overall results seem to point to the fact that when the rewards differ affectively, even when the affectivity of the tasks also differed, people only rely on the affectivity of the rewards (obtained in Study 1 - with a marginal effect, and in Study 2). However, when the rewards do not differ affectively (i.e. they do not elicit markedly different affective reactions) and the tasks do differ affectively, people only rely on the affectivity of the tasks (obtained in Study 3 and Study 4). Furthermore, these effects seem to be independent of the strength of the affective reactions associated with the rewards and whether the participants were explicitly asked to provide an evaluation of the affective reaction (i.e. whether we asked the affect-related questions or not). A possible reason for why the affective quality associated with the rewards might be more important could be because rewards are essentially the possible outcome (i.e. consequence) of the decision, and decision makers have been shown to be inherently more sensitive to the consequences of the decision (Blanchette & Richards, 2010; Rick & Loewenstein, 2008). Indeed, nearly every classical model of decision making, from expected utility theory, subjective utility theory, to prospect theory, posits that people are focused on the possible consequences of their decisions (Bell, 1985; Lucey & Dowling, 2005; Mishra, 2014). Therefore, the affective quality associated with the rewards could be a much more important cue for the decision, which is why people rely on it more, even when another affective cue is present (i.e. tasks).

Limitations. However, there could be other possibilities for why we failed to observe affective combination (i.e. a combined impact of the affective qualities of task and reward on

the decision). Chief among them is the fact that no other extraneous information is shown to our participants. Indeed, participants are not shown how much the rewards are worth (in terms of the monetary value), nor are they shown how likely they are to succeed in the tasks. This information was not shown because, as I have argued in the introduction to Study 1, a preponderance of research shows that when explicit information like this is given up front, people simply rely less, or not at all, on affective reactions (cf. Denes-Raj & Epstein, 1994; Pachur, Hertwig, & Wolkewitz, 2013; Van Gelder, De Vries, & Van Der Pligt, 2009). However, one might argue that the lack of this information is what is causing our inability to observe a combined impact of the two affective pieces of information on the decision. For instance, because participants do not know this information, the decision situations that they are in can be said to exemplify uncertainty (Rachlin, 2003). This uncertainty has been shown to lead to an increase reliance on affect (Rad & Pham, 2017), but it could be leading people to only focus on *one* piece of affective information (whichever they consider more pertinent), anchoring on it, and ignoring the other piece of affective information. If they had all the other extraneous information and two affective reactions were evoked, maybe we could observe a combination because participants would take into account the entire decision situation. This possibility is tested in next study.

Study 5

In this study, it was attempted to see if we would observe a combined impact of affective reactions when all the extraneous information was explicitly given to participants. Therefore, to the descriptions of the task we added what chances people had to be successful in them, and to the description of the rewards we added how much they were worth.

Alongside these changes, attempts were made to more reliably induce affective reactions from the tasks and rewards. In order to do this, alongside the description of tasks and rewards, pictures were added that represented them, in order to better flesh out the immediate affective reactions. This would hopefully lead to more precise and consistent immediate affective reactions. As mentioned in previous chapters, imagery is strongly associated with

affect elicitation and with the augmentation of the impact of affect (Gollnisch & Averill, 1993; Keller, Vischers, & Siegrist, 2012; MacGregor, Slovic, Dreman, & Berry, 2000) therefore, it should aid in observing consistent affective reactions.

Method

Participants

A total of 240²⁸ participants were recruited on mTurk. They were randomly assigned to a 2 (Task: P vs. LP) x 2 (Reward: P vs. LP) between subject design with the order of the task and reward presentation being counterbalanced. The IMC (i.e. the satisficing measure) was again implemented at the start of the study and six participants that did not correctly answer the question were excluded. Thus, the total number of participants was 234 (101 female, $M_{Age} = 36.24$, $SD_{Age} = 11.66$).

Procedure

The procedure was similar to the ones presented in the previous studies with six changes. First, as mentioned above, all descriptions of tasks and rewards were supplemented with a photo that represented them (Figure 5). The test in this study hinged on the fact that both the task and the reward evoked clear P and LP immediate affective reactions. Adding the photo might increase the chance of forming an immediate affective reaction since imagery is strongly associated with affect elicitation and with the augmentation of the impact of affect. Second, different reward descriptions were used to the ones presented in Studies 3 and 4. The reward descriptions did not evoke the desired affective reactions in studies 3 and 4, which is why they were changed. For the P reward, participants were now presented with: “A *voucher for a romantic dinner for two. The restaurant has good food, it's clean, the general atmosphere is cozy, and very intimate*”. For the LP reward, the participants were now presented with: “A *voucher for a romantic dinner for two. The restaurant has good food, but it's a bit grimy, the*

²⁸ This is roughly the same number of participants that were asked the questions in Study 4, allowing us to detect an effect as low as $\eta_p^2 = .03$ with 80% power, which is between the effect sizes obtained in Study 4 (.01) and Study 3 (.06).

general atmosphere is noisy, and it's shabby” (Both of these rewards differed in their affectivity, see pre-test). Third, with the description of tasks, the participants were told that they have a 50% chance of success and with the description of the rewards, participants were told that they cost \$50. These additions made the situations equal (i.e. participants had a 50% chance to win a \$50 reward) with the only difference being the affectivity²⁹. Fourth, the phrasing of the main dependent variable question was slightly altered. Now, the participants did not offer money to get *an opportunity* to play the game. Giving money to get the opportunity to play something is not the same as giving money for something, so this wording was discarded. Rather, the question was more direct and participants were instructed that they could buy tokens that ensured an attempt at the game. This change was instituted because one could argue that the roundabout way of asking the question could lead to less engagement by participants and make the decision sound less realistic. Participants were told that the tokens cost 20 cents, and that they could decide to buy as many as they wanted. Thus, the dependent variable was the mean number of tickets bought (i.e. the decision). Fifth, in the previous studies, participants were also told that they had 10 Euros and that they could choose some of that sum to give for the game. This could have stymied their response leading to a ceiling effect. In this study, people were no longer limited by a certain range. They could buy any amount of tickets that they wanted. The participants were told that there would be no actual exchange of money and that the decision situation was hypothetical. Sixth, the measure of BMIS was discarded as it was shown throughout four studies that mood did not in any way interact with the integral affect manipulations. At the end of the study, participants were presented with a screen that served as a debriefing.

²⁹ It is worth pointing out that the situations could be said to be “objectively” equal, but subjectively, the participant could, for instance, think that the LP reward was overpriced, or that the P reward was underpriced. However, this would still mean that the participants took into account the affective quality of the reward, meaning that this would be reflected in the decision. In such a case, we would observe the participants giving more money for the P reward and less for the LP reward.





| | P | LP |
|--------|---|--|
| Task |  |  |
| Reward |  |  |

Figure 5. Pictorial representations of the tasks and rewards used in Study 5. These pictures were presented alongside the P (LP) descriptions.

Results

Affective quality of task / reward, and subjective probability

Immediate integral affect – task. As expected, the 2 (Task: P vs. LP) x 2 (Reward: P vs. LP) ANOVA showed a main effect of the affective quality of the task, $F(1, 230) = 16.99, p < .001, \eta_p^2 = .07$ with the P task evoking more pleasant feelings ($M = 1.13, SD = 2.00$) than the LP task ($M = -0.07, SD = 2.40$). No other effects were significant, all F 's $< 1.82, ps > .67$.

Immediate integral affect – reward. Similarly, in a 2x2 ANOVA, as expected, the P reward evoked more pleasant feelings ($M = 2.68, SD = 1.63$) than the LP reward ($M = -0.02, SD = 2.10$), $F(1, 230) = 119.41, p < .001, \eta_p^2 = .34$. No other effects were significant, all F 's $< 1, ps > .76$.

Expected affect and subjective probability. The 2x2 ANOVA showed only a main effect of the affective quality of the reward, $F(1, 230) = 18.89, p < .001, \eta_p^2 = .08$, with participants expecting to feel more pleasant if they were to win the P reward ($M = 2.62, SD = 1.64$) than the LP reward ($M = 1.56, SD = 2.07$). Additionally, there was no impact on subjective probability, all F 's $< 2.46, ps > .12$.

Affective quality of task / reward on the decision

Because participants could choose any number for their decision there could be extreme responses, flagged as outliers, which could impact the decision. Using a method of standardized residuals, six such outliers were identified (with $RSS > 3$) and removed from the analysis. Unexpectedly, the analysis failed to reveal any significant effects of the factors on the decision variable (all F 's $< .46$, $ps > .50$). It is standard practice to repeat the results with the excluded outliers in order to verify that the results are not overly sensitive to a single observation (Bakker & Wicherts, 2014). Including the six outliers and repeating the same 2x2 ANOVA does not change the results.

Discussion – Study 5

The changes that were instituted for the task and reward descriptions seem to have been successful. Immediate affective reactions were successfully evoked from both the tasks and the rewards. There was even a significant effect of affective quality of reward on expected affect (something that was not present in any of the studies before). However, unexpectedly, and in spite of these successful manipulations, there was a failure to observe any effect on the decision.

These results cannot be explained by a lack of manipulation of affective reactions nor by a lack of power since the number of participants was sufficient to obtain effect similar to those in the previous studies. Therefore, given the findings from previous studies, one can presume that because of the presence of extraneous information, participants failed to rely on the affectivity associated with the tasks and rewards. Previous research showed that when other information is present, reliance on affect is diminished (Denes-Raj & Epstein, 1994; Pachur et al., 2013; Van Gelder et al., 2009). This seem to be particularly true when information is pertinent to the decision (Pham & Avnet, 2004; Van Gelder et al., 2009). Additionally, the extraneous information was provided in such a way to effectively make the games equal i.e. there was a 50% to win a reward of \$50, thus precipitating the results where no difference between the conditions would be obtained. The only difference between the conditions were the affective qualities of the tasks and the rewards, which the participants obviously did not rely

on due to the presence of the extraneous information. Finally, this means that the presence of extraneous information was not the reason for why we failed to observe a combined impact of the two affective reactions in the previous studies.

Limitations. In this study, it was shown that the presence of extraneous information did not prove to be conducive to demonstrate affective combination. Similarly, it was shown, in previous studies, that the lack of an affective combination is not due to strength with which the affective reactions were evoked, nor due to the fact that participants are asked to state the affective quality of the tasks or rewards immediately after their presentation. Indeed, the working model presented in the discussion of Study 4 states that there will be no affective combination if the rewards differ in their affectivity, even when the tasks also differ in their affectivity i.e. that there will only be a significant effect of the affective quality of the reward. We explain this by noting that the main feature of a reward stimulus is that it is a potential outcome (i.e. consequence) of the decision and that decision makers are inherently more sensitive to the consequences of the decision (Loewenstein et al., 2001; Rick & Loewenstein, 2008; Shafir & Tversky, 1992). Indeed, nearly every classical model of decision making, from expected utility theory, subjective utility theory, to prospect theory, posits that people are focused on the possible consequences of their decisions (Bell, 1985; Lucey & Dowling, 2005; Mishra, 2014). The affective quality of the reward could thus be more important, since it changes a feature of the reward that gives the decision maker a cue that is related to this consequentiality. One obvious cue that it could impact is the perceived monetary value of the reward. Indeed, as mentioned in Chapter 4, while discussing possible reasons for why we might not observe affective combination, it is mentioned that affect can act as “spotlight” (Peters, Västfjäll, Gärling, et al., 2006). This means that an affective reaction could focus the decision maker on new information. This new information could be the perceived monetary value.

Therefore, in accordance with our working model, we would expect that if we were to repeat Study 5, but without the extraneous information, we would observe a main effect of the affective quality of the reward, even though both the task and the reward would differ

affectively. However, we could also verify if this is due to the fact that the affective reaction associated with the reward has changed the important consequential cue of perceived monetary value of the reward, thus making the affective quality of the reward more important. This could be an explanation for why participants only rely on the affectivity of the reward, ignoring other affective information, which leads to non-combination.

Study 6

The first goal of this study was to test the working model that proposes that no combination will be observed when the affectivity of the rewards differs even when the affectivity of the tasks also differ, i.e. that only the effect of the reward on the decision will be significant. The second goal was to test whether this happens because the affectivity of the rewards changes the consequential feature of the perceived monetary value of the reward.

Method

Participants and procedure

A total of 240 participants were recruited on mTurk. Eighteen participants did not successfully pass the IMC and were excluded. Total number of participants was therefore 222 (99 female, $M_{Age} = 35.91$, $SD_{Age} = 11.71$). The design, procedure, and the stimuli were the same as in Study 5, with two changes. First, no extraneous information is presented given that it most likely leads to less reliance on affect. Two, in order to control the potential effect of monetary value, we asked participants a question regarding how much money they thought the rewards were worth (participants could put in any number they saw fit, there were no anchors).

Results

Affective quality of task / reward, subjective probability, and monetary value

Immediate integral affect – task. As expected, the 2 (Task: P vs. LP) x 2 (Reward: P vs. LP) ANOVA revealed a main effect of affective quality of task, with P task evoking more pleasant feelings ($M = 1.23$, $SD = 2.06$) than the LP task ($M = -0.15$, $SD = 2.02$), $F(1, 218) = 25.05$, $p < .001$, $\eta_p^2 = .10$. No other effects were significant, all F 's $< .75$, $ps > .39$.

