



UNIVERSITÉ
LUMIÈRE
LYON 2

N° d'ordre NNT : 2018LYSE2049

THESE de DOCTORAT DE L'UNIVERSITÉ DE LYON

Opérée au sein de

L'UNIVERSITÉ LUMIÈRE LYON 2

École Doctorale : ED 476 Neurosciences et Cognition

Discipline : Sciences cognitives

Soutenue publiquement le 14 juin 2018, par :

Nora PARREN

The Cognitive Naturalness of Witchcraft Beliefs

*An intersection of religious cognition, threat perception, and
coalitional psychology*

Devant le jury composé de :

Ira NOVECK, Directeur de Recherche, C.N.R.S., Président

Anne DE SALES, Directrice de Recherche, C.N.R.S., Rapporteur

Coralie CHEVALLIER, Chargée de Recherche H.D.R., École Normale Supérieure de Paris, Rapporteur

Hugo MERCIER, Chargé de Recherche, C.N.R.S., Examineur

Pascal BOYER, Directeur de Recherche, C.N.R.S., Directeur de thèse

Contrat de diffusion

Ce document est diffusé sous le contrat *Creative Commons* « [Paternité – pas d'utilisation commerciale – pas de modification](#) » : vous êtes libre de le reproduire, de le distribuer et de le communiquer au public à condition d'en mentionner le nom de l'auteur et de ne pas le modifier, le transformer, l'adapter ni l'utiliser à des fins commerciales.

Université Lumière Lyon 2

Doctoral School of Neurosciences and Cognition

The Cognitive Naturalness of Witchcraft Beliefs

*An intersection of religious cognition, threat
perception, and coalitional psychology*

Nora PARREN

Cognitive Science

Under the direction of Prof. Pascal Boyer

Presented for Defense on the June 14, 2018

Members of the Jury:

Anne de Sales, Directeur de recherché, CNRS/ Paris Nanterre

Coralie Chevallier, Chargée de recherché, Laboratoire de Neurosciences Cognitives

Ira Noveck, Directeur de recherché, CNRS (President)

Hugo Mercier, Chargé de recherché ,CNRS

Acknowledgements

Thank you to Pascal Boyer, for giving me this opportunity and letting me share in your interests and research. Your books and research were part of the inspiration for my getting into the field and it is still somewhat astonishing to me that I should be working under your direction.

I am grateful to everyone at the Dynamique Du Langage Lab for hosting our group, the Evolution, Culture, and Cognition Group (EC2). Thank you for sharing your space, time, and for your patience with our administrative and linguistic confusion. I am grateful too to the EC2 members, for the brief time that we lasted together. Rengin Firat and Florian van Leeuwen were waving at the train station when I arrived, an initial demonstration of their general and ongoing willingness to help and guide me. I was very lucky in research assistants as well. Florie Gay and Helena Miton were incredibly helpful in terms of French, administration, exchange of ideas, and friendliness. I am excited to watch as you continue to develop your own research programs and futures, which I am sure will be bright.

Due to a preponderance of null results, no mention of research in Belfast, Northern Ireland is made in the body of this thesis. Nonetheless, I gratefully spent some time attempting experimental fieldwork there, welcomed back by the crew at the Institute of Cognition and Culture, specifically Paulo Sousa and Jon Lanman, who gave me space for a base of operations. Faith Hill, on loan from my other alma mater Vassar, was a delightful research assistant and companion. I was very grateful to have you there during all the failures and difficulties and challenging recruitment situations! Your ready willingness to tackle the next problem and think creatively about methodological issues was a true boon. I'm sorry that we do not have a paper to put your very worthy name upon!

I am very grateful to the members of my committee for their time, feedback, and encouragement throughout this process and particularly for their support when EC2 became a party of one. Ira Noveck and Hugo Mercier were wisely much more concerned than I was for the dangers of working in isolation and very kindly invited me to share a space with them at the Institut des Sciences Cognitives. I am grateful to the community there, especially to Tatiana Nazir for her permission and Diana Mazzarella, who shared not only her desk and a hundred pots of tea, but incredible warmth and friendship. Thank you also to the members of my jury for their time, effort, and their thoughtful questions and corrections.

When I moved to New Haven, isolation threatened once again, so I owe a huge debt of gratitude to Paul Bloom and the Mind and Development Lab members, who skootched chairs around the big table and welcomed me to the conversation. Your feedback on my work was helpful and your excitement reminded me that this material really is interesting, when I was growing blind to that. I have been inspired by the clarity of your thoughtful commentary to one another and by the grounded creativity of your experimental design. I am particularly grateful to Paul for his welcome, his invaluable advice about science, teaching, and life, as well as his humor, which was a bright spot on dark days.

I am similarly grateful to Joshua Knobe for letting me attend his lab meetings and to the members of the lab for the fascinating discussions. Josh is one of the kindest people I have ever met, and I so appreciated his happiness while posing intriguing philosophical and methodological questions alike. He has a remarkable ability to find what is interesting or important in any comment or any question. If I cannot imitate his brilliance, I have grown from exposure to it, and I do take his lesson in kindness and joyful engagement very much to heart. My own students should be grateful to him for that!

I have been incredibly lucky in friendship and am so grateful to the people who supported me throughout this process. Particularly, thank you to Nick Stagnaro for advice and methodological help, and for tacking some of my experiments on to yours, and for helping make New Haven seem like home. Anna Pitt made all the bad phone calls, helped me not get deported, and was a general shining beacon of delight. Erin Lynn gets it and gets me, and despite being in a different field it has been wonderful to commiserate with her. She has been an ongoing source of inspiration and love. Rachel Jones has been there for me since elementary school and I am grateful for having grown up together and having shaped one another. Molly has been both friend and sister, and I'm proud of your hard work and growth as a scientist and human.

I am also grateful to my previous supervisors and mentors, Tom Lawson and Ken Livingston. Your continued friendship means so much to me. Whenever I speak to you, I go away feeling lighter and re-energized for the world of research.

To Emmanuel Trouche, for his emotional and academic support. Thank you for teaching me how to use R, boundless patience while helping me solve problems, and for the constant reminders that nothing matters... in a good way! I love your love for the questions that interest you and deeply respect your passion for making science matter in the real world. A hundred times you picked me up when I was down and I will be forever grateful.

To my parents for their constant support, cheerleading, and belief since day one. You paved this road for me in every way that matters. You both have a deep interest in the world of ideas and I am so fortunate to have grown up in that world. From mom, I have a long-standing appreciation and awe for human beings in all their diversity and history. Your work as an archeologist and as an educator and as the most loving mother in the world did so much of this work. From childhood with feminist folktales from around the world, a general passion for reading, primary sources, travel, museums, "you're the artist," to all the current forms of exploration and support, you have taught me and held me up and set me on my way. I have witnessed and been inspired by my dad's unparalleled dedication to making the wild world a better place. A PhD pales in comparison to 30 years of data collection for one project. Training in research methods began with waving your radio telemetry antenna around. Thank you for talking with me about metaphysics and the meaning of the universe on mountain tops; what a gift. You both work incredibly hard as professionals and on behalf of your family. I know that you always have my back and that you will love me even if I fail, which is a safety net that I could not have done without. Thank you from the bottom of my heart.

I can't properly describe Hillary Lenfesty, a woman who has a beautiful spirit, a brilliant mind, and very seriously knows her way around a conference outfit. She has been a compassionate friend, a confident colleague, and an amazing academic role model, demonstrating and coaching strength and resilience, how to negotiate gender issues, and making me feel truly seen and believed in. There is no one who can understand me in all my walks of life and in all my roles, like she can. Hillary, you were an unofficial PhD and life supervisor and I would be happy as a clam if you could just supervise everything I ever do from now on. I know I can rely on you and that is a precious gift beyond reckoning.

Contents

ACKNOWLEDGEMENTS	II
LIST OF TABLES:	X
LIST OF FIGURES	XI
INTRODUCTION:	1
Abstract:	1
Witchcraft Beliefs	3
Evans-Pritchard	4
South Africa, AIDS	4
New York	6
Cameroon, Boyer Fang	7
General Cross-Cultural look at predictive factors	7
Cognitive literature overview	9
Cultural Success depends on many factors, including:	9
Religious cognition	10
MCI	11
Agency	13
Death Primes	14
Intuitions of ritual and magic efficacy	14
Threat perception	15
Bad is stronger than good	15
Belief in Threat Information	16
Advantage for negative social ideas	17
Transmission preferences	18
Coalitional Psychology	19
Coalitional Inferences and Group Tracking	19
Cue tracking	20
Ingroup support	20
Outgroup rivalry	21
Defection management	21
Groups under threat	21
Misfortune as an attack in the coalitional context	22
Coalitional context	24

Recap and transition to chapters	24
INTRODUCTION TO PAPERS 1 AND 2	26
PAPER 1: THREAT-RELATED INFORMATION SUGGESTS COMPETENCE: A POSSIBLE FACTOR IN THE SPREAD OF RUMORS	27
Abstract	27
Introduction	27
Ethics Statement	28
Data Archiving	28
Materials pre-test	28
Study 1	30
Methods	30
Design and procedure	31
Results and discussion	31
Study 2	32
Methods	32
Design and procedure	33
Results and discussion	33
Study 3	33
Methods	33
Design and procedure	34
Results	34
Study 4	34
Methods	35
Results and discussion	35
Study 5	36
Methods	37
Design and procedure	37
Results	37
General discussion	38
PAPER 2: PREFERENCE FOR SOURCES OF THREAT-RELATED INFORMATION	41
Abstract	41

Introduction	42
Ethics Statement	43
Data Archiving	43
Pre-test of materials	44
Study 1	44
Methods	45
Results	46
Study 2	46
Methods	46
Results	47
Study 3	47
Methods	48
Results	48
Study 4	48
Methods	49
Results	49
Discussion	50
INTRODUCTION TO PAPER 3	51
PAPER 3: THE TRUTH EFFECT: FLUENCY OR IMPLICIT CONSENSUS?	52
Abstract:	52
1 Introduction	52
2 Materials pre-test	57
2.1 Design.	57
3 Study 1	57
3.1 Methods	57
3.2 Design and procedure	58
3.3 Results	59
3.4 Discussion	60
4. Study 2	60
4. 1 Rationale	60
4.2 Methods	61
4.3 Results	61

4.4 Discussion	62
5. Study 3	62
5.1 Methods	63
5.2 Results	63
5.3 Discussion	64
6. Study 4	64
6.1 Methods	65
6.2 Results	65
6.3 Discussion	66
7. General Discussion	66
INTRODUCTION TO PAPER 4	68
PAPER 4: MISFORTUNE, AGENCY, AND MINIMAL COUNTER-INTUITIVENESS	69
Abstract:	69
Introduction	69
Agency	70
Threat, negativity, and misfortune	71
Study 1: Reaction Time	72
Rationale	72
Materials:	72
Design and procedure	73
Results:	74
Discussion:	75
Study 2 (Misfortune- Memory)	75
Rationale	75
Materials:	76
Design and procedure	77
Results	78
Study 3: Misfortune and MCI/normal agents- Memory	78
Rationale	78
Materials	80
Design and Procedure	81
Results	82
Study 4: Misfortune and normal agents- Memory	83
Rationale	83
Materials	83

Design and Procedure	83
Results	84
General Discussion	85
CONCLUSION	86
Summary and possible connections	86
Limitations and Future Directions	90
Perception of sources of threat-related information	91
Transmission studies	92
Misfortune and Agency	93
Fieldwork	94
Final Thoughts	94
REFERENCES	96
TABLES	105
FIGURES	132
APPENDIX A: PAPER 1– COMPLETE TEXTS USED IN STUDIES 1-4.	146
APPENDIX B: MATERIALS AND RESULTS FROM PAPER 3	152
Paper 3: Table of responses by ethnicity	159
Paper 3: Mean truth score by group, study 3	159
APPENDIX C: PAPER 4 MATERIALS	162
Stories from Study 2 (Misfortune Memory)	162
Stories from Study 3	165
Events	165

List of Tables:

Table 1. Paper 1, Study 1: Key passages that differ between TRI and NEU versions of the descriptions of three situations	105
Table 2. Paper 1, Study 1: Proportion of participants (%) who chose threat-related source, neutral source, and “don’t know” for each of the situations described.	106
Table 3. Paper 1, Study 2: TRI and NEG items used in three text-sets.....	107
Table 4. Paper 1, Study 3: Proportion of participants (%) who chose the threat-related source, negative source, and “Don’t know” for each of the vignettes.	108
Table 5. Paper 1, Study 3: Key sentences that differ between the threat and negative versions of the descriptions of three situations.	109
Table 6. Paper 1, Study 3: Proportion of participants (%) who chose the threat-related source, neutral source, and “Don’t Know” for each of the different situations described.	110
Table 7. Paper 3, Table 1: Table 7 Paper 3, Study 1, Number of Presentations and Truth Rating.....	111
Table 8. Paper 3, Table 2: Study 1 Estimate of Number of Views	112
Table 9. Paper 3, Table 3, Study 2: Number of Presentations and Truth Rating.....	113
Table 10. Paper 3, Study 2: Estimate of Number of Views.....	114
Table 11. Paper 3, Study 3: Number of Presentations and Truth Rating	115
Table 12. Paper 3, Study 3: Estimate of Number of Views at Three Levels of Actual Exposure	116
Table 13. Paper 3, Study 4: Number of Presentations and Truth Rating	117
Table 14. Paper 3, Study 4: Estimate of Number of Views at Three Levels of Actual Exposure	118
Table 15. Paper 4: Example of 4 Conditions, in Which an Agent or Impersonal Scenario is Presented and in Which the Scenario Did or Did Not Plausibly Cause the Misfortune	119
Table 16. Paper 4: Materials, “Break” Story in 4 Conditions.....	120
Table 17. Paper 4: Materials, “Food” Story in 4 Conditions.....	121
Table 18. Paper 4: Percentage of Types of Mistakes Made in Determining Causality	122
Table 19. Paper 4: Descriptive Results of Response Time for Correct Responses	123
Table 20. Paper 4: Response Time Interaction Between “Yes”/ “No” Response and Story.....	124
Table 21. Paper 4: Percentage of Participants Who Remembered Different Types of Items	125
Table 22. Paper 4: Coding Scheme Examples	126
Table 23. Paper 4: Average Number of Events Remembered in Each Category (Out of a Possible 6).....	127
Table 24. Paper 4: Memory for Intuitive and MCI agents by Context in Introduction Condition	128
Table 25. Paper 4: Number of Agents Remembered in Each Category (Out of a Possible 6)	129
Table 26. Paper 4: Religiosity Scores and Corresponding Mean Score for Memory of Positive or Negative Agents	130
Table 27. Paper 4: Introduction Type and Valence Scores, with Negative Score Indicating Better Memory for Negative Agents	131

List of Figures

Figure 1. Pre-test results of danger ratings. For each story, ratings of TRI (threat), NEU (neutral) and NEG (negative) sentences, in terms of “mentions danger”. Brackets include effect-size (Cohen’s d) for the comparison between TRI and NEG items.	132
Figure 2. Pre-test results of negativity ratings. For each text-set, ratings of TRI (threat), NEU (neutral) and NEG (negative) sentences, in terms of “negative tone”.....	133
Figure 3. Study 4 usefulness ratings. Average “usefulness” rating of the neutral and threat sources, as either 1st or 2nd text presented (error-bars: 95% CI).	134
Figure 4. Study 5 Proportion of choices. Proportion of participants (%) who chose the threat or neutral source or “don’t know” as more competent, honest and pleasant in three different text-sets (**: p<.001).	135
Figure 5. Study 5, Combined Scores. Combined scores for choice of the threat-source (out of maximum 3) as the source more likely to be competent, honest and pleasant (Error-bars: 95% CIs, ***: p<.001).	136
Figure 6. Paper 2, Figure 1, Results of Study 1. Results showing how often the TRI source was chosen as being more interested in the welfare of their customers, as well as overall number of times out of three that participants chose the TRI source.	137
Figure 7. Paper 2, Figure 2, Results of Study 2. Results showing how often the TRI source was chosen for future help, as well as overall number of times out of three that participants chose the TRI source.....	138
Figure 8. Paper 2, Figure 3, Results of Study 3. Results showing how often the TRI source was chosen for future help, as well as overall number of times out of three that participants chose the TRI source.....	139
Figure 9. Paper 2, Figure 4, Results of Study 4, showing how often the TRI source was chosen for a bonus, as well as overall number of times out of three that participants chose the TRI source.	140
Figure 10. Paper 4, Figure 1, age and response time. Results showing the relationship between the log transformed response time and age. There was a main effect of age $F(1,125)=12.95, p<.001$, with response time increasing with age.....	141
Figure 11. Paper 4, Figure 2, Memory for intuitive or MCI concepts, in negative and positive forms.	142
Figure 12. Paper 4, Figure 3, memory for types of agents. Agents remembered out of 6, with MCI agents and Intuitive Agents indicated on the x axis, divided by the four introductions, with 1 being Survival-MCI, 2 Safe-MCI, 3, Survival-Intuitive, and 4 Safe-intuitive.....	143
Figure 13. Overall valence of participant memory for agents, as they were depicted in the original presentation, calculated by giving them +1 point for each negative agent they remembered and giving -1 for each positive agent they remembered.	144
Figure 14. Valence for participants’ reports of memory, rather than the true valence in the original presentation of the agents, with one point for every negative event that they reported remembering and -1 point for every positive event that they reported remembering.....	145

Introduction:

This chapter is the basis for a shorter article that was published in 2017.