Immediate integral affect – reward. Similarly, as expected, there was only a main effect of affective quality of reward, $F(1, 218) = 145.98, p < .001, \eta_p^2 = .40$. The P reward evoked more pleasant feelings ($M = 2.64, SD = 1.62$) than the LP reward ($M = -0.58, SD = 2.25$). No other effects were significant, all F 's $< .49, ps > .48$.

Expected affect. There was again only a main effect of the affective quality of reward, $F(1, 218) = 21.83, p < .001, \eta_p^2 = .09$. Participants expected to feel more pleasant if they were to win the P reward ($M = 2.57, SD = 1.54$) than the LP reward ($M = 1.34, SD = 2.21$). No other effects were significant, all F 's $< 2.63, ps > .11$.

Perceived monetary value and subjective probability. There was a main effect of affective quality of reward on perceived monetary value, $F(1, 218) = 17.31, p < .001, \eta_p^2 = .07$. Participants thought that the P reward was worth more ($M = 117.65, SD = 135.01$) than the LP reward ($M = 53.48, SD = 89.40$). Finally, there was again no effect on subjective probability, all F 's $< 1, ps > .42$.

Affective quality of task / reward and decision

Three outliers concerning the decision were identified ($RSS > 3$) and were excluded. The results of a 2x2 ANOVA, as expected, revealed a significant main effect of reward, $F(1, 215) = 8.72, p = .003, \eta_p^2 = .04$, with people deciding to give more money for the P reward ($M = 5.62, SD = 5.67$) than for the LP reward ($M = 3.65, SD = 3.94$), see Figure 6. Conducting the same ANOVA, with the three outliers included, reveals that again, that only the main effect of reward is significant, $F(1, 218) = 7.73, p = .01, \eta_p^2 = .04$. Finally, we also inserted the perceived monetary value of the reward as a covariate in the analysis to verify if the effect of the affective quality of the reward remained significant. It did, $p = .034$, but see the discussion for a more nuanced approach to this.

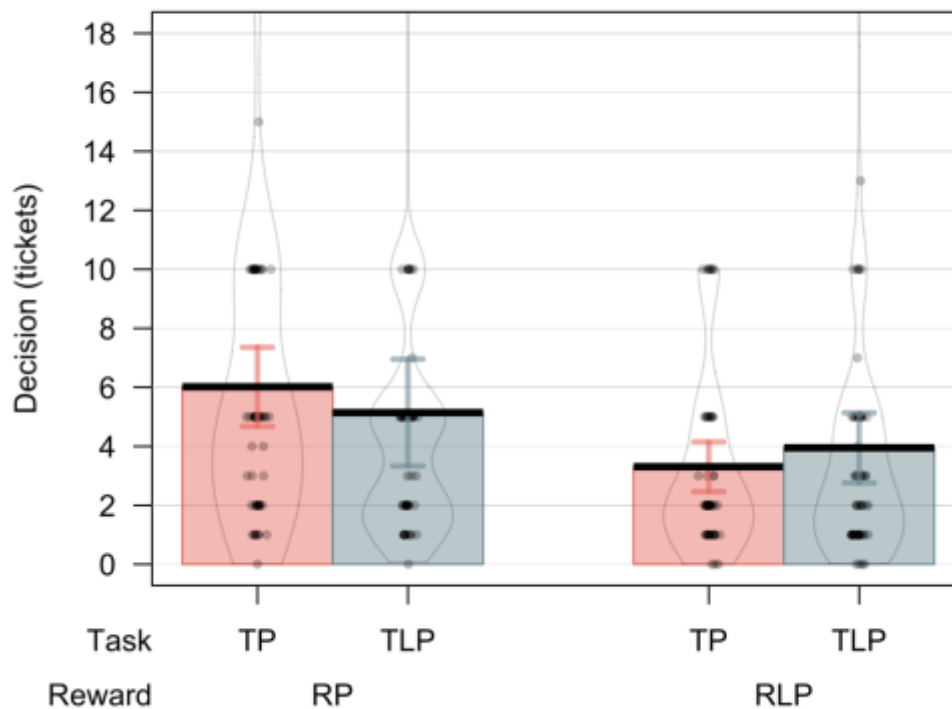


Figure 6. Decision on how many tickets to buy for the game as a function of Task and Reward for Study 6. The figure shows the main effect of the affective quality of the reward. The tails represent 95% confidence intervals. The raw data along with their distribution with the violin density graph – the wider the cone the more data is in that area – is also presented.

Mediation analysis

The PROCESS macro was used again. The rewards were the IV while the average number of tickets intended to be bought was the DV. Four mediators were included this time: immediate affect, expected affect, subjective probability, and the perceived monetary value. Monetary value was included as a mediator since under the assumptions of the third multi-step pathway a mediating affect-decision relationship could be that immediate affect impacts the evaluation of monetary value, which in turn impacts the decision. The results of the mediation analysis are depicted in Figure 7. Interestingly, two mediation models were significant. Immediate affective reactions were a significant mediator, $b = -.142$, $SE = .048$, 95% CI $[-.238, -.048]$, just like in Study 3, and the evaluations of perceived monetary values of the reward were a mediator, $b = -.042$, $SE = .023$, 95% CI $[-.097, -.008]$. The results of the mediation analysis

seem to indicate that two factors, both immediate affective reactions towards the rewards and the evaluation of the perceived monetary values of the rewards seem to impact the decision in joint, but independent ways. Furthermore, the results show that the relationship between the rewards and the decision does not remain significant once these two mediators are included. This would seem to signal that this is a full mediation model.

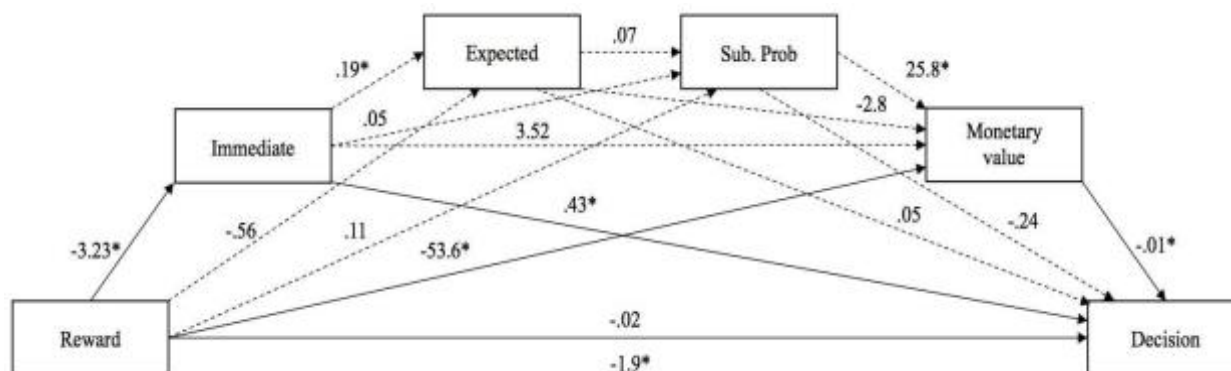


Figure 7. Mediation model for Study 6, including all possible pathways and the regression coefficients (* $p < .01$). The significant models are presented with full lines (dashed are insignificant) and it shows two significant mediator models; the immediate affective reaction and the evaluation of monetary value.

Discussion – Study 6

Study 6 again successfully induced the desired immediate affective reactions of both tasks and rewards. Unlike the result in Study 5, where extraneous information about probability of success and the monetary value were explicitly given and no significant effect were obtained, removing this information resulted again in the affectivity of the rewards impacting the decision. The results seem to confirm the working model assumption in that when the affectivity of the rewards differs, this affectivity will have an impact on the decision, even when the tasks also differ in their affectivity. Importantly, this result seems to related to the fact that the affective quality of the rewards changes the consequential cue of the perceived monetary value.

The mediation analysis results are somewhat similar to the ones obtained in Study 3, in that the immediate affective reaction was the mediator between the affectivity of the reward and the decision. However, the perceived monetary value was also a mediator, although a

separate one. This would seem to indicate an independent (i.e. parallel) impact of these two features on the decision.

As mentioned above, the perceived monetary value was introduced as a covariate and it was obtained that the effect of affective quality of the reward remained significant. This seems to imply that the perceived monetary value is a confound that needs to be controlled. However, this is the wrong view and it should be worth noting here that the analysis of covariance might not be an appropriate method to apply since the covariate differs between groups (i.e. the factor of affective quality of reward had a significant impact on the perceived monetary value), thus violating one of the assumptions necessary for the ANCOVA; that the IV and the covariate should not correlate, they should be independent (see, Miller & Chapman, 2001). Thus, the effect on the perceived monetary value is not a confound, but rather it should be considered as a feature, not a bug. The affective reaction associated with the reward *changes* the perceived monetary value. This would go in line with our assumption that the affective quality of the reward could be more important (i.e. no combined impact of task and reward), since it changes a feature of the reward that gives the decision maker a cue that is related to this consequentiality. This consequential feature is the perceived monetary value. The most likely reason for this is the fact that affect can act as a “spotlight”, in that the affectivity changes another piece of information in its impact on the decision (Peters, Västfjäll, Gärling, et al., 2006).

These results would present an interesting boundary condition for the combined impact of multiple integral affective reactions on the decision. It would seem to indicate that when an affective reaction is related to a consequential feature of a decision, all other affective features will be disregarded. It also explains our results in Studies 3 and 4 where we obtained a main effect of the affective quality of the task. The affective quality of the rewards did not differ in these studies, thus there was no consequential cue for the participants to rely on.

The peculiarity of this result is interesting for an additional two reasons which are relevant for JDM. First, the participants were aware that the game included the task which they would have to actually do if they were to play the game. There is no reason to think that this

info should not reflect on their willingness to pay for the game and yet it did not. Second, it would mean that the impact of one, or more, pieces of affective information (i.e. no combination) could be totally disregarded when the rewards evoke demonstrably different affective reactions. For our main topic of interest, it would mean that in decision situations with two (or more) independent affective reactions, coming from two (or more) independent affective sources, if one of the sources is the potential reward (i.e. related to the potential consequence or outcome), no combine impact of affective reactions can be expected. Additionally, unlike previous research where the affective combination has been (precariously; i.e., unfoundedly) proposed, we see that an affective combination, using a decision setup that includes an action that needs to be done (the task), and one that includes the possible outcome or consequence of the decision (the reward) (Hastie, 2001), a combined impact of two affective reactions cannot be expected.

Are there conditions when a combination of affect in a JDM context can appear?

Given the boundary conditions identified in the previous studies, one might wonder if a different type of setup for the decision situation might actually be more conducive to demonstrating affective combination. In this vein, one can make an assumption that a combined impact of immediate integral affective reactions is not possible when the affective reactions are coming from two independent sources, since the two independent sources will always carry additional features with them that could stymie the combination. In all the previous studies above, the individual affective reactions were coming from two independent sources, the task and the reward. This was an important feature of our decision situation because it emulated a decision setups that had both a decision action and a potential outcome. However, what if two or more affective reactions were coming, not from two independent sources, but from a single source (i.e. they were related to a single source)? One could reasonably presume that integral affective reactions could then have a combined impact. This presumption is analogous to a process first described by Asch (1946), where he posited that when two traits are perceived as pertaining to one individual, they enter in mutual interaction. Additionally, Barnett and Wickens (1988) have shown that the ability of individuals to integrate information from a number of sources is dependent on display integrality i.e. whether the information is displayed in such a way to facilitate integration. Making the affective reactions be related to a single source, would, in a way, facilitate this integration. In the following section, this idea was tested. Because the affectivity associated with the consequential feature seems to be more pertinent and more important for the decision maker, the rewards were chosen as the single source.

Study 7

In accordance with the argument presented in the above paragraph, the decision situation was changed in this study. Specifically, two pieces of information that were described to evoke either a pleasant (P) or less pleasant (LP) integral affective reaction, were presented. However, unlike in the previous two studies, where one integral affective reaction was related to the task and the other to the reward, here, the two integral affective reactions were related to a single

source (i.e. the reward). Alongside this, participants completed four decisions in a within subject design with multiple rewards. This change in the design enabled an extension of findings beyond a single type of reward since the four rewards were different, varying on many attributes like attractiveness and value. Therefore, any result we were to obtain relating to the affectivity of the information could be less attributed to the differences between the rewards. It was expected, that when the integral affective reactions were related to a single source that we would observe a combined impact of the two affective reactions on the decision.

Method

Participants

One hundred and twenty-seven psychology students at the University of Sarajevo participated in exchange for course credit. Three individuals were excluded from the analyses because they responded with the same number for all the questions. This indicated that they did not follow the instructions and that their data was unusable. Therefore, one hundred and twenty-four participants remained (women = 101, $M_{Age} = 21.11$, $SD_{Age} = 2.36$). They went through four conditions of a 2 (first piece of information: P vs. LP) x 2 (second piece of information: P vs. LP) within participant design.

Procedure and materials

The procedure was similar overall to the ones in the previous studies with several differences that pertained to the within-subject design and the fact that participants had to make four decision instead of just one. Participants completed the study in groups of 4 in a large laboratory room (5m x 10m). They were separated and could not interact with each other. They were told that they were going to be presented with four games with unknown probabilities of success (see Appendix A for a description of rewards and the affective pieces of information that were associated with them).

Special care was taken concerning the design of the study. A representation of the design is illustrated in Figure 8. There, “R” stands for reward, “+”, for P piece of information, and “-”, for the LP piece of information. First, it was necessary to ensure that the affective connotation

(i.e. the arrangement of the P and LP pieces of information) was not associated with a specific reward. For instance, it should not happen that the condition with two P pieces of information (++) is always associated with the same reward. This could be a confound as any results related to the affective connotation, could reflect, not an effect of affect, but the effect of reward. Therefore, affective connotation order (i.e., order of the way the affective pieces of information were presented) was counterbalanced, for each participant, using a Latin square design. Second, it was necessary to ensure that the sequence of how the affective connotation is presented, does not remain the same. For instance, that the ++ condition does not always follow the +- condition. Therefore, the sequence of the affective connotations was changed every four participants (see Participant 5 in Figure 8. who had a different sequence of the affective connotation conditions than Participant 4). Then this new sequence was counterbalanced using a Latin square design, until being changed again after four participants. The same was done for the rewards (see Participant 5 in Figure 8). Thus, both the order of rewards as well as the sequence of the affective connotations was varied.

| Participant 1 | Participant 2 | Participant 3 | Participant 4 | Participant 5 | ... |
|---------------|---------------|---------------|---------------|---------------|-----|
| +R1- | -R1+ | -R1- | +R1+ | +R4- | ... |
| +R2+ | +R2- | -R2+ | -R2- | -R3+ | ... |
| -R3- | +R3+ | +R3- | -R3+ | -R1- | ... |
| -R4+ | -R4- | +R4+ | +R4- | +R2+ | ... |

Figure 8. A schematic presenting the procedural design of the affective connotation sequence and the order of the rewards in Study 7.

One decision trial went as follows: say the participant was deciding while being presented with the reward of a restaurant dinner in the condition with one P and one LP piece of information. They would first be presented with the P piece of information for 5 seconds (e.g. *The restaurant is romantic*). Then, the LP piece of information would be presented for 5 seconds (e.g. *The restaurant is not so popular*). After the presentation of the affective information, a picture of the reward would be presented for 2 seconds (See Appendix B for the presentation of the pictures used to represent the rewards in this study). Immediately afterwards, participants would provide answers to the same four questions used in the previous study: the

immediate affective reaction, expected affect, subjective probability and the perceived monetary value. The immediate affective reaction question was always asked just after the presentation of the reward. The order of the other questions was randomly posed. The wording of the questions was the same as in previous studies. The only difference was that for the affect related questions, a bipolar -8 (unpleasant) to 8 (pleasant) scale was used. Unipolar measures would have substantially increased the number of questions and it could have led to fatigue for our participants given that they had a higher number of decisions to make. The main dependent variable remained the same as in Studies 5 and 6. Finally, participants had one training trial in order to familiarize themselves with the decision procedure. At the end, participants were debriefed.

Results

Affective quality of immediate integral affect, expected affect, subjective probability and perceived monetary value

Immediate integral affect. A 2 (First piece of info: P vs. LP) x 2 (Second piece of info: P vs. LP) repeated measures ANOVA revealed a main effect of the affective quality of the first piece of information, $F(1, 123) = 66.63, p < .001, \eta_p^2 = .35$, with participants in the P condition giving a more P evaluation ($M = 4.28, SD = 2.18$) than participants in the LP evaluation ($M = 2.16, SD = 2.43$). There was also a main effect of the second piece of information, $F(1, 123) = 63.47, p < .001, \eta_p^2 = .34$, with participants in the P condition giving a more P evaluation ($M = 4.44, SD = 2.25$), than participants in the LP condition ($M = 1.99, SD = 2.70$). There was no interaction. Because we observed that both the first and the second piece of information had a significant impact, we can conclude that there was a combined impact. To explore the potential combination, we conducted a series of pairwise comparisons between the four conditions, with a Bonferroni correction. The means, standard deviations, and whether they differ, are summarized in Table 3. As expected, the P-P condition produced the most pleasant immediate feelings while the LP-LP condition produced the least pleasant feelings. Both of these conditions differed from the P-LP and LP-P conditions, between which there was no difference.

Expected affect. A 2x2 repeated measures ANOVA again found that there was a main effect of the first piece of information, $F(1, 123) = 47.56, p < .001, \eta_p^2 = .28$, with participants in the P condition giving a more P evaluation ($M = 4.74, SD = 2.30$) than participants in the LP condition ($M = 2.85, SD = 2.50$). There was also a main effect of the second piece of information, $F(1, 123) = 44.32, p < .001, \eta_p^2 = .26$, with participants in the P condition giving a more P evaluation ($M = 4.80, SD = 2.33$) than participants in the LP condition ($M = 2.80, SD = 2.66$). Finally, there was also an interaction, $F(1, 123) = 5.22, p = .002, \eta_p^2 = .04$. The pairwise comparisons between four conditions showed the same pattern as for immediate affect.

Subjective probability. In the 2x2 repeated measures ANOVA, there was also a main effect of the first information, $F(1, 123) = 9.34, p = .003, \eta_p^2 = .07$, with participants in the P condition thinking that they were more likely to win ($M = 41.84, SD = 21.81$) than participants in the LP condition ($M = 37.47, SD = 20.37$). There was also a main effect of the second information, $F(1, 123) = 11.00, p = .001, \eta_p^2 = .08$, with participants in the P condition thinking that they were more likely to win ($M = 41.67, SD = 20.19$) than participants in the LP condition ($M = 37.64, SD = 21.16$). The interaction was not significant. Pairwise comparisons show that the only difference was between the P-P and LP-LP conditions.

Perceived monetary value. In the 2x2 repeated measures ANOVA, there was a main effect of first piece of information, $F(1, 123) = 28.09, p = .001, \eta_p^2 = .19$, with participants in the P condition thinking the rewards cost more ($M = 208.38, SD = 137.27$) than the participants in the LP condition ($M = 138.08, SD = 96.98$). There was also a main effect of the second piece of information, $F(1, 123) = 7.02, p = .01, \eta_p^2 = .05$ with participants in the P condition thinking that the rewards cost more ($M = 200.52, SD = 156.80$) than the participants in the LP condition ($M = 145.93, SD = 138.16$). The interaction was not significant. Pairwise comparisons show that P-P did not differ between P-LP. The other results were the same as for immediate and expected affect.

Table 3. Means, standard deviations, and pairwise comparisons for the four conditions in Study 7 on immediate affect, expected affect, subjective probability, evaluations of monetary value, and the decision.

| Condition | Immediate | Expected | Subjective probability | Monetary value | Decision |
|-----------|--------------------------|--------------------------|---------------------------|---------------------------------|-------------------------------|
| | M (SD) | M (SD) | M (SD) | M (SD) | M (SD) |
| P-P | 5.19 ^a (2.84) | 5.40 ^a (3.24) | 43.9 ^a (21.6) | 226.98 ^{ab} (200.0) | 25.72 ^a (26.29) |
| P-LP | 3.37 ^b (3.64) | 4.08 ^b (3.26) | 39.81 ^a (25.1) | 189.77 ^b (213.44) | 18.65 ^b (23.89) |
| LP-P | 3.70 ^b (3.41) | 4.19 ^b (3.29) | 39.5 ^a (22.9) | 174.07 ^b (175.13) | 19.88 ^b (22.45) |
| LP-LP | .61 ^c (3.77) | 1.51 ^c (3.67) | 35.5 ^b (24.45) | 102.08 ^c (123.14) | 8.40 ^c (13.40) |

The means that do not share the same superscript (looked at vertically across the different measures) differ significantly at the $p < .05$ level.

Affective quality of the pieces of information and the impact on the decision

One participant (with $RSS > 3$) was excluded. As expected, a 2x2 repeated measures ANOVA showed that there was a main effect of the first piece of information, $F(1, 122) = 33.54, p < .001, \eta_p^2 = .21$, with participants in the P condition deciding to get more tickets ($M = 22.18, SD = 20.38$) than participants in the LP condition ($M = 14.14, SD = 14.51$). There was also a main effect of the second piece of information, $F(1, 122) = 33.67, p < .001, \eta_p^2 = .22$, with participants in the P condition deciding to get more tickets ($M = 22.80, SD = 20.67$) than participants in the LP condition ($M = 13.52, SD = 15.39$)³⁰. The interaction was not significant (see Figure 9). The decisions were consistent with the combined affective reactions. Participants in the P-P condition bought the most tickets, while the participants in the LP-LP condition bought the least. Both of these conditions differed from the P-LP and LP-P conditions, where participants bought the same amount of tickets.

³⁰ I've done the covariate analysis for its informational value. Indeed, just like in Study 7, the two main effects of the first and second piece of P vs. LP information, remained significant after specifying the perceived monetary value evaluations of the reward as a covariate, both $F_s > 6.55, ps < .01$.

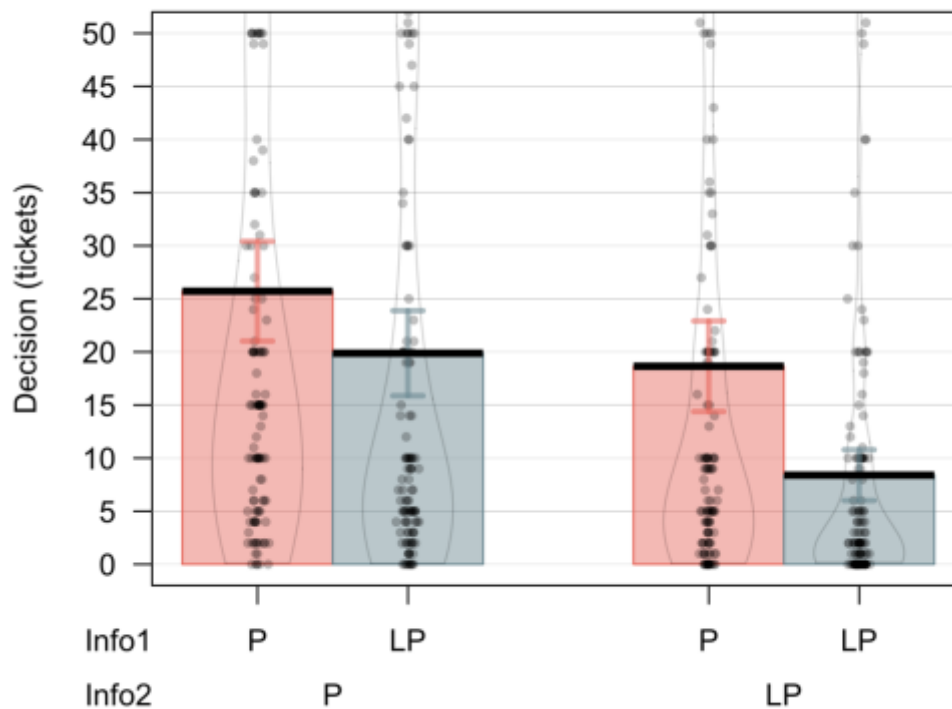


Figure 9. The two main effects of the affective quality of the First and Second piece of information on the mean number of tickets intended to be bought for the game in Study 7. The tails represent 95% confidence intervals. The raw data along with their distribution with the violin density graph – the wider the cone the more data is in that area – is also presented.

Mediation analysis

Because Study 7 utilized a repeated measures design, the mediation analysis followed Judd, Kenny, and McClelland (2001). However, since there were multiple mediators the approach by Montoya and Hayes (2016) was used. This analytical approach recast Judd et al. (2001) approach into a path analytic framework, thus allowing for multiple parallel and serial mediation tests. Because a combination effect was obtained, three global mediation analyses, which all together provide an integral test of the model, were conducted. First, a mediation analysis in which the P-P and LP-LP conditions were opposed, was conducted. Then, the results on the P-LP and the LP-P conditions were averaged, since there was no difference between them, and the average was opposed to the P-P and LP-LP conditions.

P-P vs. LP-LP. Using MPLus, a model was created where every mediator was tested in parallel (e.g., only immediate affect mediates the difference between P-P and LP-LP, only expected affect, etc.). However, we also tested whether immediate affect impacted any of the other measures in a serial manner (e.g. immediate affect impacts subjective probability, making people think that they are more likely to win). This would be a test of the indirect approach. Using 10000 bootstraps (as recommended by Montoya and Preacher, 2016) and a 95% CI, the analysis shows that the only significant indirect effect is the model where immediate affect impacts the perceived monetary value, $b = 2.431$, $SE = 1.28$, 95% CI [.566, 4.72], indicating and indirect impact of affect.

P-P vs. average of P-LP and LP-P. The only significant indirect effect is immediate affect, $b = 4.01$, $SE = 1.95$, 95% CI [1.31, 7.65].

LP-LP vs. average of P-LP and LP-P. The only significant indirect effect is immediate affect, $b = -4.32$, $SE = 1.89$, 95% CI [-7.45, -1.26].

Discussion – Study 7

There was an expected change in the results once the immediate integral affective reactions were related to the same source. In line with a combination assumption, participants were willing to pay more money when they received two pleasant pieces of information about the reward than when they received two less pleasant pieces of information (with reward mixing pleasant and less pleasant information staying in between). These results illustrate that the assumption that integral affective reactions must be related to a single (i.e. same) source to facilitate combination, was correct. The mediation analysis shows that, similar to the findings obtained in the two studies above, between two groups, the affect-decision relationship was mediated by the immediate affective reaction, indicating that the first mediation pathway is most likely the best fit. However, for the P-P vs. LP-LP conditions, the immediate affect impacted the evaluation of monetary value, which in turn impacted the decision. Unlike in Study 6, where both monetary value and the immediate affective reaction mediated the affect-decision relationship, but independently, here we saw a serial mediation, which would be an

example of the third, multi-step, pathway. This might be because the biggest difference, in terms of the decision, was between the P-P and the LP-LP. In this case, the affective impact could have “spilled” over, so that participants also thought that the rewards themselves were worth more in the P-P condition and less in the LP-LP condition.