Parren, N. (2017). The (possible) Cognitive Naturalness of Witchcraft Beliefs: An Exploration of the Existing Literature. *Journal of Cognition and Culture*, 17(5), 396-418.

Abstract:

Cross-culturally, misfortune is often attributed to witchcraft despite the high human and social costs of these beliefs. The evolved cognitive features that are often used to explain religion more broadly, in combination with threat perception and coalitional psychology, may help explain why these particular supernatural beliefs are so prevalent. Witches are minimally counter intuitive, agentic, and build upon intuitive understandings of ritual efficacy. Witchcraft beliefs may gain traction in threatening contexts and because they are threatening themselves, while simultaneously activating coalitional reasoning systems that make rejection of the idea costly. This article draws possible connections between these cognitive and environmental features with an eye toward future empirical examination.

Keywords: witchcraft, evolutionary psychology, cognitive science of religion, threat, coalition

Worldwide and throughout time, people believe and have believed that when bad things happen to them or their community, it is because another person magically caused it to happen. This, like many supernatural and magical beliefs, is very interesting to a cognitive scientist, as the utility of such beliefs is not immediately apparent, and indeed, the accused can suffer horribly, while witchcraft beliefs in a society correlate with other negative social features, including decreased trust and social support (Gershman, 2016). Why then are these beliefs so common, pervasive, and apparently natural?

This dissertation takes the position that evolved features of the human mind, particularly related to social and threat domains are activated in the case of otherwise unexplainable misfortune, relying on an error-management system that allows witchcraft beliefs and practices to be a culturally stable phenomenon. The parts of the belief system may be broken down such that we must explain:

- How these ideas arise for the first time
- Why the person who has these sorts of ideas chooses to share or transmit the ideas
- Why the ideas stick, in terms of memory and belief, and

- Why a non-affected person would support the victim of misfortune, even at personal cost

There is probably not a singular cause, but rather, features of witchcraft beliefs activate the human mind in different but predictable ways along this chain. Witchcraft beliefs are also not the inevitable result of the cognitive features we will describe, yet they are “natural” in that they can be stable and explainable. In particular, witchcraft beliefs draw on cognitive systems that have been described in three main literatures: religious cognition, threat perception, and coalitional psychology. These will each be addressed in detail below, but I will first briefly preview some possible relationships. From the religious cognition literature, we infer that witchcraft beliefs may arise in part due to the tendency to err on the side of agency detection and be remembered due to their minimally counter-intuitive and threatening nature. From the threat perception literature we infer that misfortune particularly demands explanation, and information about a threatening agent, such as a witch, may be more believable than a non-threatening one. Further, threat information may be more likely to be transmitted under the right circumstances. In terms of coalitional psychology, framing misfortune as an attack by an agent may activate powerful intuitions that lead a group to band together in defense of and support for the victim, which may motivate the victim to describe their misfortune in terms of witchcraft.

In this introductory chapter, I will first look at some actual witchcraft beliefs before reviewing the cognitive literatures that I think are relevant in understanding those beliefs. The body of this thesis will report a number of different studies we have performed that contribute to these literatures without directly testing the fully elaborated theory of why witchcraft beliefs can be expected under the right conditions. To preview, we found in a number of different studies that transmitting threat information can provide the sharer with a reputational boost in comparison with someone else who shares useful but threat-neutral or positive information. I think that this may apply to witchcraft belief transmission, as someone may be implicitly motivated to share that type of threatening information because of the social benefit. People are also more likely to transmit information that they believe is true, so we also looked at factors that may contribute to belief in information, including having multiple sources and multiple repetitions of that information. We found that for information about fairly neutral topics about which the participants had low levels of independent knowledge, repetition was effective at increasing belief, while multiple sources had no measureable effect in this context. This may imply that a few loud voices in a community could be effective for convincing for people who were previously unsure about their belief in witchcraft, though this does not speak to the case where community members are skeptical about witchcraft as a starting

position. Finally, ideas better survive cultural transmission if they are memorable. I therefore looked at combinations of factors that might lead witchcraft concepts to be retained, such as agency, threat, and minimal counterintuitiveness. While these things have been studied individually, and will be reviewed below, the interaction between them was and remains unclear. In our particular online population, each of these elements had a main effect, but there did not seem to be an additive effect, as we predicted. Supporting previous research, I found that concepts with small intuitive violations were better remembered than concepts that did not violate any ontological assumptions. However, contrary to expectations, in this online, low-stakes environment, this effect was not influenced by either threat content or context. This implies that witches may be more memorable as explanations for misfortune because of their violation of intuitions about causality, rather than their threatening nature. The role of threat may be more relevant at other stages of the transmission process, or it may also be that this set of studies was not sufficiently threatening to elicit an effect. This will all be discussed in great detail in the body of the thesis. For now, we turn to the review of literature; first about witchcraft beliefs and then about relevant findings from cognitive science.

Witchcraft Beliefs

Before delving into the cognitive explanations for the cross-cultural phenomenon of witchcraft, it is worth looking at actual patterns of belief and behavior on the ground. There is a rich anthropological and historical literature to draw from as we seek to get a handle on the various idiosyncratic and context-specific details in the specific traditions around the world as well as the similarities that are robust enough to merit investigation.

In his worldwide survey of witch-hunting, Behringer provides a generalized definition of witchcraft that can be applied to any culture: “There are evil forces around, and they try to cause harm. Some people, who are essentially anti-social, either incorporate such forces involuntarily, or form alliances with these forces intentionally in order to inflict harm by mystical means. . . . They not only act as individuals, but rather, through their alignment to evil forces, they act in groups, being part of a conspiracy” (pp. 12– 13). This is a cross-cultural phenomenon, across time, where people believe in the ability of other people in their community to cause harm through occult powers. These people are used to explain specific ills and misfortunes that befall both individuals and groups (Koning, 2013). In particular, witchcraft seems to be invoked when the origin of the misfortune is unexpected, as in the cases of illness or death, crop failure, and business problems. The witches who

commit these malevolent acts are often said to be driven by emotions like envy, jealousy, resentment, hatred, greed, or desire for revenge (Gershman, 2016).

I will look at some of these cases, attempting to draw examples from a variety of times and places. This will serve to familiarize the reader with some of the variety and similarities and give grounded examples before we go on to look at these things more systematically in terms of predictive and correlated features of culture and witchcraft beliefs.

Evans-Pritchard

Perhaps the most classic anthropological text on witchcraft is Evans-Pritchard's 1937 book *Witchcraft, oracles and magic among the Azande*. Evans-Pritchard explores the Zande's explanations for misfortune, which include general covering laws, moral retribution, and then witchcraft. In the famous example of granary collapse, Zande people know that the foundations of the structures become weakened as termites eat the wood, slowly, over time. This explanation is enough if the extent of the damage is just the loss of the building. However, people sometimes sit beneath the granaries to socialize in the shade provided. When a collapse occurs with people in harm's way, more explanation is needed. Why did the effect of the termites culminate at this particular moment? Why were those specific people the ones who were injured or killed? The Zande then look more closely at the injured parties. If moral wrongs can be attributed to them, then a sort of immanent-justice explanation may be applied (Barrett & Lanman, 2008; Baumard & Chevallier, 2012) If not, the Zande turn to the explanation of witchcraft by which someone attacked the people who were hurt. Perhaps a witch was jealous of the victim, and so caused the victim to be in the wrong place at the wrong moment. This "second spear" allows the Zande to understand that the termites caused a particular granary collapse, but that witchcraft caused it to happen at a particular time and to a particular victim.

South Africa, AIDS

There has also been diverse academic interest in witchcraft beliefs in South Africa, where "Lowveld villagers evoked witchcraft in the event of incomprehensible misfortune of a physical and mental nature (J. Stadler, Tracy, 1996; Stadler, 2003)." When people are covetous of power, wealth, or are lustful and cannot fulfill their desires on their own, it is thought that they may become witches and use invisible supernatural forces, familiars, herbs, and other substances to cause harm to their enemies or those they are jealous of (Ashforth, 2001; Legare & Gelman, 2009; J. Stadler, 1996; Stadler, 2003) Witchcraft may be blamed for a number of different misfortunes, including unemployment, interpersonal problems, and illness and death, and more recently, AIDS. Legare

and Gelman take a cognitive development approach to understanding multiple types of explanation of misfortune in this context (2008; 2009). In Sesotho-speaking communities, where HIV infection rates are among the highest in the world, there are at least two main types of explanation for AIDS. On the one hand, Legare and Gelman found high rates of biological understanding and belief in terms of the invisible nature of disease and contagion and the delayed onset of symptoms. On the other hand, among their adult participants, almost everyone endorsed views of witchcraft as a possible cause of AIDS. As in the case of the Azande, these explanations were not considered mutually exclusive.

Legare and Gelman categorized the co-existence of the explanations in three groups: juxtaposition, proximal vs. distal, and real vs. fictitious. In the case of juxtaposition, participants simply stated that both biological causes and witchcraft might be at play, without specifying how they interacted or what aspects of the world biology or witchcraft might act upon. For instance, one participant stated, "Having so many enemies causes bewitchment, and maybe unfaithful partners cause AIDS too." In the case of proximal vs. distal, participants specified the different roles, such that while biological causes could be pointed to as acting directly, witchcraft might have set the victim on the path that led them to be biologically contaminated. For instance, one participant said, "Witchcraft can fool you into sleeping with an HIV infected person" and another said "A witch can make a condom weak, and break." In the case of real vs. fictitious explanations, participants pointed out that witchcraft could trick an outside observer by, for instance, mimicking the symptoms of a biologically caused disease. One participant said, "To medical doctors it seems like AIDS, but it is not (Legare & Gelman, 2008)."

Real vs. fictitious explanations were also reported in an anthropological text in 2003, though other participants claimed relatives and healers blamed witches in order to cover the shame and stigma of AIDS (Stadler, 2003). Ashforth also recorded cases where the cause of illness was unclear but that allowed the possibility that it had been sent directly by witchcraft. A woman with a newly deceased family member said that "someone had wanted to see the young man dead and had used witchcraft to send this AIDS or isidliso to kill him." (Isidliso means "black poison" and is the evil work of witches (Ashforth, 2002)) It was also found in Ghana that people who believed that AIDS could spread through witchcraft were less likely to use condoms during sex, perhaps for related reasons (Tenkorang, Gyimah, Maticka-Tyndale, & Adjei, 2011).

Legare and Gelman also point out that this combination of types of understanding is not particular to their own population. The famous medical anthropologist Paul Farmer had similar experiences in Haiti that were reported in *Mountains Beyond Mountains*, wherein a particular

patient evinced disgust at the condescension of Farmer's questions about witchcraft's role in her tuberculosis. She knew that the disease was transmitted by germs and she understood and acted on her understanding of the utility of the medicine. None-the-less, when a year later the same patient was interviewed again, she reported that not only did she believe in sorcery, she knew who the responsible witch was. This did not seem contradictory to the patient, and when pressed, she explained that things are "not simple."

Of particular note to the current project, Legare and Gelman were able to influence which types of explanation (biological, witchcraft, or both) were spontaneously used to understand a particular case of AIDS or another unspecified deadly illness by highlighting different characteristics of the victim's background when introducing their case. For instance, contextual background information about a victim might include the degree to which that person engaged in known risky behaviors, such as having multiple sexual partners. This sort of background information enhanced the likelihood that participants would spontaneously use biological types of explanations for the victim's illness. On the other hand, the contextual information might include reference to how the victim was stingy or failed to share, which are things that might provoke a witch. These primes increased the chances that the participants would spontaneously explain the victim's illness in terms of witchcraft. This design may have certain demand characteristics that contribute to the results, but the ability of the researchers to evoke such explanations is likely an indication that different social situations and conversations with different interested parties could do the same.

New York

This sort of flexibility can also be seen in the type of misfortune and success that is attributed to witchcraft in certain contexts. Rather than just AIDS or other illnesses, Akan shrines in New York City, attended by West African diaspora communities in Brooklyn and Harlem are heavily invested in celebrity, wealth, and the "upper East Side lifestyle." Parish gives many examples of shine attendees whose misfortune was in comparison to the rich and famous. For example, "Kevin, a Ghanaian, aged 26, a worker at a fashion house...not having attained the level of success he desired, he believed that witchcraft was preventing him from fulfilling his dream of fashion stardom, like Ralph Lauren or Tyra Banks." American shrines originate in Akan practices in Ghana, which was itself first disrupted and changed by colonialism. Diviners worked to intervene when witches used and abused money out of envy of property, land and other riches held by other members of their matrilineage, especially as colonialism disrupted family structure (McCaskie, 1981; McLeod, 1981).

These shrines protected against evil magic, curses and witchcraft, while simultaneously promising prosperity and to prevent bankruptcy (Parish, 2011). In both Ghana and in New York, anthropologists have suggested that the rate of witchcraft accusations increases when there is a tension between individual wealth accumulation and kinship obligations (Stadler, 2003). The same case has been made in regard to Tudor and Stuart England witchcraft beliefs, where the prosecutions of witches happened alongside the social change from an integrated village society to a more individualistic one (Gershman, 2016; Macfarlane, 1970). There does not seem to be a direct confrontation between the relatives in the New York tradition, however. The shrine gods are recruited to spy on the witches and kill their spirits but shrine attendees do not take matters into their own hands.

Cameroon, Boyer Fang

Pascal Boyer, my supervisor and originator of many of the ideas contained in this thesis, also performed anthropological fieldwork in Cameroon with the Beti and Fang people, where suspicious misfortune is often attributed to the action of witches. As in the previous cases, it is possible for illness to be “just illness,” but sometimes the concept of illness is not enough. For instance, when someone fell out of a tree, Boyer was told that this was a witch’s doing, as the climber was skilled and wouldn’t have just fallen accidentally (Boyer, In Prep). Similarly, when a woman was unable to have children, Boyer was told that it had to be due to a witch’s influence, as the would-be mother was doing everything that was required to become pregnant. In these and many other instances, when the victim seemingly could not be blamed for their own misfortune, there was “more than meets the eye” and someone else who had the witchcraft organ *evu* was causing and profiting from that misfortune (Boyer, In Prep). However, in contrast to the South African case, it is the successful who are the most often, or even inevitably, pointed to as witches (Boyer, 2001). Their success itself seems to indicate an unfair and even malicious advantage.