Limitations. There are two general limitations of Study 7. First, the results concerning the arithmetic rule the combination followed are inconclusive. Despite successfully demonstrating a combined impact of the two immediate affective reactions, the arithmetic rule which the combination followed is still unknown. Looking at the graphical representation of the results in Figure 7, one would assume that it was addition, since two main effects were obtained and as Anderson (1979) mentioned, added results follow a pattern of parallelism. However, a more closer inspection shows that we would expect the same results if people are actually averaging the affective reactions. To be more precise, I’ll try to illustrate with a mathematical example where $P = 5$ and $LP = 3$. In the results, we obtained that there was a difference between the P-P and LP-LP conditions. Looking at the two arithmetic’s we would obtain the same result both with addition and averaging [$5+5 = 10 > 3+3 = 6$ and $(5+5)/2 = 5 > (3+3)/2 = 3$]. Similarly, where we obtained that the P-P condition was different than the P-LP condition. The same result would be obtained both with addition and averaging [$5+5 = 10 > 5+3 = 8$ and $(5+5)/2 = 5 > (5+3)/2 = 4$]. This is true for the other conditions as well. Thus, the results do not differentiate between the two possible arithmetic rules.

Second, one could argue that in Study 7, there is no effective manipulation check of whether the individual pieces of information did really evoke predictable integral affective reactions. It would have been difficult to obtain these measures without directly asking individuals to provide their affective reaction towards each piece of information, which would have increased the number of questions and it might have inadvertently impacted the results. Thus, although it was found that different decision scenarios produced expected affective reactions on the global level (i.e. after the pieces of information were shown), one cannot be sure whether this was preceded by appropriate affective reactions to each piece of information.

For instance, only the first piece of information might have provoked an affective reaction and not the second, or similar. In Study 8, these two limitations are addressed.

Study 8

The aim of Study 8 was to replicate the findings of Study 7 with two extensions. First, in order to determine the nature of the combinatorial rule, another factor related to the presence of an additional (third) piece of affective information was included. This allowed us to directly compare the averaging and addition hypotheses against each other. Precisely, if averaging is the dominant rule, then participants exposed to three or two P pieces of information (i.e., P-P-P and the P-P conditions) should be equally disposed to buy a higher quantity of tickets, in comparison to all other conditions. Conversely, participants exposed to two or three LP pieces of information (i.e., LP-LP-LP and LP-LP conditions) should be equally disposed to buy less tickets. However, if the final decision depends on the addition rule, then the *total* number of P vs. LP pieces of information should play a determining role. In that case, participants exposed to three P (or LP) pieces of information should make the most extreme decision choices, compared to those exposed to only two P (or LP) pieces of information. Second, to remedy the fact that we did not actually have a manipulation check of whether the pieces of information did evoke the desired affective reactions, in Study 8, the immediate affective reactions to each individual piece of information were unobtrusively assessed using a facial electromyogram (fEMG).

Method

Participants

A total of 37³¹ psychology students from the University of Bordeaux participated voluntarily. For three participants, the EMG signal could not be used and these individuals were excluded from the analyses. The total number of participants was 34 (women = 30, $M_{Age} =$

³¹ Given the effect sizes obtained on the decision in Study 7, and because the design in Study 8 would have 12 decision, it was determined that we would need 24 participants to have 95% power in obtaining the same decision effect. However, because fEMG data collection can be difficult with high participant attrition, a higher number of participants was collected.

19.65, $SD_{Age} = 2.40$). Each participant had to make 12 decisions (See Appendix C for a list of all the rewards and the pieces of information associated with them) resulting from crossing three within subject factors: 2 (first piece of information: P vs. LP) x 2 (second piece of information: P vs. LP) x 3 (added piece of information: None vs. P vs. LP).

Procedure and materials

The participants were run individually in the psychology laboratory at the University of Bordeaux. The general procedure was the same as in Study 7, with three modifications. First, before the presentation of each piece of information and the presentation of the reward photo (see Appendix D for a presentation of the photos representing the rewards, used in this study), there was a blank screen that lasted for 2 seconds. This served as a baseline measure for the fEMG. Second, in the previous study and indeed in none of the other studies, the mediation modelling showed that subjective probability was not involved in the affect-decision relationship and was thus excluded. Third, for the affect measures, participants provided their answer on a 0 (Unpleasant) to 10 (Pleasant) instead of the -8 to 8 scale as in Study 7. We changed the scale because some of the participants in Study 7 reported that the -8 to 8 format was a bit confusing.

fEMG measure

fEMG data was collected using BIOPAC's MP150 hardware with the Bionomadix wireless fEMG module (Biopac, Goleta, CA). Two muscles were of interest: the corrugator supercilii and the zygomaticus major. Both of these muscles have been used to study affective reactions, with the zygomaticus being more activated for pleasant affect and the corrugator for unpleasant affect (Cacioppo, Petty, Losch, & Kim, 1986; Cacioppo & Petty, 1979; Lang, Greenwald, Bradley, & Hamm, 1993; Lang et al., 1980; Larsen, Norris, & Cacioppo, 2003).

fEMG activity was measured during the presentation of the pieces of information (5 sec) and during the presentation of the reward as a photo (2 sec). Before each of these measures there was a blank screen baseline (2 sec) where activation was also measured. Fridlund and Cacioppo (1986) instructions were followed for the positioning of electrodes. Participant's skin

was prepared in three steps: first, the relevant areas were cleaned with alcohol, then with abrasive exfoliate cream, and again with alcohol. Re-usable Ag/AgCl electrodes were filled with gel and attached with adhesive patches. The experimenter made sure that the participants were comfortable with the electrodes, but they were just told that the electrodes were measuring an aspect of “cognitive” activity. There was no mention of affect or emotion. Data were recorded using Biopac’s AcqKnowledge software. The signal was online filtered with a high pass of 20Hz and a low pass at 500Hz at a sampling frequency of 2000Hz. Offline, the data were rectified and smoothed with a root means square transformation (Principe & Langlois, 2011). A 50Hz notch filter was also applied in order to eliminate any noise that could have emanated from other electrical sources. Peak facial muscle activity was averaged across the measurement periods.

Results

Affective quality, fEMG, immediate integral affect, expected affect, and perceived monetary value

Analysis of fEMG data – manipulation check. First, the baseline fEMG values were subtracted from the fEMG activity values obtained during the presentation of the information. A 2 (Muscle: Zygomaticus vs. Corrugator) x 2 (Valence: P vs. LP) x 3 (Rank of information: whether it was the information which was shown first vs. second vs. third) repeated measures ANOVA was conducted in order to verify the manipulation success of the affectivity of each piece of information. The results show that there was a significant interaction between muscle and valence, $F(1, 33) = 16.33, p < .001, \eta_p^2 = .33$, with P pieces of information evoking a higher reaction (as measured by peak muscle activity) on the Zygomaticus muscle ($M = 2.99, SD = 3.96^{32}$) than on the Corrugator muscle ($M = -.68, SD = 2.67$). Furthermore, the LP pieces of information evoked a higher reaction on the Corrugator ($M = 2.09, SD = 4.72$) than on the

³² Values concerning the fEMG results are reported to the third power (10^3) for easier representation since the original activation values are quite small and this way it is easier to visualize the differences.

Zygomaticus ($M = -.01$, $SD = 1.05$). As, expected, this interaction indicated that the zygomaticus muscles were systematically more activated during the presentation of P information, whereas the corrugators were more activated during the presentation of LP information. Finally, there was also a three way interaction between valence, muscle and information, $F(2, 66) = 4.00$, $p = .023$, $\eta_p^2 = .06$ (see Table 4. for descriptive statistics and comparisons). The results show that for every rank of the information (i.e. whether the piece of information was shown first, second, or third), the zygomaticus was more activated for the P piece of information than the corrugator, while for the LP piece of information, the corrugator was more activated than the zygomaticus. No other effects were significant, all $F_s < 1.35$, $p_s > .27$.

Table 4. Means and standard deviations (to the third power) of the peak muscle activity for the muscle activation on the fEMG for the three pieces of information in Study 8.

| | Valence | Zygomaticus M (SD) | Corrugator M (SD) |
|--------|---------|--------------------------|---------------------------|
| Info-1 | P | 3.14 (7.51) ^a | -.86 (3.01) ^b |
| | LP | -.22 (3.31) ^a | 4.19 (12.74) ^b |
| Info-2 | P | 3.06 (9.59) ^a | -.99 (7.32) ^b |
| | LP | .07 (1.48) ^a | 1.56 (2.23) ^b |
| Info-3 | P | .69 (1.65) ^a | -.19 (.58) ^b |
| | LP | -.071 (.29) ^a | .50 (1.11) ^b |

The different superscripts indicate a statistically significant difference across the two muscles (looked at horizontally) for each info rank (i.e. first, second, or third piece of information).

Analysis of EMG data after the presentation of the pieces of information. Next, the fEMG activity after the presentation of the pieces of information was looked at. For this, the fEMG activation when the participants were shown the photo of the reward, was used, since this happens after the presentation of the pieces of information. The baseline was again subtracted from the activation for both muscles. This subtraction was then converted into a z-score³³ across participants and muscle sites (i.e. for each participant). Muscle activity was standardized because the two muscles of interest have different properties and the use of z-

³³ There was no need to utilize z-scores in the former analysis since there was no direct subtraction of muscle activity to create a single measure of fEMG activity across muscle sites.

scores allowed for the examination of the change, irrespective of these differences (Cannon, Hayes, & Tipper, 2009). This makes it possible to subtract the activity on the Corrugator muscle from the activity on the Zygomaticus, creating a single EMG activation variable. The higher the value on this variable the more pleasant the reaction. A 2 (first piece of information: P vs. LP) x 2 (second piece of information: P vs. LP) x 3 (added piece of information: None vs. P vs. LP) repeated measures ANOVA found no significant effects (all $ps > .05$) on this measure. The same results were observed even when we considered each muscle individually and not the difference between them (all $ps > .05$). Overall, the fEMG results seem to indicate that while the P and LP pieces of information did evoke predictable physiological reactions, strengthening our claim of an immediate integral affect induction, there was no combined effect of the affective pieces of information on the physiological reaction.

Immediate integral affect – self-report. A 2 (first piece of information: P vs. LP) x 2 (second piece of information: P vs. LP) x 3 (added piece of information: None vs. P vs. LP) repeated measures ANOVA showed that there was a main effect of the first piece of information, $F(1, 33) = 12.55, p = .001, \eta_p^2 = .28$, with the participants in the P condition giving a more P evaluation ($M = 6.94, SD = 1.23$) than participants in the LP condition ($M = 6.22, SD = .90$). There was also a main effect of the second piece of information, $F(1, 33) = 36.91, p = .001, \eta_p^2 = .53$, with participants in the P condition giving a more P evaluation ($M = 7.96, SD = .91$) than the participants in the LP condition ($M = 6.10, SD = 1.10$). Finally, there was also a main effect of the added piece of information, $F(2, 66) = 8.31, p = .001, \eta_p^2 = .20$, with participants in the no added info condition giving a moderate evaluation ($M = 6.55, SD = 1.28$), participants in the P condition giving a higher evaluation ($M = 7.07, SD = .92$), and participants in the LP condition giving a lower evaluation ($M = 6.11, SD = 1.35$). There was no interaction. Given that all three effects had a significant impact, the results indicate combination, just as in Study 7. We again conducted pairwise comparisons with a Bonferroni correction to explore this combination. However, because of the large number of possible comparisons due to the high number of groups, we will present only those that are relevant to testing whether the

combination follows an averaging or additive arithmetic (see Table 5. for the statistics). Consistent with the averaging hypothesis participants exposed to three or two P pieces of information (i.e., P-P-P and the P-P conditions) bought the highest amount of tickets, in comparison to all other conditions while, while participants exposed to two or three LP pieces of information (i.e., LP-LP-LP and LP-LP conditions) bought the least amount of tickets. Crucially, there was no difference between the P-P and P-P-P conditions, nor between the LP-LP and LP-LP-LP conditions.

Expected affect. The same 2x2x3 ANOVA was conducted as for the immediate integral affect, and it showed that there was again a main effect of the first piece of information, $F(1, 33) = 16.74, p = .001, \eta_p^2 = .34$, with participants in the P condition giving a more P evaluation ($M = 7.26, SD = 1.13$) than participants in the LP condition ($M = 6.53, SD = .88$). There was also a main effect of the second piece of information, $F(1, 33) = 52.80, p = .001, \eta_p^2 = .62$, with participants in the P condition giving a more P evaluation ($M = 7.48, SD = .76$) than participants in the LP condition ($M = 6.32, SD = 1.17$). Finally, there was also a main effect of the added piece of information, $F(2, 66) = 10.90, p = .001, \eta_p^2 = .25$ with participants in the no added info condition giving a moderate evaluation ($M = 6.88, SD = 1.37$), participants in the P condition giving a higher evaluation ($M = 7.50, SD = .87$), and participants in the LP condition giving a lower evaluation ($M = 6.32, SD = 1.36$). There was no interaction. The results of the pairwise comparisons also point towards averaging (see Table 5. for the statistics).

Perceived monetary value. The same 2x2x3 repeated measures ANOVA as done for the immediate integral affect and expected affect, showed that there was no effect of any of the factors on the perceived monetary value.

Affective quality of the pieces of information and their impact on decision

One participant ($RSS > 3$) was excluded. The same 2x2x3 repeated measures ANOVA showed that there was a main effect of the first piece of information, $F(1, 32) = 13.44, p = .001, \eta_p^2 = .30$, with participants in the P condition deciding to get more tickets ($M = 13.38, SD = 18.23$) than participants in the LP condition ($M = 8.59, SD = 12.07$). There was also a main

effect of the second piece of information, $F(1, 32) = 13.00, p = .001, \eta_p^2 = .29$, with participants in the P condition deciding to get more tickets ($M = 13.29, SD = 17.61$) than participants in the LP condition ($M = 8.68, SD = 12.92$). In addition, there was a marginally significant main effect of the third piece of information, $F(2, 64) = 3.06, p = .05, \eta_p^2 = .10$, with participants in the no added info deciding to get a moderate amount of tickets ($M = 12.76, SD = 20.16$), participants in the P condition deciding to get a similar amount ($M = 11.47, SD = 12.94$), and participants in the LP condition deciding to buy a lower amount of tickets ($M = 8.73, SD = 13.88$). Finally, there was also a significant three way interaction between the three main factors, $F(2, 64) = 4.15, p = .02, \eta_p^2 = .12$. (see Figure 10). The results of the pairwise comparisons also point towards averaging and in addition we obtained an interaction effect which according to Anderson (1979) is a sure-fire sign of an averaging arithmetic (see Table 5. for the statistics).

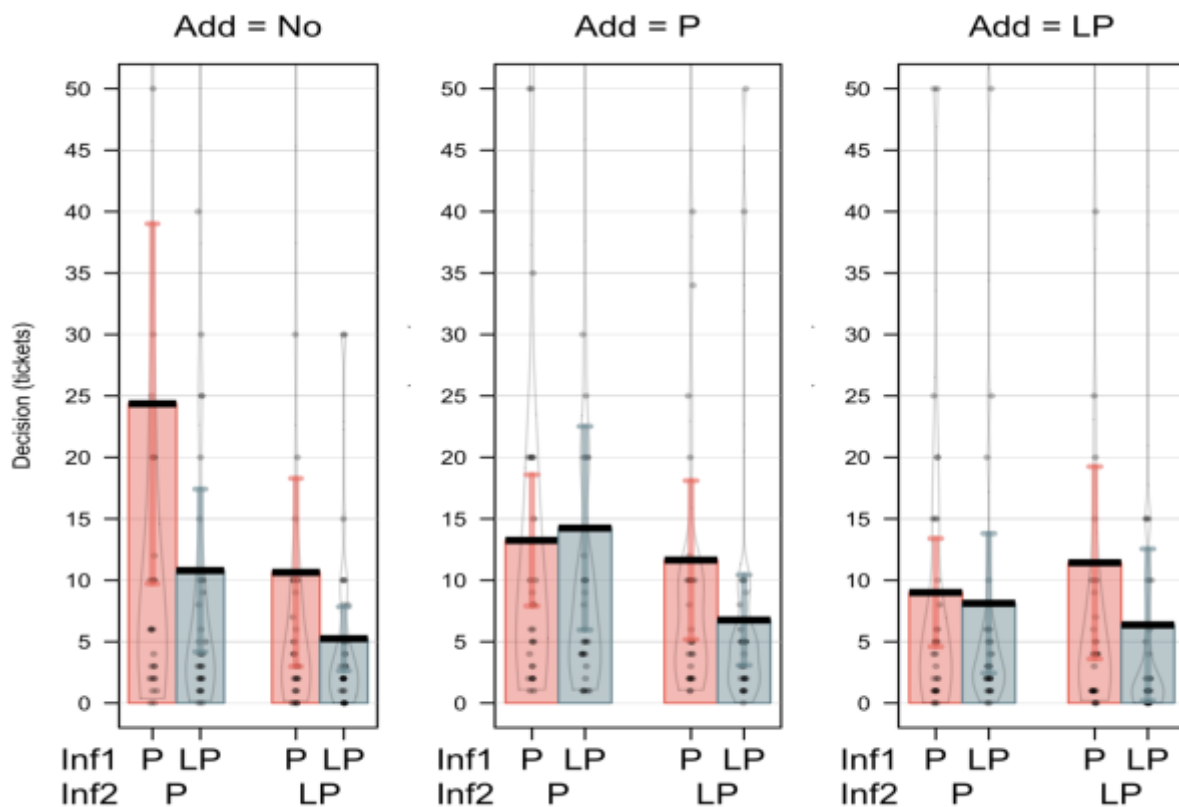


Figure 10. The intention to buy tickets as a function of the three factors (First info, Second info, and the Added info) for Study 8. The figure is presenting the three-way interaction with the individual boxes representing the third factor i.e. the additional information. The tails represent the 95% confidence intervals. The raw data along with their distribution with the violin density graph – the wider the cone the more data is in that area – is also presented.

Table 5. Means and standard deviations for the conditions in Study 8, on immediate affect, expected affect, and the decision. The comparisons are only presented for the conditions relevant to showing whether the combination follows an averaging or additive arithmetic i.e. the conditions P-P, P-P-P and the conditions LP-LP, LP-LP-LP.

| Conditions | Immediate | Expected | Decision |
|------------|--------------------------|--------------------------|----------------------------|
| | M (SD) | M (SD) | M (SD) |
| P-P | 7.38 (2.15) ^a | 8.00 (2.15) ^a | 24.36 (41.30) ^a |
| P-LP | 6.26 (2.34) | 6.62 (2.30) | 10.64 (21.58) |
| LP-P | 6.91 (1.96) | 7.15 (1.78) | 10.79 (18.69) |
| LP-LP | 5.65 (1.92) ^b | 5.74 (1.94) ^b | 5.24 (7.33) ^b |
| P-P-P | 7.68 (2.11) ^a | 8.15 (1.44) ^a | 13.24 (15.07) ^a |
| P-LP-P | 7.26 (1.62) | 7.59 (1.46) | 11.64 (18.23) |
| LP-P-P | 7.26 (1.52) | 7.76 (1.94) | 14.24 (23.35) |
| LP-LP-P | 6.09 (1.50) | 6.50 (1.31) | 6.76 (10.38) |
| P-P-LP | 6.76 (2.03) | 6.91 (2.12) | 9.00 (12.41) |
| P-LP-LP | 6.26 (2.08) | 6.29 (2.38) | 11.42 (22.06) |
| LP-P-LP | 6.35 (1.89) | 6.88 (1.74) | 8.12 (16.01) |
| LP-LP-LP | 5.06 (2.39) ^b | 5.18 (2.42) ^b | 6.36 (17.45) ^b |

Means that do not share the same superscript (looked at vertically for each measure) differ statistically at the $p < .05$ level.

Mediation analysis

The analysis was similar to the one conducted in Study 7. There was again a need to incorporate the combination hypothesis in the mediation analysis. The model had to be updated though. Because there was no effect on the perceived monetary value this measure was not included as a single mediator. Similarly, there was also no combination on the EMG measure so it was not included into the analysis. Thus, there were two parallel mediator paths in the model, immediate self-report and expected affect, and two serial paths where immediate affect impacts expected affect and where immediate affect impacts monetary value evaluation. It was endeavored to minimize the number of mediation tests so the groups where there was no difference were averaged and compared to the P-P condition, since the significant differences

for the decision was found for this condition (see Table 5). The LP-LP, LP-LP-P, LP-P-LP, LP-LP-LP, and P-LP-LP groups were averaged because they did not differ – this is average 1. Additionally, the P-LP, LP-P, P-P-LP, and P-LP-P groups were averaged because they did not differ – this is average 2. The P-P group was opposed to Average 1 and to Average 2. Finally, the Average 1 and Average 2 were opposed, given that there was a difference between them.

P-P vs. Average 1. The analysis, unexpectedly, did not reveal any significant mediators, all CI's contained a zero.

P-P vs. Average 2. Again, unexpectedly, there was no mediation for any of the models, all CI's contain a zero.

Average 1 vs. Average 2. The results show that only the immediate affective reaction was a significant mediator, $b = -1.53$, $SE = 1.07$, 95% CI [-3.37, -.017].

Discussion - Study 8

The results of Study 8 replicate those of Study 7, showing that immediate affective reactions combine to impact the decision, again in a setup where the affective reactions were related to a single source. Additionally, in Study 8 these findings are extended and we show that when an additional piece of information, that evoked an immediate affective reaction, was added, it did not play a significant role on the decision. More specifically, participants decided to purchase the same (highest) amount of tickets for the P-P and the P-P-P conditions. Had the participants added the feelings, we would have seen a difference between them. Similarly, participants decided to purchase the same (lowest) amount of tickets for the LP-LP and the LP-LP-LP conditions. Had the participants added the feelings, we would have seen a difference between these conditions. The averaging results are in line with the cognitive algebra findings of integration theory (Anderson, 1965, 1974) which have suggested averaging as a potentially uniform combinatorial rule that appears to fit results much better than addition or multiplication. With the inclusion of the fEMG measure, the claim that the pieces of information did in fact evoke an immediate affective reaction was confirmed. However, the results would also indicate that the affective reaction, measured by the fEMG, after the pieces of information were shown,

did not reflect a combined impact of the three pieces of affective information. This is in contrast to the self-report measure where the combination was clear. One possible reason for this could be that the post-information measure of the fEMG reaction happened during the presentation of the pictures that represented the rewards. This could have been a confounding feature since the measure could have been sensitive to the various properties of the picture and not the affectivity of the pieces of information. In other words, the feeling due to the individual pieces of information could have been subsumed by the reaction activated by the presentation of the photo.

The mediation analysis again found that immediate self-report affect was a significant mediator of the difference between conditions. However, two of the comparisons did not reveal significant mediation models. A likely reason for this might have again been the low sample size. Indeed, our power analysis was conducted with the explicit goal of finding the same effect in terms of the decision, so perhaps not enough participants were recruited to observe a mediation effect in all the comparisons. Nevertheless, the one comparison that was significant, again showed that it was the immediate affective reaction that was a significant mediator of the affect-decision relationship.

Table 6. Summary of all eight studies with basic info, including manipulation success of immediate affect, the main result on the decision, and the result of mediation test.

| Study | N | Design | Manipulation successful | | Main result on Decision | Mediation result |
|------------------------|---------------|---|-------------------------|-----------------------------------|---|---|
| | | | Task | Reward | | |
| 1 | 60 (55f) | 2 (Task: P vs. LP) x 2 (Reward: P vs. LP) | Yes | Yes (marginal effect, $p = .06$) | Marginal main effect of reward, $\eta_p^2 = .07$ | / |
| 2 | 104 (84f) | 2 (Task: P vs. LP) x 2 (Reward: P vs. LP) | Yes | Yes | Main effect of reward, $\eta_p^2 = .31$ | No significant mediation effect. |
| 3 | 89 (62f) | 2 (Task: P vs. LP) x 2 (Reward: P vs. LP) | / | / | Main effect of task, $\eta_p^2 = .06$ | / |
| 4 | 543 (266f) | 2 (Task: P vs. LP) x 2 (Reward: P vs. LP) x 2 (Questions: present vs. absent) | Yes | No | Main effect of task, $\eta_p^2 = .01$ | Immediate affective reaction associated with the task. |
| 5 | 234 (101f) | 2 (Task: P vs. LP) x 2 (Reward: P vs. LP) | Yes | Yes | No effect (Extraneous info presented) | / |
| 6 | 222 (99f) | 2 (Task: P vs. LP) x 2 (Reward: P vs. LP) | Yes | Yes | Main effect of reward, $\eta_p^2 = .04$ | Immediate affective reaction associated with the reward. & The perceived monetary value (two parallel mediators). |
| Paradigm change | | | Combination | | | |
| 7 | 124 (101f) | 2 (First piece of information: P vs. LP) x 2 (Second piece of information: P vs. LP) – Within subjects | | Yes | Main effect of first info, $\eta_p^2 = .21$ Main effect of second info, $\eta_p^2 = .22$ Indicating combination | Immediate affective reaction impacts the perceived monetary value. & Immediate affective reaction. |
| 8 | 34 (30f) | 2 (First piece of information: P vs. LP) x 2 (Second piece of information: P vs. LP) x 3 (Added information: none vs. P vs. LP) – Within subjects | | Yes / Rule was Averaging | Main effect of first info, $\eta_p^2 = .30$ Main effect of second info, $\eta_p^2 = .29$ Main effect of third info, $\eta_p^2 = .10$ Three-way interaction, $\eta_p^2 = .12$ | Immediate affective reaction. |

Chapter 6

General Discussion and Conclusion

The principal empirical interest of this thesis was with two topics. The first topic grew out of a simple idea. The main point was to look at how multiple affective reactions could impact decision making. I suppose that it is a sign of the field's relative recency that such a basic topic could be broached at this stage. However, while there are numerous examples where researchers have looked at the impact of a single (often evoked and experimentally manipulated) affective reaction (e.g. Bateman et al., 2007; DeSteno, Li, Dickens, & Lerner, 2014; Finucane et al., 2000; Lerner & Keltner, 2001; Small & Lerner, 2008; Wright & Rakow, 2017), there were arguably no, or few instances where people have looked at the impact of two, or more, affective reactions on decision making. In the presentation of this topic, it was proposed that the multiple affective reactions might combine in order to impact the decision. Additionally, it seems highly pertinent to research this type of impact since there are many forms with which affective reactions can enter into decision making (Cohen et al., 2008; Loewenstein & Lerner, 2003) and decision situations can consist of multiple stimuli which might evoke affective reactions (Russell, 2003; Slovic et al., 2005). So, it seems like a worthwhile endeavor given that it ultimately means that the presence of multiple affective reactions could reflect a more "real-life" or ecological picture of common decision situations (Goldstein & Hogarth, 1997).