General Cross-Cultural look at predictive factors

While widespread, witchcraft beliefs crop up with unequal frequency around the world. Other than in immigrant communities, witchcraft beliefs have largely faded in autochthonous populations (Koning, 2013; Parish, 2011, 2013) but are still present in several Asian and Latin American countries (Callan, 2007; Fandrich, 2007; Hayes, 2007; Kidder, 2003; Schram, 2010). Sub-Saharan Africa has very high rates of belief, though there is still variation between groups of people, with, for example, 96% of people surveyed in Tanzania expressing belief in witchcraft as opposed to 57% of the whole sub-Saharan African sample in the Pew Forum on Religion and Public Life in

2008/2009. In general, it seems that witchcraft beliefs are less common among foraging groups, but are prominent in agricultural communities with young or patrimonial state systems (Koning, 2013).

The importance of this field of research is highlighted by an examination of the beliefs about who the witches are and what is done about them. In some cases, witchcraft is considered heritable and in other places, becoming a witch can happen to anyone. In some African cultures, men and women of any age can be witches, but in other places, one gender or age is more likely to be accused. It is not uncommon for people to turn their sights to elderly women and young children (Gershman, 2016; Miguel, 2005). In some groups, witches are anonymous and no one is attacked or accused by the community, but in many others, witches are believed to be members of the community and often even the family to be found and stopped, by ritual, torture, removal/expulsion, or death (Boyer, In Prep; Douglas, 2013).

Most familiar to a general Western audience is perhaps witchcraft crazes in Europe from the 1300s to the late 1600s where the number of dead probably numbers in the tens of thousands, and in the United States in the 17th century, such as in Salem where 200 people were accused and 20 were killed (Blumberg, 2007). More recently, much of the general public was exposed to the ongoing human impact of witchcraft beliefs when a picture of an aid worker helping an emaciated young child in Nigeria went viral in 2016, (Withnall, 2017). Even so, the suffering caused by witchcraft accusations is generally underestimated. For instance, between 1970 and 1988, 3072 accused witches were killed in Sukumaland, Tanzania (Miguel, 2005) and over 600 were lynched in Limpopo province in South Africa in 1996-2001 (Gershman, 2016). Across Africa, hundreds of children have been killed, maimed, and abandoned, accused of being witches by their village, individual community members, and even by family (Adinkrah, 2011).

Witchcraft beliefs may also be harmful to members of the communities who are not themselves accused. Analysis of survey data in sub-Saharan Africa finds a strong negative association between the rate of witchcraft beliefs and multiple measures of trust in societies, even when controlling for many different potentially confounding factors (Gershman, 2016). With the prevalence of witchcraft beliefs, there is also a negative association with charitable giving and participation in religious group activities. The fear of witch activity and the fear of being accused of witchcraft may both de-incentivize cooperation and cause missed opportunities for growth, economic and otherwise. Furthermore, parents who believe in witchcraft inculcate mistrust and other antisocial traits in their children, which is expressed even in second-generation immigrants in Europe (Gershman, 2016). As we saw above, in some circumstances, such beliefs may promote risk-

taking if the belief interferes with biological understanding of disease, which also increases the population risk (Tenkorang, et al., 2011).

In the following sections, I will break down these real life cases into what I see as the essential cognitive and cultural subcomponents in an attempt to understand what makes some of these features so prevalent and apparently natural.

Cognitive literature overview

In the next sections, I will look at findings from three main different cognitive literatures (religious cognition, threat detection, and coalitional psychology) and suggest ways that these features of the human mind may make witchcraft beliefs natural or likely to arise and be sustained under different conditions. Before I delve into these details, however, it is worth taking a moment to establish our theoretical background on understanding the cultural success of ideas.

Without going too deeply into what can be a contentious debate between naturalistic approaches to cultural phenomena (evolutionary vs. cognitive approaches (see (Claidière & Sperber, 2007), I take the position that “the existence and diversity of human cultures are made possible by our species-specific cognitive capacities (Sperber & Hirschfeld, 2004).” Some particular types of beliefs and practices are made natural by their “connection to human expectations and preferences that result from evolution by natural selection (Boyer & Petersen, 2012).” Domain-specific cognitive programs were evolved in the context of particular problems (Barkow, Cosmides, & Tooby, 1992) and are strongly inferential, being content-rich in assumptions about their domain. When things in the world, including cultural content, fit these programs, they are intuitive and easily understood, which gives that content a cognitive advantage over other content (Boyer & Petersen, 2012).

Cultural Success depends on many factors, including:

In the specific case of beliefs, there are a number of things that should be in place or happen to help them to become stable in a culture. An incomplete list includes:

- The initial production of the ideas in at least embryonic form
- There must be the intention to transmit the idea, by at least the originator and probably by persons who received the information second hand. (While behaviors related to the belief may be exhibited for imitation, the content of complex beliefs must be transmitted by language.)

- The idea must be memorable enough, or involve enough cultural attractors, to make transmission relatively stable through the process of reconstruction and retelling (Bartlett, 1932). For instance, a random drawing is harder to reproduce than one with meaning and thus be less likely to survive (Scott-Phillips, 2017; Sperber, 2000). If there is a pull to resolve ambiguity back toward the core idea, this promotes stability.
- In most cases, it is only information that people believe that goes on to be transmitted, so the idea must not strain credulity too far (Pezzo & Beckstead, 2006)
- It also helps if an idea is relevant to the lives of the people it is reaching. Detailed beliefs about ice are less likely to survive in the equatorial zones than closer to the poles (G. W. Allport & L. Postman, 1947).

As I move through the literature review of religious cognition, threat detection, and coalitional psychology, I bear these aspects of cultural success in mind and point to them where they are relevant.

Religious cognition

This thesis has its foundations in the cognitive science of religion (CSR), in terms of the approach to explaining phenomena, the type of phenomena in question, as well as some of the crucial theories and findings. One of the main features of CSR is that the problem of defining religion is dodged, in favor of looking at the thoughts and behaviors that make religion up, at least in many or most cases. These pieces are researched and scholars attempt to explain what cognitive features make them or allow them to show up cross-culturally. As Justin Barrett says, “If the explanations turn out to be part of a grander explanation of ‘religion’, so be it. If not, meaningful human phenomena have still been rigorously addressed (2007).” This approach is very similar to the above expressed understanding of cultural epidemiology and has been generally quite effective, with more and more researchers and publications falling under this domain all the time. When authors return to the main questions of interest, essentially, “How can we explain religion? Why is it found all over the world throughout time?” it is to the suite of underlying mechanisms that they often go. There is not one unified explanation, but rather a number of different evolved cognitive systems that make such phenomena very likely to occur in individuals and in cultures. My supervisor, Pascal Boyer, wrote one of the best known of these books, called “Religion Explained.”

This thesis is meant to do something similar, if less ambitiously, and for witchcraft in particular instead of religion in general. This will draw on many of the findings already studied and

widely discussed in CSR, such as the memory advantage for minimally counterintuitive concepts, the hyperactive agency detector, and intuitions of ritual and magical efficacy. I, too, am able to dodge the debates over what exactly constitutes witchcraft, as opposed to, for instance, sorcery, or between ancestral and interpersonal jealousy in witchcraft which have been of some debate in anthropological circles (Evans-Pritchard, 1937; Koning, 2013; Legare & Gelman, 2009). Distinctions of some debate between these experts are usually not at the level of specificity that we are commenting on, though it may be interesting to try and explain why one group of people have what anthropologists consider “sorcery” and why another group of people have what those anthropologists consider “witchcraft” assuming there is a cognitive element behind the distinction. In the case of witchcraft, we will draw on many of the subcomponents, but in particular, the focus will be on how people understand misfortune in terms of agents, counterintuitive concepts, the hyperactive agency detector, and intuitions of ritual and magical efficacy. As Barrett notes in the case of CSR, the components that we study here need not lead inevitably to witchcraft beliefs. Under other environmental circumstances, both in the natural world and in the cultural context, these underlying mechanisms may continue to affect thinking, but make other agent based explanations of misfortune more natural. Indeed, in looking at witchcraft belief data against subsistence mode data in the Standard Cross Cultural Sample database, Koning argues that the same mechanisms that produce witchcraft beliefs in agricultural communities with embryonic or patrimonial state systems leads to more collective forms of social paranoia in more-evolved agrarian societies, such as violent anti-immigrant stances (Koning, 2013). Some this will be discussed later in the chapter, but for now, we turn to a closer examination of some of the main findings from CSR that speak particularly to witchcraft. While we can draw from these existing literatures and imagine how cognitive biases and features may interact with one another and environmental conditions, this is, of course, only a first step. By looking at the possibilities below, we hope to uncover rich avenues for future experimental work that may be less obvious than when trying to explain religion as a whole.

MCI

Minimally counter intuitive (MCI) concepts are often defined as those that violate just one or two of our innate or deep intuitions that are part of the evolved architecture described above, in particular, violations of conceptual expectations at the level of domain knowledge, such as about a person, or about an animal. Such concepts are often seen in religious content. These violations provide a memory and attention advantage for the concept over maximally counter-intuitive concepts (that violate many intuitions) and purely natural concepts (Boyer, 2003; Boyer & Ramble,

2001). For instance, a man who is invisible is a catchy yet understandable idea. We can use all of our usual cognitive tricks to understand such a man; we can attribute desires and interests, assume biological and physical properties (such as needing to eat and being solid), and so on, but the invisibility violates our assumption about solid objects reflecting light. On the other hand, an invisible man, with a brain in each foot, who can fly and thinks only in rhyme and experiences time backwards is perhaps an interesting concept, if the author may flatter herself, but one that is difficult to retain because of the number of intuitive violations. It is a lot of work to imagine such a man, and details are likely to therefore blur or be forgotten, along with the concept itself. Alternatively a man who plays golf on Fridays is not as likely to be remembered either, as it is not as interesting. Experimental work and surveys of religious literature have borne this out, while also inviting new and interesting questions. There has recently been discussion and criticism about the exact mechanisms and types of violation that may drive the effect, and how they map on to real religious beliefs (for example, (Purzycki & Willard, 2016), but for the purpose of our particular discussion and application, these concerns can be set aside, as the case of witchcraft is not in the categorical grey zone under dispute.

Witchcraft beliefs clearly could benefit from such a memory and attention advantage to concepts that at least largely overlap with MCI. Witches are usually people about whom all of the usual inferential reasoning applies in terms of folk biology, theory of mind, and social reasoning, the latter of which in particular seems to be activated, given the frequency with which witches are assumed to be jealous or covetous, either of their victims in particular, or in general. However, witches violate some standard expectations; in particular, that they are able to cause misfortune to befall others in mysterious and non-physical ways. Local theories define how witches accomplish this, which makes the particular type of intuitive violation vary between cultures. For instance, as with the Fang discussed above, it is a magical organ, which violates some intuitive biology as well as physics. Despite the particulars of the violations, witches are minimally counter-intuitive agents, so when people talk about them, as when looking for an explanation of the death of a young person in the community, the witchcraft explanation likely enjoys a memory advantage over a purely biological explanation like germs. This makes it slightly more likely that the witchcraft explanation will be transmitted again, or be remembered the next time there is a similar death. The cumulative effects of the memory and transmission advantage may contribute to the stability of witchcraft beliefs in a culture.

Agency

Another classic target of CSR investigation is that of attributions of agency. There are a few approaches (Guthrie, 1995), but in the most commonly cited case, it is argued that people are prone to interpret ambiguous signals as intentional agents, because of the high cost of failing to detect them in the evolutionary context and the relatively low cost of incorrectly detecting them. This tendency has been dubbed the Hyperactive Agency Detection Device and has been used in various ways to help explain religious beliefs (Barrett, 2004) though some put more emphasis on the intentionality side than the agency side (Lisdorf, 2007). For instance, such a device would make us “prone to find agents around us, including supernatural ones, given fairly modest evidence of their presence. This tendency encourages the generation and spread of god concepts (Barrett, 2004).” This can happen even in the case of explicit disbelief, as happened to “confirmed atheist” and psychologist Jesse Bering. As he recounted in his book “The Belief Instinct,” after his mother died, he heard wind chimes ringing, and could not help but interpret them as some sort of communication from his departed loved one, at least in that moment (Bering, 2013). There are many different types of signals that could be interpreted as agent based, however, and it is not clear how these relate to one another. For instance, there may be perceptual biases (Guthrie, 1995; van Elk, 2013, 2015; van Elk, Rutjens, van der Pligt, & Van Harreveld, 2016) that are activated in a very different way from cognitive biases that lead people to see minds or intentionality to a greater extent (Epley, Waytz, Akalis, & Cacioppo, 2008; Waytz et al., 2010) especially when there are existing expectations about agents and certain types of negative affect.

In another approach, it is argued that anthropomorphic representations are likely to become stable because they activate powerful inferences for mentalistic accounts of behavior, while also being counter-intuitive, and thus getting an attention and memory boost as described above (Boyer, 1996). Furthermore, “when people explain salient misfortune without mentioning supernatural agents, they still assume agents as causally involved (Boyer, 2003).”

This latter example is of particular relevance to witchcraft beliefs and could play a role in both the creation and spread of such ideas. When people do not understand why something happened, or are exposed to an ambiguous stimulus, they may naturally first assume that an agent is involved, particular when something bad happens. This may contribute to the initial production of ideas that may become fully fledged witchcraft beliefs, as well as make such explanations of misfortune plausible when they are transmitted.

Death Primes

Death salience and its influences on religious thought have also been much discussed (Holbrook, Sousa, & Hahn-Holbrook, 2011; Jong, Bluemke, & Halberstadt, 2013; Jong & Halberstadt, 2016; Jong et al., 2017; C David Navarrete, Kurzban, Fessler, & Kirkpatrick, 2004). It also triggers things that are interesting in terms of witchcraft in particular. For instance, under death salience, people take a punishing attitude toward social deviance and show greater ethnic-racial intolerance or stereotyping (Boyer, 2003). It is interesting then that witches often fall into similar categories, as outsiders or people with less social power. In South Africa, witches are thought to be most often people who are covetous and cannot gain their desires on their own, such as the impoverished elderly who are jealous of the young (Stadler, 2003). This connection may suggest some connection between places and times where the population is under threat or experiencing death saliently, and the tendency to punish witches.

Intuitions of ritual and magic efficacy

It may also be that witchcraft beliefs can gain traction and be sustained because people really are surrounded by ritual and magical actors, which may also help inspire the initial production of ideas and make them more plausible in transmission. Intuitions of ritual and magical efficacy is another of the original research topics in CSR, with the take away message for our purposes being that people have strong intuitions about rituals and magic working and what makes some sorts of ritual and magic behaviors more effective than others (Barrett & Lawson, 2001; Legare & Souza, 2012; Liénard & Boyer, 2006; Lienard & Lawson, 2008; McCauley & Lawson, 2002; Sørensen, 2007).

These beliefs often exist within a codified structure and wider magical and religious worldview, but need not always. Individuals may be convinced of their own power over uncertainty relatively quickly even outside of an established belief system or belief in a particular “specialness” of an object. For instance, while someone might be familiar with the concept of luck or luckiness, they might not actually believe in the concept as playing a role in their life, until a special pair of socks takes on significance after a single “win” or escape from danger. Such spontaneous imbuing of significance can be elaborated and fit into a larger system, either for the individual or in a community or culture, but again, it need not necessarily do so. Indeed, the ritual and magical idiosyncrasies of neighbors may be ignored or accepted by an individual, but the presence of such behaviors and beliefs makes the concept more salient and perhaps available to call on when explaining misfortune, even in the absence of an existing cultural belief in witchcraft. If this person

down the road uses and believes in magic, might it not be that she is using that magic against me? If she isn't, is someone else?

Threat perception

Prosperity is easily received as our due, and few questions are asked concerning its cause or author On the other hand, every disastrous accident alarms us, and sets us on enquiries concerning the principles whence it arose And the mind, sunk into diffidence, terror, and melancholy, has recourse to every method of appeasing those secret intelligent powers, on whom our fortune is supposed entirely to depend. (Hume, 1757/1956, p. 31)

We turn now to another domain of psychological research that bears heavily on the phenomenon of witchcraft beliefs: the asymmetry in various cognitive domains to threats as opposed to positive or neutral stimuli. As mentioned in terms of the threat primes and agency detection above, this is not exclusively a non-religious phenomenon, and indeed has already been examined to some degree in that context. However, it is worth exploring more fully here, as it is specifically misfortune perception and then rumination that is the context of witchcraft beliefs.

Bad is stronger than good

Put simply, threat and negativity seem to exert a disproportionately powerful force on many of our cognitive processes, including perception of stimuli, attention and information processing, emotions, belief, and memory (Fessler, Pisor, & Holbrook, 2017; P. Rozin & E. B. Royzman, 2001). “Bad is stronger than good” in reacting to events of various kinds in life and during a day, in close relationships such as long-term relationships and between family members, as well as in brief relationships and friendships, in the emotional world, including emotional language, emotional recall and emotional effects, and economics (Roy F Baumeister, Ellen Bratslavsky, Catrin Finkenauer, & Kathleen D Vohs, 2001) Baumeister et al. argue that being better attuned to bad things in general gave organisms an advantage as they would be more likely to survive threats (Kahneman, Tversky, Finkenauer, & Vohs, 1984/2001). An information processing advantage for negative stimuli should promote survival in so far as it enables the rapid identification and avoidance of potential threat (Roy F Baumeister, et al., 2001; P. Rozin & E. B. Royzman, 2001).

It also seems that a threatening context can enhance certain types of processing and memory (Kang, McDermott, & Cohen, 2008; Kazanas & Altarriba, 2017; Nairne & Pandeirada, 2008, 2010; Nairne, Thompson, & Pandeirada, 2007; Soderstrom & McCabe, 2011; Weinstein, Bugg, & Roediger, 2008) but see (Rozin, Royzman, & Roediger III, 2001/2009).

It also seems that a threatening context can enhance certain types of processing and memory. A popular paradigm involves inviting participants to imagine themselves in a survival scenario and then rate words based on their relevance or usefulness in that situation. A control group rates words based on their pleasantness or performs some other deep processing task without imagining a survival scenario. In a surprise memory task, participants who were in the survival priming condition remember words better than in the pleasantness/other control condition (Kang, et al., 2008; Kazanas & Altarriba, 2017; Nairne & Pandeirada, 2008, 2010; Nairne, et al., 2007; Soderstrom & McCabe, 2011; Weinstein, et al., 2008) but see (A. C. Butler, Stephanie A, Kang, & Roediger III, 2009, 2017; Soderstrom & McCabe, 2011). Furthermore, the greater the threat, the greater the memory advantage. When the survival scenario involved zombies rather than unspecified predators, participants performed better on the subsequent memory task, and while zombie scenarios were seen as more arousing than the nondescript predators/attackers, this arousal did not account for the differences in recall performance when added as a covariate in the model (Soderstrom & McCabe, 2011) However, in a follow-up study, demons and nondescript predators did not lead to significantly different memory performance, though participants in both of those conditions out-performed the participants in a non-MCI but bizarre condition (Kazanas & Altarriba, 2017; Soderstrom & McCabe, 2011). It is difficult to interpret the relevance of these findings to the question witchcraft apart from saying that there may be an interaction between threat context and supernatural “predators” that bears future investigation.

It will be particularly interesting to examine the ways in which negativity and more specifically threat biases might make witchcraft beliefs more natural. Therefore, I will look more closely at how negative information is preferenced in terms of credulity and in terms of understanding agents.

[Belief in Threat Information](#)

Of particular interest to the study of witchcraft beliefs is the finding that there is also a credulity bias for negative information. The same cost-benefit calculations are at play here, where believing negative information should have a lower cost than ignoring potentially true threat information. This imbalance fits within the larger set of problems discussed above that come from being a species that relies on cultural information and are therefore subject to the risk of exploitation (D. M. Fessler, A. C. Pisor, & C. D. Navarrete, 2014; Hilbig, 2009, 2012). None-the-less, some credulity is required for cooperation, and credulity should be biased in such a way as to minimize costs. This is demonstrated in experiments showing that information that is presented in a way that emphasizes the negative is believed more than the equivalent information that emphasizes the positive (D. M.

Fessler, et al., 2014; Hilbig, 2009, 2012). For instance, a participant might see the positive information that 88% of adults pay their rent on time, which of course implies that the remaining 12% do not. However, this positively framed statement might be believed less than the negatively framed statement that 12% of adults do not pay their rent on time (Hilbig, 2012). Fessler et al. point out that such framing, while logically equivalent, is also clearly not equivalent in terms of communicative intention. Foregrounding negative, or in their case hazard information, signals an intent to warn. Crucially, this negative credulity effect is particularly strong among participants who already view the world as a dangerous place (Fessler, et al., 2017; D. M. Fessler, et al., 2014). These findings suggest that witchcraft rumors may have a cultural advantage based on their very negativity and threat content. MCI concepts, while memorable, might raise some credulity issues, but this incredulity may be lessened by an error management system whereby threat information is given the benefit of the doubt. As these biases are shared to some extent (despite individual variation) in a community, the cumulative effect may help such beliefs become widespread and established. Furthermore, witchcraft accusations and attacks do seem to be correlated with threat and/or resource strain, as may be implied by the findings on individual differences in beliefs that the world is a dangerous place. In particular, it has been noted that extreme rain conditions, either drought or flooding, leads to a large increase in the number of people (in this case usually elderly women) murdered for supposed witchcraft, though there is no increase in other types of murder (Miguel, 2005).

[Advantage for negative social ideas](#)

There also appears to be a negativity bias specifically within the social domain. As is the case generally, negative social information is automatically given more attention than positive social information (Pratto & John, 2005). People are attentive to cues that someone might be a bad social exchange partner or that they might be pathogen bearer, which leads us to avoid and stigmatize those people (Kurzban & Leary, 2001). Bad impressions and negative stereotypes form more quickly than positive impressions and stereotypes, and are harder to change in a positive direction (Roy F Baumeister, et al., 2001; Skowronski & Carlston, 1989). In addition, negative events may also elicit an expectation that another person is causally involved more than positive or neutral events, even if the probability does not really favor personal over impersonal causality (Morewedge, 2009). As mentioned in the CSR section, this is also the case with supernatural agents, where salient misfortune elicits the assumption that agents are involved (Boyer, 2003). Similarly, when the environment is unpredictable, which itself may be seen as somewhat threatening, people are more likely to anthropomorphize (Waytz, et al., 2010).

All of these tendencies could be relevant in a witchcraft context. If you hear that people might be witches, or that one person in particular might be a witch, such negative information might stick and be hard to let go of. While this is already implied by the general threat bias literature, it is important to establish that the effects are found in this particular domain. However, questions remain about the interaction of agency and threat biases, which will be addressed in the body of this thesis.

Transmission preferences

Of course, attention, memory, and belief are not enough for cultural success in the absence of transmission between people. However, there is some evidence that, at least in some cases, there are also transmission advantages for threat information. Rumors that contain information about undesirable events are more virulent than those about desirable events, even when matched for importance and believability (Walker & Blaine, 1991). Transmission rates also reflect disgust preference, a sub-category of threat preference (Eriksson & Coultas, 2014; Heath, Bell, & Sternberg, 2001). Another study found that in the process of social transmission, negatively-valenced information is favored, both in survival of information that was originally negatively-valenced, as well as in the resolution of information that was originally ambiguous (Bebbington, MacLeod, Ellison, & Fay, 2017). Urban legends and supernatural beliefs worldwide show a high percentage of hazard information (D. M. Fessler, et al., 2014).

However, these transmission results are not completely straight-forward. In some situations, such as when the general domain of discussion is perceived as positive, people prefer to transmit congruently positive emotion, while still preferring to transmit bad news within a negative domain (Heath, 1996). In an analysis of which New York Times articles were emailed on from the site, it was found that highly arousing content, such as articles that inspired awe, anger, or disgust were the most transmitted, especially in contrast to low arousal content, such as sad stories. However, in this study, positive arousal stories were more emailed than the negative arousal stories (Berger & Milkman, 2012). Others found that social information is transmitted more if it has emotional content, including disgust but also happiness, though there are differences in transmission based on audience (Peters, Kashima, & Clark, 2009). This conforms to our intuitive experience of the world. While in some cases negative information seems to be everywhere, focusing on the bad is not always socially appropriate. The context must be right.

Altshteyn and Barrett looked for a threat bias on Twitter, expecting to find high rates of warning information, as there is a low cost to transmit such information, but it should be of high value to receiver. They further reasoned that recipients of warning information may be indebted to the transmitter and also stronger allies by virtue of not falling victim to the threat. Indeed, they found that tweets containing threat information were re-tweeted up to 3.13 times more than tweets without threat information (Altshteyn, 2014).

Threat information can take many different forms, and there are domain specific and developmentally natural fears that such information can tap into (Boyer & Bergstrom, 2011). Of particular interest to us, as discussed above, is information about threatening individuals or groups. There is some evidence that social threat information, in addition to social information in general (Mesoudi, Whiten, & Dunbar, 2006), enjoys a transmission advantage. Florian Van Leeuwen used Google's Ngram to compare the transmission of information about human caused and naturally occurring disasters, matched for number of people killed, time period, and location by continent, and found that the human caused events were mentioned an average of ten times as often (2014). A lethal event that was caused by a witch may thus be more prone to transmission than a lethal event caused by nature.

Coalitional Psychology

Another essential domain for our understanding of the cognitive naturalness of witchcraft beliefs is that of coalitional psychology (Boyer, In Prep). Of course, as discussed above, for there to be a cultural representation like witchcraft, there must be a cooperative culture in which such information is transmitted to people. In addition, witchcraft ideas may be particularly powerful ones in that they activate coalitional reasoning processes that motivate behavior and signaling in a way that other responses to misfortune would not. Here, we will first review those processes of coalitional reasoning in terms of their activation, in-group processes, rivalry process, and defection management, before then turning to a discussion of how witchcraft ideas may operate in those spaces.

Coalitional Inferences and Group Tracking

As was previewed in our discussions of transmission, humans are uniquely cooperative and rely on groups for a large part of general functionality (Buss & Kenrick, 1998; Fessler, 2006; Pietraszewski, 2013). This reliance on conspecifics prompted and is dependent on a distinct evolved psychology, calibrated by the particulars of the social environment in which one is raised. The problems of cooperation in a group can be computationally demanding. For example, relationships between

multiple people can be affected by a single event in many different ways, dependent on the nature of the individual connections between the actors. We have many idioms that point to some of these relationships, such as “the friend of my enemy is my friend.” But what if the two former enemies resolve their differences and become allies? The change in their relationship changes the former friendship as well, without any direct interaction between the once-friends. To understand this and other such dynamics, it is necessary to draw upon sophisticated and selective inferences (Pietraszewski, 2013). Systems are in place that bias people in such a way as to promote the tracking of actual and possible alliances, predict how individuals and groups will act based on those alliances, and how to perform and promote oneself within such a context, particularly for recruiting assistance.

Cue tracking

It seems that people automatically monitor the world for cues of coalition, looking for patterns of coordination, cooperation and competition. These cues can take many different forms, including clothing or other such markers, shared ideas and knowledge, race, physical closeness, synchronic movements, etc (Fessler, Holbrook, & Dashoff, 2016; Pietraszewski, Curry, Petersen, Cosmides, & Tooby, 2015). These cues can quickly activate coalitional reasoning systems, even when the diagnosticity is new. It is by these mechanisms that “race [can be] erased” when not a cue of coalition, in favor of a more accurate marker, while t-shirt color can quickly take on the role of coalitional cue when diagnostic of a rival team among children (Bigler, Jones, & Lobliner, 1997; Kurzban, Tooby, & Cosmides, 2001). Study participants showed bias and favoritism toward an arbitrary group with unmistakably insignificant or even no special features (a “minimal group”), apart from the participant being assigned to that group in the lab (Tajfel, Billig, Bundy, & Flament, 1971; Billig & Tajfel, 1973) and more readily associate minimal out-groups with aversive stimulus than minimal in-group members (Carlos David Navarrete et al., 2012).

Ingroup support

Despite this flexibility, “group” is a powerful force and people actually tend to see coalitions as stable, where past affiliation can be used to predict future behavior. Being part of a group or a coalition promotes cooperation, of course, including extreme sacrifices of resources, time, and even life, while possible cheating is constantly and unconsciously monitored (Cosmides & Tooby, 2005; Cosmides, Tooby, Fiddick, & Bryant, 2005; Fu et al., 2012; Goette, Huffman, & Meier, 2006; Tajfel, Billig, Bundy, & Flament, 1971; Yamagishi, Jin, & Kiyonari, 1999; Yamagishi & Mifune, 2008). While coalitional reasoning is activated, people tend to see gains for the group as a gain for themselves,

and a gain for someone within the group as a gain for everyone. Similarly, costs are shared. If a member of the coalition is hurt or suffers a misfortune, the other group members perceive that they are hurt as a whole and therefore as individuals. In this sense, the members of the coalition become to some degree interchangeable and there is a motivation to promote the good of all and ameliorate the negative, even if it doesn't directly affect all the players. It is crucial to be an accepted member of such a group, and the threat of being ostracized is carefully guarded against (Baumeister & Leary, 1995; Eisenberger, Lieberman, & Williams, 2003; K. D. Williams, Cheung, & Choi, 2000).

Outgroup rivalry

Of course, that strong coalitional support for ingroup members has the converse in rivalrous interactions, real and perceived. Outgroups are readily seen as threatening, similar to types of natural hazards (Carlos David Navarrete, et al., 2012; Olsson, Ebert, Banaji, & Phelps, 2005). People tend to see groups as operating in a zero sum competition, where success and procurement of resources by another coalition is perceived as a loss for one's own coalition, and vice-versa (Esses, Dovidio, Jackson, & Armstrong, 2001). Furthermore, the "group as one" perception extends from one's own group to the rival coalitions, where an attack on a member of one's own group is seen as an attack on oneself, but retaliation is also interchangeable in terms of target in the other group (Crawford, Sherman, & Hamilton, 2002; Lickel, Miller, Stenstrom, Denson, & Schmader, 2006; Vasquez, Wenborne, Peers, Alleyne, & Ellis, 2015). The original attacker need not be punished if another member of his group can be attacked.

Defection management

In this context, defection from the coalition is a grave offence and people are motivated to punish defectors. People who swap groups are seen as traitorous and are regarded with suspicion in their new group as well. Meanwhile, people are motivated to discourage defection both by checking for and eliciting commitment signals before allowing new members to join their group and by promising punishment for defection. These responses are not necessarily conscious, or are motivated by emotions without the need for careful reflection on them (Boyer, In Prep).

Groups under threat

We have already examined some of the ways in which threat perception exerts a powerful cognitive force, so perhaps unsurprisingly, threat context influences coalitional psychology as well. The mechanisms covered in this section are easily triggered but also seem to become particularly intense under different domain specific forms of threat. Navarrete et al argue that under threat, and even the idea of threat, social relationships are particularly important for protection and support.

When implicitly attempting to gain or retain this support, expressions of commitment to the group or coalition should be particularly strong, for instance in terms of pro-normative attitudes. Indeed, this was born out in cross-cultural experiments in which participants were asked to contemplate aversive scenarios (C David Navarrete, et al., 2004). Pro-group attitudes also again have their converse in stronger anti-out group sentiment under threat (Stephan, Ybarra, Martinez, Schwarzwald, & Tur-Kaspa, 1998). For instance, chronic disease worries activate stronger out-group bias, where people see foreign out groups as dangerous and predicts a less positive attitude toward foreign immigrant groups (Faulkner, Schaller, Park, & Duncan, 2004).