This proposition of whether multiple affective reactions combine in order to impact the decision was naturally followed by asking questions which relate to how this combination might be playing out. Specifically, were there certain rules that the affective reactions follow when combining, i.e. could we describe the combination with a relatively simple analogy of mathematical arithmetic? Several possible arithmetic rules were identified. In the process of theoretical building of such a proposition, I was mostly relying on literature that has previously looked at stimulus combination. There were examples of stimulus combination rules in

impression formation research and integration theory (Anderson, 1979; Anderson, 1981), but also examples found in psychophysics, e.g. looking at loudness or brightness research (Birnbaum & Elmasian, 1977). Several possible arithmetic rules were proposed such as averaging (Anderson, 1965), addition (Shanteau, 1970), and multiplication (Oden, 1977; Shanteau & James, 1974). In addition to these “arithmetic” rules, other examples of arithmetic’s, where there could be multiple affective reactions, included the “peak end rule” (Fredrickson & Kahneman, 1993) and various contrast effects which are more akin to classic primacy and recency phenomena (Chowdhury et al., 2008; Forgas, 2011).

The second topic was more procedural and it relates to the critique that is leveled at the EJDM field in general (which I have touched upon in the introduction), which states that the field is often silent on processes, mechanisms, and the behind-the-scenes that governs certain effects (Lerner et al., 2007; Volz & Hertwig, 2016). The second topic’s main interest was with the mediators of affect’s impact on the decision, i.e. the mediators of the affect-decision relationship. While plenty of research has looked at the possible mediators of affect’s impact on the decision, its hallmark has been that it often remained boxed in without a lot of crossover. This essentially means that authors have not compared the various mediation pathways that have been suggested in disparate papers, inadvertently exposing a certain gap. It seemed like a natural progression from Topic 1 to investigate the mediators of this impact, if (combined) affect does have an impact on the decision. Additionally, even the casual reader of the EJDM literature would, after a short time, be confronted with the fact that authors have often identified mediators of the affect’s impact on the decision, but these mediators tend to be different from paper to paper (most likely because, again a very basic proposition, authors simply were not looking at several possible mediators at the same time). Three potential mediating pathways, that kept cropping up, were identified in the literature. The first, and most basic one, was where authors have argued that it is the actual immediate felt affective reaction that serves as a mediator of the affect’s impact (Bechara, 1997, 2011; Schlösser et al., 2013). The second is where expected affect acts as the only mediator. Expected emotions are not actually felt

emotions, but are, as their name suggests, cognitive expectations about possible emotions that might be activated after certain outcomes become known (Loewenstein et al., 2001). Papers have measured expected emotions and often found that they are a significant mediator of the affect-decision relationship (e.g. Carrera, Caballero, & Muñoz, 2012; Charpentier et al., 2016; Mellers, 2001). These two pathways are examples of single mediators. However, the third pathway is an example of a multi-step or a serial mediation model. The third pathway is more theoretical and it has been suggested, almost implicitly, by different authors. For instance, an example of the third pathway has been suggested in the interpretation of the affect heuristic. Slovic and colleagues (Finucane et al., 2000; Peters & Slovic, 2000) suggest that fear felt at the time of decision making leads people to shy away from a risk by essentially leading people to see the odds of negative events occurring as higher. The main implication being that affect impacts the assessment of subjective probability, which in turn impacts the decision. Another example might be when Loewenstein et al. (2003) suggest that affect can change the predicted utility for possible outcomes. Again, this would be a serial mediation with affect impacting the utility, which then impacts the decision. The third pathway can also be said to subsume the first two ones. For instance, it is possible that the immediate felt affect (pathway 1) could impact the expected emotions (pathway 2), and that this could be described as a serial mediator (pathway 3).

In relation to these two topics, two general questions were posed. In order to remind the reader, I will repeat the two main questions that were asked. These questions will then help us categorize the general discussion. Q1: In decision situations with multiple sources of independent integral affective reactions (say a task and a reward): i) would we observe a combined impact of evoked affective reactions on the decision and, ii) which rule, if any, would this combination follow? Q2: If and when (combined) affect impacts the decision, i) is this impact mediated by the actual felt immediate reaction, ii) the expected affective reaction, or iii) does the immediate felt affective reaction change a different attribute related to the decision, which, in turn, impacts the decision, in a form of a multi-step mediational process?

Do multiple affective reactions combine in order to impact the decision?

The straightforward answer, given the results obtained in all the studies, would seem to suggest that affective reactions do indeed combine to impact the decision, but only when the reactions are related to the same source. When however, the affective reactions are related to two independent sources, people rely on the affective reaction associated with the consequential source (i.e. the source that relates more closely to the potential consequence of the decision). Naturally, the above answer depends on several features of our approach, so I will try to unpack it. In our approach to this question, we relied on integral affective reactions and, at first, we created a decision situation which consisted of two pieces of information. The main goal with this decision situation was to stay true to a standard JDM paradigm, by trying to approximate what a gamble-like decision situation would consist of. Decision makers were presented with a task (i.e. an action that must be performed as part of a decision) and a potential reward (i.e. consequence or outcome) of the decision. These two features could then be treated as pieces of information (or stimuli) which could be described in ways so that they would evoke differently valenced affective reactions. Because these pieces of information are inherently related to the decision, the affective reactions were integral.

Thus, we presented our participants with a game-like decision situation that consisted of a task and a reward. In addition, the decision makers were in situations that exemplified uncertainty i.e. no particular extraneous information of a decidedly cognitive (i.e. non-affective) nature, like probability of success, or how much money the rewards cost, were presented. This is because, as previous results have fairly consistently shown, when this type of information is present, individuals' reliance on affect is highly diminished (Denes-Raj & Epstein, 1994; Epstein & Seymour, 1994; Slovic et al., 2004; Van Gelder et al., 2009). This was considered justified additionally because, as Gigerenzer (2010) states, decision situations that exemplify uncertainty are more reflective of real-world decision making and since Rad and Pham (2017) show that uncertainty increases reliance on affect in decisions.

The main assumption was that we would see a combined impact of the two pieces of information (i.e. task and reward) on the decision. Meaning that we would observe a main effect of task affectivity and a main effect of reward affectivity (possibly an interaction dependent on the combination rule that the affective reactions would follow³⁴). Looked at globally, however, these results, using this decision paradigm, never materialized. The first insight that was obtained was that when both the task and the reward evoked immediate integral affective reactions (thus we would expect a combined impact), there was only a main effect of the affectivity of the reward (Study 1 with a marginal effect, Study 2, and Study 6). However, when the rewards do not differ in their affectivity (i.e. only the tasks differ in their affectivity), then there was only a main effect of the affectivity of the task (Study 3 and 4). These findings are independent of changes in mood (as measured by the BMIS, Mayer and Gaschke, 1988), they are independent of the strength of affective reaction that the affectively described rewards evoked, and they are independent of demand, i.e. whether participants were asked vs. not asked, to report on the immediate affective reactions that the tasks and rewards presumably evoked. Additionally, it must be highlighted that the findings were relatively consistently obtained across three different population samples. Studies were done both on a student population in Bosnia and Herzegovina, as well as a student population in France, but also using online experiments with non-student populations. Let us now take a look at each of the main effects (task and reward) individually.

The main effect of task affectivity

In Studies 3 and 4, it was shown that the affectivity of the tasks had significantly impacted the participants' decision. Specifically, participants were willing to give more money when they were presented with a task that evoked a pleasant immediate affective reaction, and less when they were presented with a task that evoked a less pleasant immediate affective reaction. The results are interesting from a decision-making standpoint since the tasks can be

³⁴ Addition would be represented in the data as parallelism (i.e. two main effects) while averaging would be presented as an interaction (Anderson, 1979).

regarded as a relatively unimportant cue for the decision when looked at from a classic JDM perspective. As argued in the previous chapter, most decision-making models (in particular the economic ones) are consequentialist in nature; they assume that decision makers choose between alternative courses of action by assessing the desirability and likelihood of their consequences (Rick & Loewenstein, 2008). By relying on the affective quality of the task, one could presume that this assumption was invalidated. The task was to find a red ball among many in a box that was either filled with cotton wool (pleasant) or dirty, muddy water (less pleasant). Thus, by themselves, the tasks were not “carrying” any consequential information with them. By relying on the affectivity of the task, participants seemed to have disregarded the desirability and likelihood of the consequence (which is related to the reward, i.e. a consequence being whether the person might win or lose the reward).

However, it could be possible that the participants were relying on the affectivity of the task because the affectivity gave our participants an important consequential cue for the decision. Specifically, the pleasantness of the task might have changed how likely participants thought they were to find the ball. This does not seem likely however, since, in none of the studies, the measure of subjective probability was not impacted by the affectivity of the task. Additionally, the mediation model also showed that the immediate affective reaction elicited by the tasks was the only mediator of the task’s impact on the decision (Study 4). This result seems to go in line with some fairly recent findings showing that the immediate integral reactions, that are associated with a possible decision action that participants must do (e.g. throw a die, or throw a coin) as part of a decision situation, were a significant predictor of the decision (Schlösser et al., 2013). What is therefore important to highlight is that these results point to the fact that the reliance on the affectivity of the task was entirely independent of the reward. It must be stated however, that the situation was uncertain with no other details that were given to the participants. For instance, the participants were unaware of what their chances are for finding the correct ball and they were unaware of how much the rewards cost.

But, the main interest of obtaining a combined impact of two affective reactions could not be ascertained in these studies (3 and 4) since the rewards did not differ in their affectivity. Therefore, the second affective reaction was missing. For that, we must look to other studies that have successfully induced the immediate integral affective reactions from both the task and the reward.

The main effect of reward affectivity

Whether there would be a combined impact of two affective reactions on the decision could only be verified if both the task and the reward evoked different immediate affective reactions. However, in situations where the manipulation checks were successful (Study 1 with a marginal effect, Study 2, Study 5, and Study 6), there was no combined impact of both task and reward on the decision. Instead, the affective quality associated with the reward was the only significant effect on the decision (except in Study 5 where no effect on decision was obtained due to the presence of extraneous information). First, it is important to highlight that, with this result, people have essentially disregarded one piece of affective information about the decision situation. For instance, participants were disregarding the impact of the less pleasant task on the decision. Second, it would seem that the affective cue associated with the rewards was far more important for the decision makers.

One explanation for this result could be that the participants were not really relying on the affectivity of the rewards but on the fact that the rewards were simply different. Indeed, in studies 1 and 2, participants were presented with qualitatively different rewards, e.g. a trip as a pleasant reward and a cafeteria lunch as a less pleasant reward (in Study 6 the rewards were fairly similar with both being a restaurant dinner, it is just that the restaurant was described either to evoke a pleasant or less pleasant affective reaction). However, this does not seem to be a correct assumption since the participants were not presented with the two rewards side-by-side. Thus, participants were not enabled to make the comparison. Similar manipulations have been used previously. For instance, Hsee and Rottenstreich (2004) presented a cash reward (as an affect-poor reward) and a music book (as an affect-rich reward) which differ in many

potentially important ways but, presented separately, they served their purpose of inducing an affect-poor vs. an affect-rich manipulation. Thus, when there is no direct opportunity to compare the two rewards, participants should rely only on other features of the stimulus, which in this case was the affective reaction (Hsee & Kunreuther, 2000; Rottenstreich & Hsee, 2001).

A more pertinent explanation of these findings and the lack of a combined impact of these two affective pieces of information is that the affective reaction associated with the rewards is a much more important cue for the decision maker because the rewards are essentially a consequential feature of the choice. They are the possible outcome and possible outcomes have a strong amount of pull on the decision maker, cf. the consequentialist approach to JDM (Blanchette & Richards, 2010). Thus, the affective reaction associated with them has a stronger impact. So much so, that it leads to a disregard of the other affective cue, one associated with the task.

Before actually testing what might be the reason for this, it was verified (Study 5) whether the fact that no other information about the decision was provided to participants (i.e. probability of success, monetary value of the reward) was why we failed to observe a combined impact of the two affectively described pieces of information. It was hypothesized that the uncertainty which is espoused in these types of situations could be inadvertently guiding participants to rely only on one piece of affective information and disregarding the other one. However, this assumption did not pan out. In Study 5, the extraneous information was presented, the tasks and rewards differed affectively, and yet there was again no combined impact on the decision. In fact, there was no impact at all. This lack of impact was probably due to the fact that the decision situation was objectively presented to appear to have the same utility (i.e. tasks always had 50% chance of success associated with them, and both rewards cost \$50).

It was then hypothesized that the participants only rely on the affectivity of the reward, because the affectivity associated with the rewards changes an important consequential cue. This cue was most likely the perceived monetary value of the reward. Since participants were

not provided this information, they might have imbued it from the affect. Indeed, a proposition of integral affect is that it can act as a “spotlight” (Nabi, 2003; Peters, Västfjäll, Gärling, et al., 2006). For instance, an affective reaction could focus the decision maker on new information and this new information (rather than the feeling) is used to guide judgment. It was thus hypothesized that the affective reaction impacts the perceived monetary value of the reward, which leads the participant to disregard of the other affective pieces of information (i.e. the task). Indeed, this is what Study 6 has essentially shown. The immediate affective reaction associated with the rewards had a clear impact on the perceived monetary value of the reward. The mediation analysis showed that both the affective quality of the reward and the perceived monetary value were two, parallel mediators of the affect-decision relationship.