Misfortune as an attack in the coalitional context

We can now turn to looking at how witchcraft ideas operate within a coalitional psychological context. Since witchcraft beliefs are agentive models of misfortune, they should activate coalitional psychology systems and therefore make it more likely that other people will assist the injured party and/or give signals of coalitional commitment that can be drawn on later. Essentially, witchcraft beliefs may serve to turn a case of misfortune into a coalitional conflict, in which people must choose a side. The injured party may be (implicitly or explicitly) motivated by their misfortune to promote strong coalitional behavior amongst their fellows, similar to the motivations described in the previous section (C David Navarrete, et al., 2004). Given that they have suffered a loss of some kind, they should be sensitive to threat, making them more sensitive to cues of agency and interested in coalitional support. They may propose the idea that their misfortune was caused by a witch. The idea that a negative event occurred because someone was attacking a group member is enough to activate the coalitional psychology systems of their fellows, which would likely serve the victim better than other sorts of explanations of their misfortune. While the idea of a single witch attacking the group is enough to activate this coalitional system, it is worth returning to the definition of witchcraft provided by Behringer at the beginning of this chapter. Based on his worldwide survey, he notes that witches are often seen to “form alliances with these forces intentionally in order to inflict harm by mystical means. . . . They not only act as individuals, but rather, through their alignment to evil forces, they act in groups, being part of a conspiracy (Behringer, 2004).” This perception of coalitional conflict should be powerful and motivating.

To be clear, these coalitional mechanisms were selected independently, but are activated in this new context. Indeed, as we saw in the discussion of societies with witchcraft beliefs, the end result may actually be anti-social and have negative consequences for everyone (Gershman, 2016). None-

the-less, the agent-based explanations are relevant to people and mesh with their assumptions and motivations, even if this is at a cost in this particular case.

To illustrate the idea, consider a typical sort of misfortune in agricultural communities with young or patrimonial state systems (Koning, 2013). Imagine that John and Mark are both farmers and well respected in their village. One day, John's fields flood, but Mark's are spared. A number of different explanations and reactions could be evoked at this point. Mark might be reasonably happy about this turn of events in so much as he is in competition with John for status and access to mates, for example. Mark may think that John was a bad farmer because he planted too close to the water and thus got what he deserved, or Mark may think that John was randomly unfortunate and be grateful that his fields are fine. Under these circumstances, Mark would be at most minimally interested in helping John. The crop failure was not Mark's fault and not his problem to fix. Perhaps if Mark has leftover crops after taking care of himself and his family, he might share, but would not feel obligated to do so.

Imagine now that John does not think his misfortune was due to his own negligence nor does he think he was struck by random chance or a covering law by which everyone may expect misfortune from time to time. For some of the reasons discussed in previous sections, John thinks that he was attacked by a witch, perhaps who was jealous of his success. He may even find such an explanation compelling because it may help his case socially. This agent based interpretation changes the situation for Mark. A witch who attacks farmers out of jealousy is a terrifying threat. Even if Mark has some doubts, his error management system should lead him to err on the side of caution and take such a threat seriously. John may also come to seem less like a minor rival in this context and more like a fellow group-member, and one with whom Mark shares many attributes! In this coalitional context, John's misfortune feels like Mark's misfortune, because it lowers the strength of the group as a whole. As a fellow coalition member, Mark should be motivated to help John.

Furthermore, as there is suspicion of witchcraft, Mark may himself be suspected, either as a witch or a witch sympathizer. This is a very serious concern and one that can be more threatening than the fear of bewitchment, even when the result is "just" social isolation rather than physical punishment (Gershman, 2016; Schindler, 2010). Therefore, Mark would be further motivated to demonstrate his position in the conflict, on the side of John and against the witch/es.

Coalitional context

Such a scene could play out with many different sorts of misfortune in many different contexts. As discussed in the beginning of this chapter, illness is a particularly good candidate for a witchcraft caused misfortune, given the invisible and mysterious nature (Ashforth, 2001, 2002; Kidder, 2003; Legare & Gelman, 2008, 2009; Stadler, 2003; F. Thomas, 2007). Different cultural variation in the particular forms of accusation and reaction to witchcraft may also arise depending on the pre-existing norms of coalitional support (Boyer, In Prep). This variation in coalitional support, strength, and size, however, is most likely to be within a certain range if witchcraft beliefs are to flourish and/or be sustained.

As we saw, witchcraft beliefs are most prevalent in certain types of agrarian cultures, and much less common in hunter-gatherer or industrial, urban, or “developed” societies (Koning, 2013). Now that we have looked at cognitive elements of threat and coalition, we may better understand why this is. While the same cognitive features are shared by these groups, responses to threat should differ by the coalitional resources and costs that exist in society.

In societies where there is intensification and capitalization of agriculture, there is often a stratification of class and greater imbalance of wealth and opportunity between groups that co-exist. In such a context, coalitional thinking is more readily activated to deal with the structure of farmers against landlords, for example. Different misfortunes are emphasized and blamed on out-groups as a whole rather than on specific individuals. This could be seen in the African Great Lakes region, where advanced agriculture and social differentiation coincided with targeting collective groups, like Indian “bloodsuckers” and Tutsi “cockroaches.” Imbalances of resource and population in the context of some fear have been the background for the targeting of Jews, communists, Muslims, and immigrants (Koning, 2013). Coalitional reasoning promotes the drawing together of a group in support of themselves and against an outsider. Supernatural beliefs may then play a stronger role in defining and strengthening group than in explaining the mechanics of misfortune.

We can see then that religious cognition, threat perception, and coalitional psychology can be activated in many different ways and in different combinations, but under the right conditions they may interact in such a way that witchcraft beliefs are natural and easily become pervasive.

Recap and transition to chapters

If we return to the introductory bullet points of things to explain, we see that there is already a lot of suggestive evidence from the cognition literature.

- How do witchcraft ideas arise for the first time?
 - ✓ There is a tendency to see agents as causal forces, in general, but particularly under threat and misfortune. Agents who cause things magically may already exist in the form of ritual and magical practitioners, who are motivated by a different set of intuitions.
- Why would a person with the concept choose to share or transmit witchcraft beliefs?
 - ✓ There may be a social advantage to sharing witchcraft beliefs, where there is a low cost to transmit, but a possible high value to the receiver in terms of being safer from that danger. If the transmitter of the witchcraft ideas is also the person who suffered a misfortune that could be attributed to witchcraft, this may help recruit coalitional support or at least signals of commitment.
- Why do witchcraft ideas stick, in terms of memory and belief?
 - ✓ Witchcraft ideas are both minimally counter intuitive and threatening, and both of those attributes give a concept a boost in terms of memory. Threatening information and particularly negative information about social actors is also given a credulity advantage and those beliefs, once in place, are difficult to revise.
- Why would a bystander support the victim of supposed witchcraft, even at personal cost?
 - ✓ Witchcraft ideas can activate coalitional reasoning whereby an attack on a member of the group is felt as an attack on oneself. Under these circumstances, a bystander might support or signal support for the victim of misfortune to bolster the strength of the coalition as a whole, as well as to make it clear that the bystander is on the side of the group, and not defecting to the witches.

In the following sections, I continue to try to fill out the answers to these questions. First, in two papers, I will look at the reputational benefits of sharing threat information. I will then look at the sensitivity of source tracking when being exposed to new, truth ambiguous information. Finally, I will look more deeply at how witchcraft beliefs, as agentic explanations of misfortune, are intuitive and memorable.

Introduction to Papers 1 and 2

In the next two papers, we investigate the possible role of reputation enhancement through the spread of threat information. If it is beneficial to an individual to share information about a threat, that may help the information spread and potentially become a stable belief. It is important for individuals to be aware of potential threats in their environments so as to avoid or confront them with the best possible outcome, so information about threats is inherently valuable. If another individual shares such information, it demonstrates willingness to aid as well as demonstrates that the individual has access to threat information, which is a type of resource.

Therefore, an individual who wants social support may be motivated to spread such information. Threat information is also less likely to be tested or checked than information about resources or other approach motivators. Threats tend to be avoided and therefore go un-checked, which may make it easier for an individual to gain the reputational benefits of sharing information and demonstrating partnership, without necessarily really having privileged or special information. Note, however, that this is just one possible motivation among many that may be in conflict in some instances.

In the following two papers, we test the hypothesis that sharing threat-related information does provide a reputational or other benefit to the source. Our materials describe mild threats that participants from the United States would be familiar with, rather than the sort of threats that might be present in social transmission about witchcraft. This allows us to test the hypotheses with relatively conservative materials, so that if an effect is found, we may assume it can be easily triggered.

Paper 1: Threat-related information suggests competence: A possible factor in the spread of rumors

Pascal Boyer & Nora Parren

Abstract

Information about potential danger is a central component of many rumors, urban legends, ritual prescriptions, religious prohibitions and witchcraft crazes. We investigate a potential factor in the cultural success of such material, namely that a source of threat-related information may be intuitively judged as more competent than a source that does not convey such information. In five studies, we asked participants to judge which of two sources of information, only one of which conveyed threat-related information, was more knowledgeable. Results suggest that mention of potential danger makes a source appear more competent than others, that the effect is not due to a general negativity bias, and that it concerns competence rather than a more generally positive evaluation of the source.

Introduction

Information about potential danger is a central element in many rumors (G. W. Allport & L. J. Postman, 1947; Difonzo & Bordia, 2007), and urban legends (Cotter, 2008; Eriksson & Coultas, 2014; Stubbersfield, Tehrani, & Flynn, 2014), but also of ritual prescriptions (Lienard & Boyer, 2006), religious prohibitions (Douglas, 1966) or witchcraft crazes (Bonhomme, 2012; K. Thomas, 1997). Some of this cultural information has important social consequences, as for instance in witchcraft accusations but also in rumors about the alleged dangers of vaccination or medication (Bogart, Wagner, Galvan, & Banks, 2010; Salathé & Bonhoeffer, 2008). This cultural spread begs the question of the individual processes whereby people attend to such information, but also find it compelling and relevant. Here we investigate one possible component of this prevalence of threat-related information, namely that all else being equal, a source of threat-related information may be intuitively judged as more competent than a source that does not convey such information, thereby increasing the motivation to transmit the negative message information.

There are of course a number of ways that a source of information or a potential partner could signal competence. So why focus on threat-information? Our conjecture is grounded in very general features of the psychology of threat-detection and precaution. While fear-systems guide responses to imminent danger, we also have dedicated systems to orient behaviors towards potential threats (Woody & Szechtman, 2011b). The activation of such systems may explain why humans are generally more attentive, all else being equal, to potential danger than potential benefits, a tendency variously described as a “negativity bias” (Peeters & Czapinski, 1990; Pratto & John, 1991; P. Rozin

& E. Royzman, 2001) following which “bad is stronger than good” (Roy F. Baumeister, Ellen Bratslavsky, Catrin Finkenauer, & Kathleen D. Vohs, 2001). Several recent studies have demonstrated a specific consequence of this very general bias, namely that people seem to judge negatively framed pieces of information, (e.g. “5% of heart-attacks are lethal”) as more plausible than positively framed, identical information (e.g. “95% of heart-attack are not lethal”) (D. M. T. Fessler, A. Pisor, & C. D. Navarrete, 2014; Hilbig, 2009, 2012).

In the studies presented here, we asked participants to judge which of two sources of information about various topics seemed more authoritative about various familiar situations. The only difference between the pieces of information conveyed by these two sources lay in the presence or absence of threat-related information, operationalized in these studies as the mention of potential danger.

Ethics Statement

All studies were examined and approved by Le Comite de Protection des Personnes SUD-EST IV at the University of Lyon. Following the protocol approved by this committee, participants first read a description of the study procedures, about any risks or discomforts, confidentiality measures, and were provided with the contact information for the primary investigator in order to ask any questions. Compensation was described during advertising, which the participants were then reminded of. Consent was written, but anonymous, as consent would have been the only point at which personal identity would have been revealed. Participants marked either “yes” or “no” in response to the statement “I have read and understood the above consent form and desire of my own free will to participate in this study.” Participants could not continue to the rest of the study unless they had indicated “yes”. Record of consent was stored with the rest of the participant data.

Data Archiving

Data for all studies described in this paper are archived at figshare.

<http://dx.doi.org/10.6084/m9.figshare.1248900>

Materials pre-test

We wrote six sets of texts ostensibly authored by employees of various businesses to describe one of their new products. We used familiar concepts in order to effectively explore our cognitive hypothesis, providing plausible sets of information rather than more dramatic or outlandish claims in some urban legends and conspiracy theories, which many participants would reject out of hand in a study context. The products described were (1) a guided trek in the Amazon, (2) a data-base computer program, (3) a cooking recipe, (4) a washing machine, (5) baby diapers and (6) a seaside

resort. To calibrate the different sets of stimuli used in the studies, we ran a pre-test with 55 US resident participants recruited via the Amazon m-Turk website, to rate key sentences from these texts.

For each product described, we created three versions that differed only in one key sentence, describing a potential danger (threat-related information or TRI); a negative feature of the product (NEG); or a neutral feature (NEU). For example, the participants saw the following (TRI) text displayed on the screen: “This was taken from the instructions for use manual, for installing a program on a personal computer: ‘If you press control keys during installation, the software may damage your hard disk.’”

For each such statement, we asked participants to provide 1-7 Likert-scale ratings as answers to the following questions: [a] “How useful is this statement?”, [b] “Is it negative in tone?”, [c] “Does it describe a potential danger?”, [d] “Is it written in good English?” and [e] “Does it describe some advantage of the product?”

We focused on the ratings in terms of “negative tone” and “describes potential danger”. Given the hypothesis that mention of threat-information would trigger specific intuitions of competence, we needed to check that TRI items were indeed interpreted as “describing danger”, more so than other (NEG or NEU) items. Also, we tested the extent to which our NEG items were indeed perceived as “negative in tone”, more so than NEU items. We also expected that TRI and NEG items would be judged equally “negative in tone”.

Figure 1 and Figure 2 summarize the results, for the “includes danger” and “negative in tone” questions.

For the “includes danger” question, TRI items in all stories were rated higher than NEU items in all text-sets. Planned comparisons confirmed that the effect was significant for all text-sets, all $p < .001$ (two-tailed). The results were mixed as regards the difference between TRI and NEG items. In four of our situations (trekking, computer, cooking, washer), the TRI items were much higher in “danger” than the NEG items. For two other stories (baby diapers and seaside resort), the difference was much smaller, as NEG items were rated relatively high in terms of “including danger”. To measure this apparent discrepancy, we evaluated the effect-sizes (Cohen’s d) for the difference between TRI and NEG items, in terms of “danger”, in all stories. These measures, reported on S1 Fig, confirm that the distinctiveness of our TRI items is higher in the first four stories than in the last

two. There were no significant differences (all $p > .2$) between stories in usefulness and good English (high ratings for all items).

S1 Fig. Pre-test. For each story, ratings of TRI (threat), NEU (neutral) and NEG (negative) sentences, in terms of “mentions danger”. Brackets include effect-size (Cohen’s d) for the comparison between TRI and NEG items.

For the “negative tone” question, the ratings were consistent with the prediction, that both NEG and TRI sentences would be rated higher than the NEU sentences (see S2 Fig). Planned comparisons confirmed that the effect was significant for all text-sets, all $p < .001$ (two-tailed).

S2 Fig. Pre-test. For each text-set, ratings of TRI (threat), NEU (neutral) and NEG (negative) sentences, in terms of “negative tone”.

Study 1

In this study, participants were asked to read and compare descriptions of three distinct products (a trekking trip, a computer program, and a cooking recipe) ostensibly provided by two different sources for each topic. The contents of the descriptions were essentially identical, save for the inclusion of threat-related content in the key version, replaced with neutral content in the control version. After reading each pair of descriptions, participants had to choose which of the authors seemed more competent.

Methods

Participants

We recruited 166 US resident participants using the Amazon M-Turk website. There were 58 women. Ages ranged 18 to 70, $M=30.5$, $SD=9.41$. Among these 37 participants self-identified as members of an ethnic minority, and 129 as White.

Materials

We used the first three text-sets mentioned above, concerning (a) what to expect during a trek through the Amazon in the company of specialized guides; (b) how to install a program on a personal computer; (c) how to prepare and cook a stew of wildebeest meat (see complete texts in Appendix A). The key difference between the two texts, in each set, consisted in a single sentence

that provided either threat-related information or neutral information, as indicated in Table 1. The rest of the texts were essentially similar, as each piece of non-key information (e.g. “this computer program will take up 100MB of your disk”) was presented in all three versions in slightly different formulations (e.g. “you will need 100MB of free space on your disk for this program”), and in a different order.

Design and procedure

There were three trials, one for each of the situations: Trekking, Computer, Cooking. At each trial, participants were shown the two versions of the story (Threat and Neutral respectively), in parallel on the computer screen. After reading the two parallel versions of an explanation, participants had to answer the question, “Which of these two persons do you think is more competent, concerning the trek [/program installation/cooking recipe]?” The cover story – judging people’s presentations of a commercial product, in a competitive situation – made it natural to compare very similar versions. So the method provides an ecologically valid measure to assess the unique contribution of the key items to people’s judgments of competence. Each question was a three-alternative forced-choice item, with the two names of the different sources and “Don’t Know” as possible choices. The order of trials and side of the monitor for displaying the key and control versions, were counter-balanced across subjects. For each set of two texts, we counterbalanced which version of the text included the TRI item vs. the NEU item. After completing the three trials and answering demographic questions, participants were debriefed about the goals of the study.

Results and discussion

Overall completion time was $M=180s$ ($SD=85$), but a number of participants had completed the task in less than 80s, which suggested negligence. To establish a sensible cut-off point, we considered the average silent reading time for English text, that is estimated at roughly 200-400 words per minute and about 30% less for full comprehension (Wallot, O’Brien, Haussmann, Kloos, & Lyby, 2014; J. L. Williams et al., 2011). Each of the text-sets used here comprised about ~250 words. So it would take the participants 122s to read all three texts-sets at the fast reading rate of 400w/m, without any time left for pondering each of the questions. This led us to exclude the results from all participants whose total completion task was under 120s, a very conservative criterion. This left 111 participants, 31 women, 23 members of minorities, ages ranging from 18 to 63, $M=30.5$, $SD=9.4$.

We computed two dependent variables. One was the number of participants choosing the Threat or Neutral sources as more competent, or the Don't Know option. The second DV was a score, for each participant, of the number of choices of the Threat source over all three trials, between 0 and 3.

Table 2 summarizes the numbers of participants making the different choices. For all three text-sets, the proportion of participants choosing the TRI (threat-related) source was above chance, binomial test with a $\frac{1}{3}$ chance of success (i.e. of choosing the TRI source), $p < .001$.

Using the combined responses as a continuous DV out of a maximum score of 3, overall mean was $M = 1.973$, $SD = .995$, 95% CI [1.79, 2.16], which was significantly above a chance level of 1 in a one-group t-test, $t(110) = 5.01$, $p < .001$ (two-tailed). There were no significant effects of age, sex or ethnicity, all $ps > .35$.

Results suggest that participants intuitively associate the mention of potential threats with relatively higher competence, regarding a particular field of action, compared with non-threat-related information. In study 2 we attempted to replicate this result, using a slightly different formulation to gauge this association.

Study 2

The results of study 1 were interpreted as supporting the hypothesis, that participants intuitively construe the communication of threat-related information as an index of competence. However, a “negativity bias” (see introduction) could make the text including threat-related information more salient than neutral text, therefore creating a response bias. To check this, we ran a replication of study 1, replacing neutral content with clearly negative content. The two versions of the stories were now of the same valence, except that one included threat-related negative information.

Methods

Participants

We recruited 167 US residents from the Amazon M-Turk website, ages 18 to 76 ($M = 32.8$, $SD = 8.5$), 70 women, 125 self-identified as “White” and 42 as other ethnicities.

Materials

These were identical to materials in Study 1, except for the substitution of negative statements for the neutral statements used previously in control items. Instead of the NEU sentences of our pre-test (see Materials pre-test), we used NEG sentences that had rated at pre-test as significantly more “negative in tone” than the neutral ones. Table 3 lists the critical items for each text-set.

Design and procedure

Identical to Study 1.

Results and discussion

Using the same criteria as in Study 1, we excluded the data from participants whose completion time was under 120s. This left 129 participants, ages 18 to 76 ($M= 30.2$, $SD= 11.4$), 37 women, 19 minorities.

The proportions of participants' choices are summarized in Table 4. For all three stories, the proportion of participants choosing the threat-related source was significantly above chance, binomial test with a $\frac{1}{3}$ chance of success (i.e. of choosing the threat-related source), all $ps < .001$.

Using the combined responses as a continuous DV out of 3, the overall score was $M=2.047$, $SD=.995$, 95% CI [2.042, 2.051], different from the chance level of 1, $t(128)=7.59$, $p < .001$ (two-tailed). There were no significant effects of age, sex or ethnicity, all $ps > .40$.

This suggests that the preference for threat-related information in study 1 was not caused by the difference in valence between threat-related and neutral content.

Study 3

To check that the association between threat-information and competence in studies 1-2 really stemmed from the potential danger contained in our critical items, we replicated study 1, using a new set of texts, this time concerning (a) a seaside resort, (b) a new kind of baby diapers and (c) a new washing machine. These texts had, as in the previous studies, been pre-tested for potential danger and negativity. Only one of these new sets of texts, about the washing machine, showed a significant difference in ratings between Negative and Threat items at pre-test (as described above). We predicted that participants would choose the threat-source in that particular situation, due to the perceivable difference in danger, but not in the other ones, due to the absence of perceivable danger.

Methods

Participants

We recruited 175 US residents using the Amazon M-Turk website, ages 18 to 68 ($M=34.3$ $SD=12.5$), 101 women and 74 men, 127 self-identified as "White" and 48 as minority ethnicities.

Materials

We used three text-sets mentioned in Pre-test section, concerning (a) a seaside resort, (b) a new kind of baby diapers and (c) a new washing machine. Table 5 summarizes the critical differences between these text-sets.

Design and procedure

Identical to Study 1

Results

As in previous studies, we excluded data from participants whose completion time was under 120 s. This left 128 participants, ages 18 to 68, ($M = 37$, $SD = 12.6$), 75 women, 35 minorities.

The participants' choices of sources are reported in Table 6 below. The pattern of choices was different for the seaside and diaper stories, on the one hand, and the washer story on the other. For the latter story, more participants chose the threat-source as more competent, a significant difference binomial test with $\frac{1}{3}$ success rate, $p < .001$. The association was not significant for the other two stories, both $p > .8$ for the binomial test. The difference between the stories was statistically significant, $\chi^2(2) = 16.1$, $p < .001$.

These results would suggest that the association between threat-information and competence in studies 1-2 was indeed driven by the mention of potential danger in the threat-source versions of the different texts. For two text-sets, both versions (NEG and TRI) were identified at pre-test as relatively close in "potential danger" ratings. This resulted in chance performance when choosing for the more competent source. By contrast, there was a clear choice of the threat-source when considering the one text-set for which there was a greater difference in "danger" rating between the two versions at pre-test.

Study 4

In studies 1-3, the source providing threat-related information was consistently judged more competent than the source that did not provide such information. This could support the notion that threat-information is intuitively seen as an index of competence, reliability, etc. However, a slightly different interpretation is possible, in which the effect is driven by a negative estimation of the non-threat source. Specifically, since the participant is informed (by one of the sources) of a potential threat (e.g. the leeches in the forest or the computer freeze), he or she may form the impression that the other source, which did not mention that threat, was negligent or irresponsible.

To test this hypothesis, we used two of our pre-tested text-sets in a modified protocol, in which participants read the threat and non-threat versions of the story sequentially, and provided a Likert scale estimate of how helpful the information was after reading each version. For one text-set, threat came before non-threat information and vice-versa for the other. Our reasoning was that, if the threat-source was seen as intrinsically more valuable than the neutral source, the rating of threat-source would be much higher when threat-information came in second position (after the participant had read a neutral version) than if it came in first position (in which case participants could not detect the threat-information as a distinctive feature). By contrast, if negligence in the neutral source drove the effects observed so far, we should observe a large drop in ratings between neutral source in first position (probably judged useful, with no comparative basis for judgment) and neutral source in the second position (judged negligent, as it fails to mention a danger that the participant now knows about). Obviously, the design allows for both processes to occur simultaneously.

Methods

Participants

We recruited 105 US residents using the Amazon M-Turk website, ages 19 to 73 ($M=33.6$, $SD=12$), 38 women and 67 men, 86 self-identified as “White” and 19 as minority ethnicities.

Materials

We used the “trekking” and “computer program” texts of study 2, followed by the question: “How useful do you think this description was?” instead of the forced-choice of study 1.

Design and procedure

Participants were instructed in the same way as in previous studies. For each situation, they first read the text introducing the situation, then one of the descriptions (either threat-information or non-threat), followed by a prompt for their estimate of usefulness, using a 1-7 Likert scale. They then read the alternative description (non-threat or threat) of the same situation, followed by the same prompt. This was repeated twice. The threat/non-threat order, and the order of stories, were counter-balanced across participants.

Results and discussion

We excluded data from participants with completion rate under 120s. This left 69 participants, ages 19 to 73 ($M= 36.4$, $SD= 13.6$), 26 women and 15 members of ethnic minorities.

Average ratings for the two sources are illustrated in Figure 3.

A repeated measure ANOVA showed a significant main effect of information type (threat vs. neutral), $F_{1,68}=22.2$, $p<.001$, partial $\eta^2=.25$; no significant main effect of serial position (first vs. second text), $F_{1,68}<1$; a significant information type * serial position interaction, $F_{1,68}=14.3$, $p<.001$, partial $\eta^2=.17$. There was no significant effect of sex, $F_{1,68}=1.1$, $p=.35$; a trend to an effect of ethnicity, $F_{1,68}=3.1$, $p=.09$; no effect of age, $p=.30$, and no further interactions.

Planned comparisons showed a significant difference between ratings of threat-first and threat-second texts, $t(68)=3.25$, $p=.002$, 95% CI [.21, .88]; for neutral first compared to neutral second texts, there was a trend to a significant difference above the conventional α , $t(68)=1.89$, $p=.062$, 95% CI [.02, .68]. Confirming this, the effect-sizes for these two tests are different, Cohen's $d_z=.49$ for the threat-items (between 1st and 2nd presentations), and $d_z=.28$ for neutral items (again between 1st and 2nd presentations).

These results suggest, first, that the competence impression observed in studies 1-3 is a contrastive effect that obtains when participants are confronted with otherwise highly similar threat-including and non-threat-including sources on the same topic. In this study, due to the sequential presentation of the sources, we could measure whether threat- would be rated higher than non-threat information, independently of this contrast. But that was not the case, as the initial ratings for threat and non-threat sources ($M=5.4$ and $M=5.5$ respectively) were not different. Results also suggest that this contrastive effect may be driven both by a devaluation of the neutral source and by a higher evaluation of the threat source. If the neutral source was devalued as negligent after hearing of potential threats, the ratings for the neutral source in second position should be significantly lower than they are for neutral source in first position – as the information from that second neutral source would be judged as clearly insufficient. We observed a trend in that direction. By contrast, if the threat source is seen as more informative than the neutral source, we should expect it to be rated significantly higher when it can be contrasted to a neutral source, which is only possible when it is read as the second text. We should therefore expect a significantly higher rating of the threat source as second text, compared to the threat source as first text, which is what we observed.

Study 5

Results of studies 1-4 suggest that sources conveying threat-related information are judged competent in contrast to other sources. We hypothesized that this may contribute to the cultural spread of threat-related information. But this effect may be due, not just to a specific effect on

competence, but to an overall positive impression provided by the communication of threat-information. To judge whether the contrastive effects observed so far are driven by a specific intuition of competence, we replicated study 1 with a set of different questions, asking participants, not just about competence, but also about perceived honesty and pleasantness of the sources. If threat-information suggests competence in a narrow way, then it should have no positive effect on pleasantness – in fact the opposite should be expected, as the information in question is unpleasant and may contaminate the source. There should be no effect on honesty, as neither threat- nor neutral-information provides cues for deception or dishonesty.

Methods

Participants

We recruited 106 US residents using the Amazon M-Turk website, ages 19 to 65 ($M=35.5$ $SD=12.2$), 56 women and 50 men, 73 self-identified as “White” and 35 as minority ethnicities.

Materials

Texts identical to Study 1.

Design and procedure

Identical to Study 1, except that each pair of side-by-side texts was followed by three questions: [a] which of these do you think is more competent? [b] which of these do you think is more honest? And [c] which of these do you think is more pleasant as a person? Each question was a three-alternative forced-choice, with the two sources and “don’t know” as possible choices.

Results

We excluded participants whose completion time was under the minimum reading time. This left 68 participants, ages 19 to 65, $M=38.6$, $SD=13.3$, comprising 39 women and 19 members of ethnic minorities.

As in previous studies, we computed both the numbers of participants making each choice in each situation, and a combined score with the number of times they selected the threat-source over three trials.

Choices are summarized in Figure 4, showing that participants tended to choose the threat-source as more “competent” than the others, that the scores for “honest” were closer to chance for cooking and program but favored the threat source for trekking; participants did not choose the threat-source as the “pleasant” one. Results significantly different from chance, on a binomial test with $\frac{1}{3}$ as $p(\text{success})$, are marked ** on the chart.

The combined score was computed by adding all the trials in which the participant had chosen the threat-source over the other sources. Different one-group t-tests compared the means for the different criteria (competent, honest, pleasant) with a chance level of 1.5, as in previous studies. The results show significant deviations from chance for both “competent” and “pleasant”, but a chance result for “honest”. One-group t-test results with $p < .001$ (two-tailed) are marked *** on Figure 5. There was no effect of sex or ethnicity, both $p > .10$, or correlation between age and responses, $p > .20$.

These results replicate the finding of studies 1-4, as the communication of threat information is associated with competence, when compared with sources that do not communicate such information. They also reflect that this effect is driven by a specific intuition of competence, not by a general “positive glow” associated with the particular source. Participants were at chance or favorable to the threat-source when judging honesty – the choice of the threat-source would make sense in a commercial context, where customers appreciate to be warned of potential problems with the product. Participants generally judged the threat-conveying source as less pleasant than the others, probably as an effect of the negative information contaminating the source.

General discussion

Humans rely on other humans for information, coordinated activities, to help avoid dangers, and to confront threats when they appear. This reliance also comes with risks, such as acting on the basis of incorrect information, and selecting incompetent partners. A large body of research examines how characteristics such as authority, physical attractiveness, and markers of in-group coalition influence the believability of what that person communicates (Kumkale, Albarracín, & Seignourel, 2010). The current research expands on these ideas to examine the possible role of the content of the information in an interaction, and how this information leads the target to make judgments about the competence of the information source.

There is good evidence to support the notion that due to error management, people are likely to believe threat related information. Congruent with these results, the present studies support the idea that sources of threat related information are viewed as more competent and useful. This competence effect may feed back into the transmission of cultural information. By taking sources of information about hazards more seriously than others, listeners would also contribute to the cultural spread of threat- and precaution-related information. Though this series of studies relied on a North American population, we predict that the same pattern would be found in diverse

cultural environments, given the centrality of threat to cognitive processing and the importance of good sources of information in the evolutionary context, though this remains to be tested.

Studies 1-5 demonstrated a clear pattern whereby a source of threat-related information was judged more competent than a source of equivalent information with no mention of potential danger. Successive replications showed that the effect (a) occurred with materials describing very different products and situations, (b) that it was not driven by the negative valence of threat information (studies 2, 3), (c) that it is at least partially driven by a positive evaluation of the threat-source (study 4), and (d) that it is specifically about competence rather than being grounded in an overall positive “glow” around the threat source (study 5). Study 4 also confirmed (e) that the competence impression occurs in the context of a contrast between the two sources. These results support the notion that the transmission of threat-related information can improve the perception of the source as competent and therefore a potentially useful partner. Future studies should investigate the longevity and the generality of the effect.

Obviously, the dangerous features described in our stories may seem trivial compared to the usual subject-matter of many cultural rumors (murders, penis-snatching, poisoning wells and kidnapping children). We conjecture that the competence effect observed here may prove just as strong or stronger when the threat described is more serious, although this of course requires that the rumor is held to be true. Only naturalistic studies could validate that conjecture.