The overall findings concerning the fact that no combined impact of two affective reactions related to the decision was obtained, indicate that a combined impact cannot be expected when: i) the affective reactions are associated with two independent sources related to the decision, ii) when there is no extraneous information pertinent to probability of monetary value, and iii) when one of the affective reactions is associated with a consequential feature of the decision. These results have some applicative meaning as well. One could easily imagine situations where a relatively unpleasant decision attribute could be sneaked in with a more pleasant, but consequential one, to induce a certain type of decision in an individual. For instance, with a higher focus on the affectivity associated with possible consequences, people could disregard other attributes that might lead to worse decisions for the decision maker (e.g. perhaps the other attribute leads the decision-maker to be worse off financially or something similar). Additionally, it could also mean that if decision makers are too focused on the affective quality that is associated with a consequential decision source, they might disregard other important information. Indeed, the participants in our studies did not know what chances they had if they were to play the game, and yet they decided to give money anyway, based entirely on the affective quality associated with the reward. One could argue that maybe, for them, the utility (i.e. the perceived monetary value) that was changed by the affective reaction associated

with the reward meant that the decision was worth the shot. This is true, but it still means that their decision lead to complete probability disregard (see Pachur et al., 2013; Rottenstreich & Hsee, 2001; Slovic et al., 2005 for discussions on how affective reactions can lead people to disregard probabilistic information).

Limitations concerning the first six studies and the finding of no combination

The first and clearest limitation is that the findings relating to non-combination would perhaps not happen had a different type of decision situation been used. For instance, one could argue that the affective quality associated with the task was simply not relevant enough. Perhaps if the second integral affective reaction was related to some other aspect of the decision, we would have observed a combination. This assumption is entirely valid, although it is somewhat diminished given that the affective quality of the task had an impact when there was no difference in reward affectivity. Nevertheless, future research in this domain should perhaps incorporate other decision situations that could be engineered to evoke multiple integral affective reactions. However, researchers must be careful in doing this. Decision situations naturally carry different meanings and dependencies with them (Inbar, Cone, & Gilovich, 2010). It could be that every type of decision making situation will hold some specifics that one simply cannot control for. One could manipulate two integral affective reactions in a decision situation related to buying an apartment (similar to what Mikels et al., 2010 did), or one could manipulate two integral affective reactions in a decision situation related to insurance (e.g. Johnson et al., 1993; Seta, Seta, McCormick, & Gallagher, 2014), but these two situations will always carry some specific dependencies with them.

Another limitation of the studies where no combination was observed is the often-times patchy success with the manipulation checks of the immediate integral affective reactions. Indeed, in studies 3 and 4, even though in the pre-test the rewards evoked clearly different affective reactions, in the study, there was no difference. This might be related to the highly subjective nature of the evaluative process (Lambie & Marcel, 2002), but future research should, perhaps for this reason, always include manipulation checks in the studies, even if the

stimuli used has been pre-tested. Examples of studies abound where only pre-tested affectively different stimuli was used, but where there was no manipulation check implemented in the study itself (e.g. Hsee & Rottenstreich, 2004; Hsee, Rottenstreich, & Xiao, 2005; McGraw, Shafir, & Todorov, 2010). The conclusions associated with these studies should perhaps be taken with a grain of salt. There are other limitations, but they relate to all the studies, not just to the ones where no combined impact was observed, and will be discussed in the general limitations section.

Multiple affective reactions combine when they are related to the same source

The essential goal of looking at the impact of multiple affective reactions was to see if they would combine in order to impact the decision. However, the first studies, using the task-reward paradigm, failed to demonstrate this. They do however demonstrate an interesting boundary condition of a combined impact, but there was a need to probe further. Because of this, it was hypothesized that a combined impact of immediate integral affective reactions is not possible when the affective reactions are coming from two independent sources. The task and reward can be considered independent sources and the idea is that independent sources will always carry additional features with them that could stymie the affective combination. Given this assumption, we asked that maybe we would observe a combined impact of multiple affective reactions if they were related to the same source? This presumption is analogous to a process first described by Asch (1946), where he posited that when two traits are perceived as pertaining to one individual, they enter in mutual interaction. In the last two studies, this idea was tested. In Study 7, we utilized two pieces of information relating only to the reward (i.e. a single source) as the inducers of two immediate integral affective reactions. The pieces of information were designed to evoke either a pleasant or a less pleasant affective reaction. With this change, we observed the coveted combined impact of the two immediate affective reactions on the decision. In addition, the combination was replicated in Study 8. Furthermore, in Study 8, a facial electromyography (fEMG) measure was used to unobtrusively verify if the pieces of information did really evoke the desired immediate affective reactions. fEMG has been used

extensively to unobtrusively verify affective reactions (e.g. Fridlund & Cacioppo, 1986; Rasch, Louviere, & Teichert, 2015). In accordance with expectations, the fEMG measure showed that all the pieces of information have successfully induced immediate affective reactions, further strengthening the claim of a combined affective impact on the decision when the affective reactions are related to the same source.

It was necessary to ensure that the effect of a combined impact does not rest on a type of stimulus. Thus, the last two studies used a within subject design that was aimed at presenting multiple different rewards to our participants. In this way, the different affective connotations (i.e. whether a specific reward was associated with two pleasant pieces of information, or one pleasant and the other less pleasant, or two less pleasant) could be ensured to be associated with different rewards so that when we observed a combined impact, it would not be due to the type of reward, but due to the affective reactions.

One possible reason for this change being so effective in obtaining a combined impact of affect, could be due to a simple perceptual-presentation style effect. For instance, Banks and Prinzmetal (1976) show that the perceptual organization of a multi elemental display, can affect how the information is processed. Additionally, Barnett and Wickens (1988) have shown that the ability of individuals to integrate information from a number of sources is dependent on display integrality. They used boxes as aids of “integrality” and found that these formats increased participants’ capabilities to integrate stimuli.

Limitations concerning the last two studies where combination was obtained

The first limitation that comes to mind is that in the last two studies, we focused on rewards. It was necessary to focalize the affective reactions on one single source and rewards were chosen due to their relevance in the previous studies. However, this does mean that it is necessary to downplay the assumption that we would observe a combined impact of affective reactions if they were related to other sources relevant for the decision. For instance, it would have been useful to show that the same type of combination if the affective reactions were associated with the tasks. However, it also needs to said that there is no reason why we would

not expect a combination to happen since the reasoning behind the “single source” assumption (i.e. that the affective reactions would combine once they are related to a single source) does not preclude that the same thing would not happen with a different source. Thus, it should not matter which source the affective reactions are associated with, but this claim does need empirical verification nevertheless.

Additionally, the last two studies used a within subject design which had made it easier to use multiple different rewards, but it also came at a heavier price of ecological validity. Indeed, the participants had to make a series of decisions with the pieces of information being presented in a timely fashion, which cannot be said to exemplify real world decisions. There are other limitations, but they relate to all the studies, not just to the ones where no combined impact was observed, and will be discussed in the general limitations section.

What rule does the combination follow?

It was only possible to look at the potential rule with which the affective reactions combine in order to impact the decision in the last two studies (where combination was actually obtained). In Study 7, with two affective reactions, we obtained two main effects. More specifically, there was a main effect of the first piece of affective information and the second piece of affective information. According to research in impression formation, the two main effects (i.e. parallelism in the data) would be an indication of an additive arithmetic rule (Anderson, 1974; Anderson, 1979). However, upon closer examination it was concluded, as explained in the discussion of Study 7, using a mathematical example, that the same results would have been obtained if people were actually averaging the affective reactions (expressed in Anderson’s terms, it could just mean that there was not enough power to detect an interaction in the data.) To be more precise, say that the pieces of information were evaluated as Pleasant = 5 and Less Pleasant = 3. In Study 7, we obtained that there was a difference between the P-P and LP-LP conditions. Looking at the two arithmetic’s we would obtain the same result both with addition and averaging [e.g. $5+5 = 10 > 3+3 = 6$ and $(5+5)/2 = 5 > (3+3)/2 = 3$]. This applies to the results concerning the other condition differences, i.e. the difference between the

P-P and the P-LP, etc. Therefore, in Study 8, another piece of information was added to ascertain the potential arithmetic rule. With a third piece of affective information, one would expect that if averaging is the dominant rule, then participants exposed to three or two P pieces of information (i.e., P-P-P and the P-P conditions) should be equally disposed to make the decision to buy a higher quantity of tickets, in comparison to all other conditions. Conversely, participants exposed to two or three LP pieces of information (i.e., LP-LP-LP and LP-LP conditions) should be equally disposed to make the decision to buy less tickets. However, if the combination depends on the addition rule, then the *total* number of P vs. LP pieces of information should play a determining role. Indeed, in Study 8, we found that there were no differences between the P-P and the P-P-P condition, nor were there differences between the LP-LP and LP-LP-LP conditions. The results therefore confirmed averaging as the rule (in addition, there was significant interaction in the data, which even according to Anderson's rules, indicates averaging).

This would mean that at a certain level, no matter the number of positive or negative information is added (information relevant for the decision), it would not for instance, increase (in the case of positive) or decrease (in the case of negative) a decision concerning willingness to pay. In a certain way, averaging was the most likely rule since it was extensively highlighted in other research as the most often obtained rule in stimulus integration (Anderson, 1979; Seta, Haire, & Seta, 2008b; Weaver et al., 2012).

Limitations related to the combination rule findings

The first thing that comes to mind concerning the findings that favored averaging in Study 8 is a potential ceiling effect. Indeed, it could be that the participants have not actually averaged the information, but that the third piece of affective information simply did not have an effect on our decision variable. Additionally, while the findings do favor averaging, it must be said that more targeted tests should be conducted to rule out all other possible combination rules. For instance, the impact of the first piece of information seemed to have been the strongest (i.e. strongest effect size was obtained, cf. Study 8). It could be that the first piece of information

has a stronger impact which might indicate some sort of peak rule which might imply a contrast effect (Fraenkel et al., 2016). Furthermore, the intensity of the affective reactions was not taken into account in our analysis (in the last two studies), i.e. it was not experimentally varied. It could be that averaging might not happen if the first or last piece of information is exceptionally potent. For instance, Chowdhury et al. (2008) found that when an advertisement contained several positive images, the most extreme image determined the overall response (i.e. how the ad was evaluated).

Which pathway mediates the impact of affect on decision?

In order to verify which one of the three potential pathways would be obtained in a multiple mediation model, we consistently requested answers on four distinct measures. The first was a measure of immediate integral affect. This measure was posed after the presentation of every task and reward (in the studies that used this paradigm) and after the presentation of each reward in Studies 7 and 8. We also measured expected emotions, alongside subjective probability and perceived monetary value. The measures were taken before the decision so that they could be included into a mediation model. The modeling was done using the multiple mediation developments that allow us to test several models at the same time, i.e. both serial and parallel ones (Hayes, 2013; Hayes, 2009; Montoya & Hayes, 2016). Although, it must be said that the perceived monetary value was only measured in the last three studies. The most consistently obtained mediation result seems to favor the first pathway, where the immediate affective reaction is the only mediator of the affect-decision relationship. This result was obtained in Studies 4, 6, 7 and 8 (Study 2 did not obtain any significant models and other studies did not conduct the mediation). However, there are certain specifics that warrant attention when it comes to the general conclusion concerning these results.

First, expected emotions were not a significant mediator in none of the mediation analyses. It was neither a single mediator, nor was it included as part a serial model potentially displaying the third pathway. This is in contrast to many of the studies that have shown expected affect mediating the affect-decision relationship (e.g. Charpentier et al., 2016; Pollai et al.,

2011; Shiv & Huber, 2000). A distinct number of studies has also been found, in a recent meta-analysis, as showing expected emotions as mediators of an affect-decision relationship (DeWall et al., 2016). One possible explanation for the lack of mediation of expected affect is that in our studies, affect was explicitly induced (i.e. manipulated). In a lot of the studies that found expected emotions as a mediator, affect was simply measured and there was no specific induction of immediate affect. Indeed, DeWall et al. (2016) highlight that the studies included in their meta-analysis were not inducing affect, but only measuring it. Thus, it could be that since we induced immediate affective reactions, there was no effect of expected emotions. The actual feeling then takes precedent to the expected feeling.

Second, there was also no relation to subjective probability, which has been hypothesized to be an important mediator in research on the affect heuristic. For instance, fear felt at the time of decision making might prompt people to see the odds of some negative events to be higher (Finucane et al., 2000). However, relations to subjective probability might only be relevant if the decision involves risk and probability calculations, which our studies did not have. The lack of an effect on subjective probability, i.e. that it was not a significant mediator, was found in another study, where only a type of immediate affect was a mediator (Schlösser et al., 2013). The speculation that subjective probability plays a significant role in the mediation of affective impact on decision, could be just that, a speculation.

Third, while the immediate affective reaction was most often the mediator, there were instances when it was not the *only* mediator. For example, in Study 6, the perceived monetary value was also a mediator, but a parallel one, meaning that it mediated the affect-decision relationship *alongside* immediate integral affective reactions. Additionally, in one of the group comparisons in Study 7, the difference between the P-P and the LP-LP conditions was mediated by a serial mediator, which is an example of the third pathway. Indeed, the immediate integral affective reaction impacted the perceived monetary value, which in turn impacted the decision. This type of pathway would be a direct demonstration of our assumption that the affectivity associated with the rewards impacts a consequential feature (in this case the perceived monetary

value), which in turn impacts the decision. However, this mediation model was not found in any of the other examples.