In a speculative manner, the present results may allow us to put forward an interpretation of the cultural success of threat-related material that is more specific than a simple “negative bias”. First, it seems that the ecology of human evolution comprised many potential dangers, against which organisms had fewer defenses than their predecessors (Woody & Szechtman, 2011b). For instance, evolving a generalist diet resulted in an increased vulnerability to pathogens; depending on cooperation for survival made humans vulnerable to status loss. Second, human defenses against such threats consist for a large part in socially transmitted information, in other agents pointing to hazards and providing precautionary information (Tooby & DeVore, 1987). Third, human communication allows for useful information transfer but also for deception as well as straightforward nonsense (Sperber et al., 2010). Having in one’s social environment some sources of information about potential danger would be precious, and one would be motivated to weigh such information above the rest, and to value the sources accordingly – a valuation that would be reflected in specific judgments of “competence” expressed by the participants in our studies. This competence effect may feed back into the transmission of cultural information. Furthermore, we

may speculatively suggest that information about potential danger does not invite testing, so sources of incorrect threat related information may retain their reputational advantage. By taking sources of information about hazards more seriously than others, listeners would also contribute to the cultural spread of threat- and precaution-related information.

Paper 2: Preference for Sources of Threat-Related Information

Nora Parren & Pascal Boyer

(This article was prepared for submission at PlosOne)

Abstract

Humans are particularly sensitive to potential threats in their environment. We predicted that as a consequence, individuals who choose to share information about potential dangers would be seen as useful partners. In four studies, we found support for this hypothesis. In study 1, we found that participants considered the source of threat related information to be more concerned about their welfare, compared to sources of neutral information. In study 2, participants indicated that they would prefer to get help from a person who provided them information about a threat compared to a person who provided neutral information. In study 3, participants indicated that they would prefer to get help from a source of threat information compared to a person who provided non-threatening negative information. Study 4 found that participants chose to reward sources of threat information above sources of neutral information.

Introduction

Survival requires that organisms pay special attention not just to direct threats in their environment, but also to potential sources of danger. Humans extract most of their information about potential danger from communication with conspecifics. Indeed, many typical fears among humans are based on vicarious experience (Boyer & Bergstrom, 2011; Poulton, Davies, Menzies, Langley, & Silva, 1998; Rachman, 1991). As threat-related information is a useful resource, we would expect that people favor those who communicate about potential threats, and would prefer them to others as partners, other factors being equal. In the four studies reported here we tested this hypothesis.

Our previous work showed that people may consider sources of threat-related information to be more competent than others, and that this effect is not driven by mere attention to negative information (Boyer & Parren, 2015). Here, we extend our research to see if threat-relevant information also makes the source desirable as a partner for interaction. Do people prefer to interact with sources of threat-related information rather than sources of other kinds of information, all else being equal?

These studies are motivated by three sets of findings:

a) Humans are generally more attentive to potential danger than to potential benefits (Peeters & Czapinski, 1990; Pratto & John, 1991; P. Rozin & E. B. Royzman, 2001; Woody & Szechtman, 2011a). Across many psychological domains, “bad is stronger than good” (Roy F. Baumeister, et al., 2001), and people give more credence to negatively framed information than to positively framed information, even when logically equivalent (D. M. T. Fessler, et al., 2014; Hilbig, 2009, 2012). This makes evolutionary sense as the application of error-management heuristics, in conditions where false-alarms are less costly than misses (Haselton & Buss, 2000).

b) We know that source identity and quality are essential ingredients in our evaluation of communication. Our beliefs can be controlled in part by our memory for source information. It matters whether the source of a “fact” is the National Enquirer or Consumer Reports, as that is essential in determining the use and worth of the recalled information. Source memory is also essential for making social decisions, as in “Was it Paul or Jason who made the racist comment?” (Sherman & Bessenoff, 1999). Such information can be recalled through either systematic, effortful processes and/or by fast heuristics processes. Heuristic cues include perceived expertise of the

source, likability of the source, stereotypes about the source, as well as consensus information (Chaiken, Liberman, & Eagly, 1989; Sherman & Bessenoff, 1999).

c) We know that people engage in partner evaluation. Indeed, a foundation of models of human cooperation is that people track which benefits may come from interaction with different individuals (André & Baumard, 2011, 2012; Barclay, 2016). Particularly important in partner evaluation are cues of ability to confer benefits and cues of willingness to confer benefits (Barclay, 2016; Bliege Bird & Power, 2015; Nelissen & Meijers, 2011). Transmission of threat-related information is a potential cue of both. Such information can be a valuable resource, saving the recipient from potentially costly experimentation. The source demonstrates that she has the ability to obtain this sort of resource as well as the willingness to share it. The recipient, in order to retain this good partner, may be motivated to extend benefits back to the source of threat-related information.

Given the importance and salience of threat related information described above, we hypothesize that a partner who can provide information about threats would be considered particularly valuable, especially in a partner market where one partner option fails to provide that information. The studies reported here test this conjecture.

Ethics Statement

All studies were examined and approved by Le Comité de Protection des Personnes SUD-EST IV at the University of Lyon. Following the protocol approved by this committee, participants first read a description of the study procedures, about any risks or discomforts, confidentiality measures, and were provided with the contact information for the primary investigator in order to ask any questions. Compensation was described during advertising, which the participants were then reminded of. Consent was written, but anonymous, as consent would have been the only point at which personal identity would have been revealed. Participants marked either “yes” or “no” in response to the statement “I have read and understood the above consent form and desire of my own free will to participate in this study.” Participants could not continue to the rest of the study unless they had indicated “yes”. Record of consent was stored with the rest of the participant data.

Data Archiving

Data for all studies described in this paper are archived at figshare
<https://dx.doi.org/10.6084/m9.figshare.3407629.v1>

Pre-test of materials

The studies in this paper make use of materials that have been used and reported on in our previous work (Boyer & Parren, 2015) as well as new materials. All materials may be found in Appendix A. In two waves, we pre-tested texts that describe a business's product. In the first wave, pre-tests examined sets of 3 different texts that contained the same information, except for one crucial sentence. In the second wave, the crucial sentences were rated independently of the overall texts. In all cases, one text included information about a potential danger (threat-related information or TRI), another described a negative aspect of the product (NEG), while a final text included information about a neutral aspect (NEU). For instance, one of the new sets of texts describes a ride at an amusement park. The TRI text included the sentence, "As internal organs move during such a ride, it not advised for visitors with heart conditions or a history of epilepsy."

For each statement, participants were asked to rate the items on a 1-7 scale in terms of a) "How useful is this statement?" b) "Is it negative in tone?" c) "Does it describe a potential danger?" d) "Is it written in good English?" and e) "Does it describe some advantage of the product?"

All participants were recruited from the Amazon Mechanical Turk website (N=55 and N=63, respectively). We were particularly interested to ensure that the TRI items were seen as including danger, compared to the NEG and NEU items, while TRI and NEG items should be similar in terms of negative tone, especially compared to the NEU items (Boyer & Parren, 2015). For the text sets selected to be used below, the TRI items were rated as significantly higher in danger than NEU and NEG items (planned comparisons, all $ps < .001$, two tailed). The TRI and NEG items were also rated as higher in negative tone than the NEU items. Again, planned comparisons confirmed that the effect was significant in each case, $ps < .001$ (two-tailed).

Study 1

In order to investigate the possible influence of TRI on partner choice, participants were presented with two distinct sources of information, for each of three distinct topics (a trip in the Amazon, installing a computer program, and a recipe for soup). They were asked to judge, for each of the topics, which of the two sources had more of an interest in their welfare. The two texts about each topic were essentially the same, with the exception that one included threat related content while in the other, that threat information was replaced with neutral content.

Methods

Participants

We recruited 106 US residents were recruited using the Amazon M-Turk website. There were 47 women and 59 men. Ages ranged from 18 to 65, $M=32$, $SD=11$. Among the participants, 82 self-identified as White and 24 as other ethnicities.

Materials

We used 3 pre-tested text-sets that were used in previous research (Boyer & Parren, 2015). For each topic, participants read two different descriptions, proffered by two different sources. For example, one text-set described a guided trek in the Amazon. Two different guides describe the trip with the same information, except for that the threat source includes the sentence, “There are leeches that cling to your feet and can give you very serious deep burns. But if you wear high rubber boots you will be fine”, while the neutral source instead includes the sentence “There are many species of colorful birds and flowers so you will have lots of opportunities for great pictures!” The complete texts can be found in Appendix A.

Design and procedure

Participants were shown one set of two texts and then asked the corresponding question, before moving on to the next set. The questions were as follows:

Trekking: Which of these two guides do you think is more attentive to the needs of the travelers?

Computer program: Which of these two computer programmers do you think is more interested in helping his customers?

Cooking: Which of these two cooks do you think is more motivated to help people with this recipe?

Each question was a three-alternative forced-choice item, with the two names of the different sources and “Don’t Know” as possible choices. The order of trials and side of the monitor for displaying the key and control versions, were counter-balanced across subjects. For each set of two texts, we counterbalanced which version of the text included the TRI item vs. the NEU item. After completing the three trials and answering demographic questions, participants were debriefed about the goals of the study.

Results

Participants were dropped if their completion time was less than 120s, as the average silent reading time for English text is 200-400 words per minute and about 30% less for full comprehension. If participants were reading at the high end (400w/m) it would take them about 122s to read all three text-sets (~250 words each), without any time left to consider the questions. This left 76 participants, ages 18 to 65, ($M=33.6$, $SD=11.0$), 38 women, 62 self-identified as “White”.

Results are summarized in Figure 6.

We gave each participant a score between 0 and 3 for the number of times they chose the threat source as more interested in their welfare over all three trials. This number can be compared to a chance level of one out of three, given that there were 3 answer options (the two sources and “don’t know”). However, given that there were so few “Don’t Know” responses, we chose to be conservative and treat it as a two-alternative forced-choice protocol and compared the participants’ summed TRI choices to a chance result of 1.5. The .75 difference between this chance level of 1.5 and the observed mean of 2.25, was significantly above chance in a one-group t-test, $t(75, \text{two-tailed})=8.17$, $p<.001$, 95% CI [.57, .93].

Results suggest that participants see sources of threat-related information as a better partner with a higher investment in their audience’s welfare.

Study 2

In this study, participants were presented with the same information as in study 1, but this time were asked which source they would choose to help them. Again, the descriptions for each topic were essentially the same, with the exception that in one version, threat related content was shared, while in the other, the threat information was replaced with neutral content.

Methods

Participants

We recruited 103 US residents using the Amazon M-Turk website. There were 65 men and 38 women. Ages ranged from 19 to 80, $M=33.18$, $SD=11$. Among the participants, 83 self-identified as White, and 20 as other ethnicities.

Materials

The materials were the same as in study 1, except for the final question about each set of texts was different.

Design and procedure

The procedure was the same as in study 1, except for that after reading both of the descriptions, participants had to answer the question, “Which of these two persons would you choose as your guide when you visit the Amazon [/to help you install the program/ to help you prepare the stew]?” Each question was a three-alternative forced-choice item, with the two names and a “Don’t know” option. Participants were given a maximum of 30s to answer the questions. After completing the three trials and answering demographic questions, participants were debriefed about the goals of the study.

Results

As in study 1, participants were dropped if their completion time was less than 120s. This conservative cut-off point left 75 participants, aged 19 to 80, $M=33.7$, $SD=11.5$, of whom 29 were women, and 60 self-identified as White.

We gave each participant a score for the number of times they chose the threat source to help them over all three trials, giving them a score between 0 and 3. Results are summarized in Figure 7.

Using the combined responses as a continuous DV, overall mean was 2.09 ($SD= .8$) out of a maximum score of 3. Again using the conservative criterion described in Study 1, Results, we compared the subjects’ scores to a chance level of 1.5 (i.e. a $\frac{1}{2}$ probability in three trials). A one-group t-test showed that the .513 difference between this chance level of 1.5 and the mean of 2.09, was significantly above chance, $t(74, \text{two-tailed})=5.58$, $p<.001$, 95% CIs [.33, .70]. There were no significant effects of age, sex, or ethnicity, all $ps>.49$.

Results suggest that participants preferred the source of threat-related information as a source of future help, compared with sources who did not share threat-related information.

Study 3

In this study, we followed a protocol similar to Study 2, though with new materials and comparing threat related information to negative information rather than neutral information, in the same way as in our previous studies (Boyer & Parren, 2015), to check that the effects of threat-related information was indeed associated with the threat-content, rather than with the negative valence of such information. Here both texts contained negative information, though one was related to potential threats.

Methods

Participants

We recruited 104 US residents from the Amazon M-Turk website, ages ranging from 19 to 76, ($M=37.3$, $SD=12.4$), 50 women and 54 men, 87 self-identified as White and 27 as other ethnicities.

Materials

The stories in this study described a new drug, a roller-coaster, and a washing machine. The descriptions were purported to have been written by people working in the development or use of the products. The complete texts can be found in the Appendix A.

Design and procedure

The design was the same as in the previous study. Below the two texts, the participants are prompted with the question: “which of these two specialists would you choose to advise you about [kind of product]?”

Results

As in the previous study, we excluded participants whose completion time was less than 120s. This left 71 participants, ages 20 to 76, ($M=39.7$, $SD=13.3$), 35 women, 60 self-identified as “White”.

The results are summarized in Figure 8.

Using the combined responses as a continuous DV, overall mean was 1.86 out of a maximum score of 3. We compared the subjects’ scores to our conservative criterion, a chance level of 1.5 (i.e. a ½ probability in three trials) even though participants had three choices. A one-group t-test showed that the .36 difference between this chance level of 1.5 and the mean of 2.09, was significantly above chance, $t(70, \text{two-tailed})=3.56$, $p<.01$, 95% CIs [.16, .56]. There were no significant effects of age, sex, or ethnicity, all $ps>.38$.

Results suggest that as in the previous study, participants prefer to be helped by a source who provided threat-related information compared with a source who provided just negative information.

Study 4

To extend the results of studies 1 -3, we tried to test whether participants would be motivated to allocate some resources to a source of threat-related information, more so than to a neutral source.

We presented the same stories as in studies 1 and 2, but we ask which of the two authors should be chosen for the firm's promotion and receive a \$100 bonus.

Methods

Participants

We recruited 122 participants from the Amazon m-Turk™ website, ages ranging from 18 to 65 ($M=35.7$, $SD=11.8$), among whom 63 were women, and 102 participants self-identified as "White".

Materials

The materials were the same as in study 2, though the question asked about the text-sets was different.

Design and procedure

The design for this study is within subjects (as before, with each story set containing a TRI source and a NEU information source). The trial structure is the same as in previous studies, with a change in the question. In this study, the question reads: "The company has to choose one of these texts, to use for its publicity materials. The author of the text that's chosen will receive a \$100 bonus. Which author do you think did a better job?"

Results

As in previous studies, we excluded data from participants whose completion time was under 120s. This left 94 participants, ages ranging from 18 to 65 ($M=36.1$, $SD=12$), among whom 52 women, and 76 participants self-identified as "White".

The results are summarized in Figure 9.

Using the combined responses as a continuous DV, overall mean was 1.83 ($SD=.935$) out of a possible 3. The .33 difference between the chance level of 1.5 and the mean of 1.83, was significantly above chance, $t(93, \text{two-tailed})= 3.42$, $p=.001$, 95% CI [.14, .52].

These results suggest that in addition to regarding sources of threat related information a better choice of partner, participants also see them as deserving of reciprocation, in the form of having their work chosen and getting a bonus. However, note that the scores were noticeably lower than in previous studies, and that for one of the stories (computer program), there was no effect of the threat- vs. neutral-information manipulation.

Discussion

Although there is a large experimental literature demonstrating the salience of negative over positive information (D. M. T. Fessler, et al., 2014; Hilbig, 2012; Peeters & Czapinski, 1990; Pratto & John, 1991; P. Rozin & E. B. Royzman, 2001; Woody & Szechtman, 2011a), the reasons for this privilege of “bad” over “good” are still not clearly understood. Our results, together with those of our previous studies (Boyer & Parren, 2015) may suggest a possible explanation in terms of adaptive heuristics. Threat-related information is more useful than other types of information, particularly in light of error-management strategies. It is particularly costly to ignore information about threats when the threat is real, compared to negative, neutral, or even positive types of information. This would predict that [a] threat-related information is salient relative to other kinds of information, [b] sources of such information as seen as more competent, and [c] these sources are valued as partners for social interaction. The present studies tested the last prediction.