Limitations concerning the mediating pathways

The limitations that come to mind are mostly related to power. It could be possible that none of our studies had enough power to detect several other potential pathways. This could explain why for instance, in Study 7 a significant serial mediation model was obtained, while it was not obtained in other studies. Indeed, Fritz and MacKinnon (2007) suggest that extensively higher numbers of participants are needed than are usually used in mediation analyses. They even suggest that to get a complete mediation with the classic Baron and Kenny method, for small to medium sized effects, one would need an N of 20,886. Our mediation analysis is aided by the fact that it relied on the bootstrapping methods of Hayes and others, but there is still the possibility that we did not have enough power to detect other potential pathways.

Naturally, another limitation could be that there are always other potential mediators that were not included in our studies. Participants could be relying on an entirely different mediator, or affect could be impacting an entirely different measure in a serial mediation model (i.e. the third pathway). For instance, one potential mediator could be the physiological affective reactions (Dunn et al., 2006). We did have a measure of fEMG activity collected after the pieces of information were presented, but it was shown that it was not impacted by the pieces of information, so it could not be included in the mediation model. This measure is also confounded by the fact that it was collected during the presentation of the photos, which might have had an adverse impact.

General Limitations

The first general limitation concerns the fact that, in this thesis, the focus was only on integral affective reactions. As argued in Chapter 2, there are multiple ways in which emotions can enter into decision making, which means that there are multiple possible ways to look at affective combination. Indeed, researchers could also look at the way an incidental and integral

reaction might combine to impact the decision. Västfjäll et al. (2016) suggest such an option specifically and offer several, testable, theoretical predictions. They suggest that incidental affect may influence judgments of integral affect through mechanisms of mood congruence/assimilation and mood incongruence/contrast, or according to the affect-additivity principle (Neumann et al., 2001). Researching multiple affective reactions can provide a venue for an interesting new research stream and as Västfjäll et al. (2016, p. 2) observe: “Research on integral and incidental affect has been separate with integral affect research seldom considering participants’ incidental mood states.” This means, additionally, that researchers must stay conscious of measuring both of these types of emotions in their studies (no matter if they are manipulating only integral, or only incidental emotions) since they can conceivably interact and impact the decision in previously non-identified ways. Finally, by taking into account other types of emotion and looking at their combination, one might find other examples of a combinatorial rule. Perhaps in situations where incidental affect is combined with integral affect, one might observe a different arithmetic.

A second limitation is that, in our studies, there was no explicit attempt to address the effect of order on the presentation of integral affective reactions. How information is presented has a substantial role in social judgment and this factor should not be ignored if we want to talk about combination of affective reactions. For instance, maybe presenting a source that evokes a positive integral reaction before presenting a source that evokes a negative reaction has an impact on the resulting combined reaction. Order effects call back to the classic study by Asch (1946) where a primacy effect was obtained in that the impression was more favorable when people were presented with a good-bad order than a bad-good order. More recently, for instance, people who were shown positive attributes about certain cars first, were more likely to prefer those cars, indicating a type of primacy effect (González-Vallejo et al., 2014). The standard primacy effect can readily be changed to a recency effect by mild changes to the research procedure. Ubel et al. (2010), for instance, found that in an experimental study manipulating the order of risk and benefit information in a decision aid, women who read about

the risks of a drug to prevent breast cancer last (i.e. after the benefits) judged benefits more favorably than women who received information about risks first. Order effects research is mixed with no evident pattern emerging (McGuire, 1969), but they are obviously important and their control should be incorporated into the study of affective reaction combination³⁵.

A third limitation is that, in our studies, we only took into account the affective quality of valence, disregarding the arousal. Indeed, arousal has been shown to impact decision making (Ariely & Loewenstein, 2006; Dunn et al., 2010; FeldmanHall et al., 2016), but it was not considered relevant here. Future research should take into account how arousal might be impacting the combination of affective reactions and how it affects the rules which this combination follows³⁶.

The fourth limitation is that the decisions in our studies were not real per se. That is, participants were not paying any real money, nor could they actually win any of the rewards. This is, unfortunately, a standard limitation in decision making studies and it depends strongly on the capabilities of the researchers to provide funding that can ensure real decisions. However, it is a limitation that must be mentioned since decision behavior obtained in real decision making situations (meaning those that involve some type of actual betting or money) and ones obtained in the laboratory, have a tendency to be different (Camerer & Mobbs, 2017). This additionally relates to the fact that we did rely, to a certain sense, on a gambling paradigm that was criticized by others (Keren & Wu, 2015). Future research should try and attempt to extend these findings into more applicative areas, involving real decisions.

³⁵ In our studies, order was controlled, but it was not included as a factor so it is necessary that future research address this. Order was not included as a factor for fears of diminishing the power of our studies, but also because there were no specific hypotheses developed beforehand. However, it is worth mentioning that in the last two studies, the order of information did not play a significant role. For instance, in Study 7, there was no difference between the P-LP and the LP-P conditions.

³⁶ We did have information on arousal since we utilized the unipolar measures which obtains both measures of valence and arousal (Kron et al., 2013). While we did not include this measure in the descriptions of the studies, it was verified in a post-hoc manner and arousal was not impacted by any of our independent variables that were designed to evoke immediate integral affective reactions.

Conclusion

At the end, I would like to touch upon the two broad challenges set up for this thesis and defined very early on in the introduction. The first was to try to clearly represent what we know so far and what is still missing in research concerning the way affective reactions interact with, and impact decision making. The second, a challenge for any thesis, was to offer new insights into the main field of interest, here, that of emotion, judgment, and decision making.

The pertinence of the first challenge was especially high given that the field of Emotion, Judgment and Decision Making, while developing fast (Lerner et al., 2015), is considered by many authors to still be in quite early stages of development (Gross & Barrett, 2013; Lucey & Dowling, 2005; Volz & Hertwig, 2016). The argument is that because of the fact that EJDM has so recently seen a large uptake in interest, the field has skipped over the details, with research being more focused on obtaining interesting effects than on delving into work elucidating the mechanisms, boundary conditions, or limitations of the field. The pertinence of this challenge is also the result of a personal pet-peeve. Throughout my work in this domain, it has become increasingly obvious to me that the field suffers from various terminological, conceptual, and theoretical deficiencies. Because of this, I have devoted entire chapters in this thesis to untangling and explaining various concepts and approaches that stand to benefit from an overview perspective. It was highlighted how JDM has disregarded the impact of emotions for a long time; how authors have indiscriminately used various terms and definitions pertaining to emotional qualities, leading inadvertently to confusing usage of these terms; how various authors have approached a very important theoretical categorization, types of emotion, in markedly different ways, and; how several theoretical approaches in EDJM still seem to be underdeveloped and often-times similar in their main points without much cross-over research that is focused on their commensurability.

The importance of the second challenge is undisputable for any thesis. It is in the field's interest, and in the interest of the researcher, to provide a certain addition to the overall knowledge base. The hope is that this challenge was addressed with the empirical studies and

the introduction of findings that relate to a previously not researched idea; how multiple affective reactions impact the decision. Furthermore, there was also an attempt to tackle a procedural question with a special interest in the mediating mechanisms of how affect impacts the decision. There should be no illusion to the fact that any attempts at research are without fault, and this one certainly hasn't been. Despite this, the main findings seem to indicate that immediate integral affective reactions do indeed combine to impact the decision, but only when the reactions are related to the same source. When however, the affective reactions are related to two independent sources, people rely on the affective reaction associated with the more consequential source (i.e. the source that relates more closely to the potential consequence of the decision). In addition, the mediation analyses of the affective impact on the decision showed that, most often, only the actual immediate felt reaction was the significant mediator.

Finally, in a commentary from 1991, published in *Psychological Science*, Daniel Kahneman shared his views on why he thinks JDM is so appealing to many researchers (Daniel Kahneman, 1991). He enumerates that the topic is like a large puzzle that will not go away - "a search for the bounds of human rationality." It is hard to disagree with him there. I have been fascinated by the study of JDM and I have managed to combine this fascination with my interest in affect and emotions. It is my hope that this thesis has contributed somewhat to the field that I hold so dear.

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APPENDIX A

List of pieces of information designed to induce an integral affective reaction and the rewards which they were associated with for Study 7.

| Concert tickets | | Restaurant dinner | | A set of academic textbooks | | A short trip | |
|---|--|---------------------------------|-----------------------------------|---|----------------|------------------------------|---|
| P | LP | P | LP | P | LP | P | LP |
| The tickets are for your favorite band. | There are more tickets sold than there is space. | The restaurant is romantic. | The restaurant is somewhat messy. | The textbooks have marked sections that highlight things important for exams. | They are new. | The trip is to the seacoast. | The travel mode is a bus that has no air-condition. |
| Tickets are for the front row. | The concert is during the exam period. | The restaurant is very popular. | The restaurant is not so popular. | Some pages are worn out. | They are used. | Sunny weather is expected. | The place is somewhat boring and there is not much to do. |

APPENDIX B

The pictures representing the rewards used in Study 7. All pictures are under a Creative Commons license meaning that they are free to use and re-use for non-commercial purposes.



Concert tickets



Restaurant dinner



A set of academic textbooks



A short trip

APPENDIX C

List of pieces of information designed to induce an integral affective reaction and the rewards which they were associated for Study 8.

| Concert | | Restaurant dinner | | A set of textbooks | | A short trip | |
|---|--|--|--|---|---|--|---|
| P | LP | P | LP | P | LP | P | LP |
| The tickets are for your favorite band. | More tickets are sold than there is room and it's going to be crowded. | The restaurant is romantic. | The restaurant is somewhat messy. | The textbooks have marked sections that highlight things important for exams. | Some pages are a bit torn. | The trip is to the picturesque seaside. | The travel mode is a bus that has no air-condition. |
| Tickets are for the front row. | The concert is during the exam period. | The restaurant is very popular. | The restaurant is unpopular. | The textbooks are new. | The textbooks are used. | Sunny weather is expected. | The location is described as boring and there is not much to do there. |
| The tickets come with a VIP pass and you can meet the band. | The concert is in another city and you will have to travel. | The restaurant has delicious food. | The only available table is next to the toilet. | The textbooks also come in an electronic version so you can search by keyword | You have to share them with other students. | Your hotel is right on the beach. | There is only room for one, you have to go alone. |
| A bicycle | | A coupon for four visits to the supermarket | | A coupon for a foreign language course | | Movie tickets | |
| P | LP | P | LP | P | LP | P | LP |
| The bicycle is light and made of modern materials. | The bicycle is dirty and you have to clean it. | The coupons are valid for a year. | You can only use the coupons from 8-9am on Saturday. | The teacher is a native speaker of the language but also speaks great French. | You cannot choose when the courses are held. | You can take another person for a romantic date. | The projection will be held with a group of small children from a local school. |
| The bicycle is completely new and comes with spare parts. | The bicycle is missing some parts. | You can share the coupons with your friends. | If you do not use the coupons you have to pay a penalty fee. | You learn the language outside of the classroom with a lot of fieldtrips. | The group is full of people over 60 years of age. | The tickets are for the opening night with celebrity guests. | The ushers are on strike and the cinema will not be cleaned. |

| | | | | | | | |
|------------------------------------|-------------------------------|--|--|--|--|---|---|
| The bicycle is difficult to steal. | The bicycle is easy to steal. | You can use the coupons for every item in the store. | You can only use the coupons for certain items, not all. | You can get a personal tutor of your choice. | The course is overcrowded and you would not get a lot of opportunities to speak. | You can exchange them for another film if you prefer. | The construction of the cinema is not finished so there will be some noise in the background. |
|------------------------------------|-------------------------------|--|--|--|--|---|---|

| A boat trip | | A laptop | | A smartphone | | A visit to a movie set | |
|--|--|---|--|---|--|--|--|
| P | LP | P | LP | P | LP | P | LP |
| You can drive the boat for a short period. | The boat rocks a lot and people get sick often. | The laptop is really fast. | The laptop has a lot of data that needs to be cleaned and deleted. | The phone comes with free mobile internet for six months. | The phone has been dropped a few times. | It is a superhero movie with famous actors filmed in France. | The movie is about the war in Syria. |
| You get full service on the boat (food etc.) | The deck has not been cleaned and has a bad smell. | The laptop has several popular movies and TV shows already pre-saved. | The laptop has been infected with a computer virus twice. | The phone is under warranty for two years. | The unlock key on the phone does not work that well. | You get to spend a day as a famous actress/actor. | The budget is tight so you might be asked to help with a few things. |
| The boat has a pool and you can go for a swim. | The trip starts in the morning and its very cold. | The laptop is really light and easy to carry to classes. | Some keys on the laptop do not work. | The phone was previously owned by a famous actor. | The phone was previously owned by a person who is now in prison. | You will get free stuff and props from the movie. | The set is quite dangerous with one actor going to the hospital. |

APPENDIX D

The pictures representing the rewards used in Study 8. The same four pictures as in Study 7 shown in Appendix B were used here. These are the remaining eight pictures. All pictures are under a Creative Commons license meaning that they are free to use and re-use for non-commercial purposes.



Bicycle



Supermarket



Language course



Movie tickets



Boat trip



Laptop



Smartphone



Movie set visit