The results of study 1 suggest that people indeed see the source of information about danger as more concerned with their welfare, than a source of neutral information. Studies 2 and 3 suggest that the source of threat-information as a better potential help, than a source of neutral or negative information. Study 4 also showed that people are motivated to allocate a benefit to the source of threat-information rather than the neutral source, although this effect was not as large as in previous studies, and it varied with the type of situation described.

These studies replicated the phenomenon observed in our previous work (Boyer & Parren, 2015), that people value sources of threat-related information more highly than sources of neutral or negative information, other factors being equal. In our previous studies, we showed that this valuation was not driven by the salience of negative information. Our interpretation was that communication of threat-related information, as opposed to more general negative information, is intuitively construed as a benefit. Information about danger is valuable, to the extent that it spares the recipient the cost of finding out which situations constitute dangers. This would predict that people consider the source of such information as a more valuable help (at least in the domain under consideration) and therefore a preferred partner in social interaction – which is what the present results suggest.

This would make sense, as cooperation is seen as relying on the careful choice of partners who are both able and willing to confer benefits on oneself (Noë & Hammerstein, 1994). The source of such information, in sharing something that may prevent a large cost to the recipient, shows that they care about the welfare of the recipient. The recipient may make the conjecture that this show of

caring could extend beyond the one-off case, and thus that the source might be worth investing in socially. Furthermore, the source is in possession of valuable information, which may communicate something to the recipient about the ability of the source of information to continue to provide valuable information.

These limited results are not sufficient to address the question, to what extent such effects of threat-detection and the valuation of sources can explain the cultural salience and recurrence of threat-related information (D. M. T. Fessler, et al., 2014). Further studies should investigate the boundary conditions of this phenomenon, in particular the particular domains of potential danger.

Introduction to Paper 3

Transmission decisions are also influenced by whether or not the sender believes the content. People do not tend to pass along information that they do not think is correct. However, belief in content is itself influenced by some strange features, including the “truth effect” whereby information that is encountered multiple times seems truer than information that is new. This well documented feature of belief seems surprising, given the ease with which an individual with an agenda could potentially influence people. For example, someone with a grudge might repeatedly accuse another of being a witch. If the rest of the community was originally agnostic about this possibility, this one source repeating their accusation may lead others to come to believe them. An alternative explanation for the truth effect might be that people use repetition as a proxy for source tracking in the absence of stronger source information or as an implicit method of tracking sources. In this case, the lone, loud accuser would be less influential. We examined different such possibilities in the following paper.

Paper 3: The Truth Effect: Fluency or Implicit Consensus?

Nora Parren & Pascal Boyer

Abstract:

In four studies, we examine the illusory truth effect, whereby repeated statements are judged more likely to be true than statements read only once. The effect is usually attributed to higher fluency of the repeated items, but current protocols cannot exclude another factor, the consensus effect that may be in place, if participants implicitly attribute the repeated statements to different sources. In four studies, we pit standard repetition against varied numbers of sources. Results suggest that repetition effects are solid but an implicit consensus plays little if any role in the increased truth-ratings for repeated statements. We tentatively conclude that with these materials and this methodology, fluency and familiarity explain the truth effect and source tracking does not.

Keywords: illusory truth, truth effect, mere exposure, consensus effect, implicit reasoning

1 Introduction

The “truth effect”, the finding that statements of ambiguous truth value are seen as more believable after repetition (Bacon, 1979; Hasher, Goldstein, & Toppino, 1977) (has been demonstrated with a number of different presentation types (audio, self and auto-paced reading) and topics (trivia, opinion, product information), in a number of different contexts (lab based, online, posters on campus, with statements rated for truth, familiarity, or not at all, in a within or between items design), as well as in a meta-analysis of 51 studies (Dechêne, Stahl, Hansen, & Wänke, 2010) .

The effect is often attributed to fluency (Begg, Anas, & Farinacci, 1992; Reber & Schwarz, 1999; Whittlesea & Leboe, 2003) where the difference between statements that have been seen any number of times before and statements that are totally novel is particularly strong (Arkes, Hackett, & Boehm, 1989; Hawkins & Hoch, 1992; Roggeveen & Johar, 2002) 2002).

However, these explanations raise the question of why fluency enhances truth ratings in these particular cases. Why should we believe what is repeated or fluent? If these are robust effects as a general property of communication, it would predict a tendency to believe what is repeated, even if the information comes from the same source multiple times, perhaps as part of a deceptive strategy by the speaker.

The idea that information repetition from the same source is enough to convince another person of that information is somewhat strange, especially if the person is aware of the repetition. However, it may signal that the speaker is very committed to their idea and their effort in convincing the listener may be persuasive in and of itself, as long as the information is not obviously shared due to motivation for personal gain (e.g. “Ford is better than Saab” vs. “My used car is the best used car”). Such repetition may be something like a young child with his parent in a grocery store, insisting again and again that the sugary cereal needs to go in the cart. His parent might not be convinced of the truth of that proposition, but give in because of the dedication of the messenger. Similarly, with information that isn’t particularly important to the life of the listener, it may be accepted after repetition because the effort of the repeating something is a sign that the speaker believes in and cares about what she is saying.

Repetition may also be particularly convincing when it is the only variation that a listener has to draw from. While normally a listener would evaluate source, argument strength, and motivation, if this information is lacking, the listener may be forced to rely on how convinced of the position the speaker is, which may be communicated by repetition. Indeed, such a context looks a great deal like the design of an illusory truth experiment. There are also real world allegories, if only ones that are possible in our somewhat bizarre modern world. For instance, advertising slogans are similar in concept to the illusory truth paradigm and are known to be effective, a feature that has not been lost on researchers in the field (e.g.(Roggeveen & Johar, 2002)). However, the distance between these contextually divorced pieces of information and the type of social information that was typically available during human evolution is suggestive in terms of explaining the somewhat surprising effect.

Humans are deeply social. Human society has been able to flourish in particular ways because we do not have to discover everything for ourselves, but instead can cooperate and rely on information from trusted fellows. The only way that this is possible, however, is because we have what some people have described epistemic vigilance mechanisms (Harris, 2012; Harris & Lane, 2014; Mercier, in prep; Sperber, et al., 2010) 2013).

These are mechanisms that allow people to increase the odds that what they learn from others is actually true or beneficial, so that they are not victim to malicious or ignorant sources who might spread lies, manipulation, or deceit. While such mechanisms are not perfect, people calibrate their trust of information based on, for example, the arguments that support that information, on the

plausibility of the information, and on evaluations of the source, and motives of the source(Sperber, et al., 2010).

One possible interpretation of the truth effect, consistent with epistemic vigilance, is in terms of a consensus effect. In this view, participants implicitly attribute the repeated instances of a statement to distinct sources. That is, what is said three times is tacitly construed as having been said by three individuals. If that is the case, the truth effect could be an expression of the reasonable belief that information that is provided by several independent sources is probably more reliable than that coming from one source. By this interpretation, the truth effect could be seen as a special variant of the consensus effect.

This interpretation is consistent with evolutionary perspectives on communication. People should be (and experimental results show that we are) sensitive to informational conformity. That is, when a majority of people agree about a topic, it is often a good heuristic to go with the crowd. This strategy is computationally simple, freeing up cognitive resources for other or finer grained tasks (Boyd & Richerson, 1988) while also being higher performing than other strategies (Hastie & Kameda, 2005; Mercier, in prep)).

Experimental results also point to the use of consensus by participants (adults and children) especially when the tasks are non-trivial and a clear majority supports one solution to the task. Use of consensus is sensitive to the size of the group and the size of the majority that supports a solution (Bernard, Harris, Terrier, & Clément, 2015; Bond, 2005; Gerard, Wilhelmy, & Conolley, 1968; McElreath et al., 2005; Mercier, in prep; T. Morgan, Rendell, Ehn, Hoppitt, & Laland, 2012; T. J. Morgan, Laland, & Harris, 2015) p.201).

It may be that in the illusory truth effect literature, participants use an implicit measure of consensus or source count in lieu of specific source tracking. The sense of fluency that comes from multiple exposures to information may thus be an implicit cue of consensus to the participant, given the lack of other cues normally recruited for epistemic purposes. While to the best of our knowledge, ours is the first research to take this particular approach to source, others have suggested that factors related to the source of information may be, at least, a contributing factor in the truth effect (Begg, et al., 1992; Roggeveen & Johar, 2002), 2002).

The truth effect is particularly strong when the participants have low source retention, implying that fluency may be used in lieu of explicitly tracking where information came from and how often (Henkel & Mattson, 2011; Mitchell, Dodson, & Schacter, 2005; Mitchell, Sullivan, Schacter, &

Budson, 2006), Hackett, & Boehm (1989) found an effect of participants' perception of where the information had come from on the truth ratings. They used the usual paradigm; presenting information once or multiple times, but then asked the participant if they had seen the information outside of the experimental context. If the participants answered yes,, those statements were also given significantly higher truth scores than statements that participants perceived to have been seen before in the experiment, though the in-experiment statements still outperformed novel statements. This did not directly manipulate source, but is suggestive because the sense of familiarity that was presumably gained just in the experiment may have been interpreted as the information coming from multiple sources. We do not know from the article if the participants really had seen the statements outside of the experiment, but the likelihood seems high that at least some of those statements really had just been seen in the experiment and the source was misattributed.

In none of these studies, however, was perception of number of sources directly manipulated or tested, which would directly test the consensus interpretation of fluency leading to the truth effects that have been observed. The only exception to this that we have been able to find comes from Roggeveen and Johar (2002) who explicitly manipulated source number, with mixed methodologies and results,

The first experiment used product testimonials that were either presented once or twice. In addition, the testimonials were signed by either one or two people. Using this method, Roggeveen and Johar found only a difference for repetition, in the usual direction, with repeated items being seen as truer than non-repeated items, but no main effect or interaction of source number.

In their second study, some testimonials were seen once, and as before, were attributed to two different people or to one person. Other testimonials were seen twice, and either attributed to the same source on both presentations, or first attributed to one source, then on the second exposure, attributed to a second source. Despite this elaboration, there was again a main effect of repetition. Drilling down, the testimonials that were seen once but attributed to two people were still given lower truth ratings than testimonials that were presented by two separate sources.

Their manipulation check found that participants often misremembered the source of testimonials repeated twice by the same person. These items were often remembered as being from two different sources. However, participants generally correctly remembered when there really were

two different sources. Testimonials that were remembered as being from two sources were rated as more likely to be true than testimonials that were remembered as being from only one source.

In the first two studies, the authors used the names of individual consumers in their source manipulation. In their third study, they used the names of three different fictional consumer watchdog groups and included up to three exposures to the testimonials as opposed to two exposures. Participants either had the same source for all three exposures, or had three different sources for the three different exposures. Items in the first exposure were all attributed to the same watchdog group, which made source tracking a simpler process for the participant. The second exposure to the same items was either from a new watchdog group, or the same as the first time. The third exposure, mixing old and new items was either from a new watchdog group again, or the same group as the previous two exposures.

Testimonials were also pre-tested to be either high or low in initial plausibility. This interacted with repetition, though there was no main effect of repetition, unlike the previous studies. There was no difference between conditions for the high plausibility items, but there was an effect of source/repetition on the low plausibility items. The new items were rated as less true than items repeated by three sources, but there was no difference between new claims and items repeated by a single source.

All of these studies potentially speak to our consensus interpretation of the classic findings in the truth effect literature. However, it is difficult to explain the difference in the findings between Roggeveen and Johar's three studies and between their studies and the standard findings in the literature. In the studies that did not reach significance for source variability, source was low in salience, while in the study that did reach significance, there were only three sources and these were in prominent, salient positions, making strong interpretation of the results challenging. Furthermore, when source salience was high, the classic finding of a truth effect due to repetition was not replicated. This is complicated by the methodology being markedly different in a number of ways. However, the results contribute to the literature suggesting that there is some effect of source number.

In the present studies, we sought to further this work in disentangling two possible underlying causes of the truth effect, the number of sources of information on the one hand and fluency of information on the other. We made the source of information more salient and looked at any differences between the information being repeated by the same source as opposed to being

repeated by different sources. We follow the classic paradigm of trivia presentation, with the simple addition of a source of the information, in the form of a picture of the source's face preceding each piece of trivia

2 Materials pre-test

A pre-test of trivia statements was run in two phases on the Amazon Mechanical Turk website. All statements were trivia items that were pre-selected to be unlikely to be of particular interest to participants and unlikely to elicit an emotional reaction of any kind. In phrase 1, 84 participants ranged between 20 and 69 years of age, $M=34.01$, $SD=11.15$, 34 participants were women, and 66 identified as White. In phrase 2, 82 participants ranged between 20 and 63 years of age, $M=35.83$, $SD=10.49$, 45 participants were women, and 63 identified as White.

2.1 Design.

In both phases, participants saw trivia statements and were asked to rate them on a scale of 1 (certainly false) to 7 (certainly true). In phase one, participants rated one of two sets of 40 trivia statements, of which 2 were catch questions and in phase 2, participants rated one of two sets of 50 trivia statements, of which 2 were catch questions, leaving 172 rated trivia statements in the database. Selection criteria for these trivia are described in the below studies.

3 Study 1

This study was designed to test to see if the truth effect would occur with new materials. Before we can untangle fluency and consensus effects, we must first replicate the truth effect with new materials that will allow for future manipulation of the source. To that end, individual sources (pictures of faces) present the items in this study, though the paradigm is otherwise the same as in the classic studies.

3.1 Methods

3.1.1 Participants

142 participants were recruited on the Amazon Mechanical Turk website, between the ages of 18 and 60, $M=33$. Of these participants, 83 were women and 95 identified as White/Caucasian.

3.1.2 Materials: Trivia statements

Thirty-two items from the pretest were selected for study 1. These items were between 5 and 10 words long, rated an average of between 3.5 and 4.5 on a 7 point "truth" scale, with an SD of under 1.38, with at least 25% of participants rating the item 4 out of 7. For a full list of the trivia items

chosen along with the pre-test results, please see Appendix B. In addition to the test items, 4 “catch” items were included, e.g. “Most English people live in igloos.”

3.1.3 Materials: Source faces

Face materials and pre-testing were provided by Bainbridge’s database of 10k faces (Bainbridge, W. A., Isola, P., & Oliva, A. (2013). The Intrinsic Memorability of Face Photographs. *Journal of Experimental Psychology: General*, 142(4), 1323 - 1334.) There are 964 faces in the database that are male, white, non-celebrities. Of these faces, we were particularly interested in selecting faces that were memorable. Brainbridge, Isola, & Oliva (2013) calculated participants’ ability to remember faces, after a test where participants saw a faces scrolling by and had to indicate if they had seen the faces before. The “hit rate” which was calculated as $HR = \text{HITS} / (\text{HITS} + \text{MISSES})$. A hit rate of .8 left 28 faces, so we created a subset of faces with a hit rate of at least .7, further narrowing it down by false alarm rate between 0 and .5 (calculated as $FAR = \text{FAs} / (\text{FAs} + \text{CRs})$). Bainbridge et al also had participants rate the faces on a number of different traits. We selected faces that were seen as friendly (3-5 on a 5 point scale) and as intelligent (5-9 on a 9 point scale). This left us with 49 faces, of which we selected a random subset of 32.

3.2 Design and procedure

There were 3 phases in the study. The first phase, “study” was to familiarize the participants with the face/item pairs. After a distraction task was the “test” phase, in which the participant rated items on how true they seemed. In the “count” phase, the participant estimated how many times they had seen the item. All questions were self paced with no timeout.

Study phase. There are 32 trials of face/trivia pairs, which participants were told may be either true or untrue. Participants saw each pair with large spaces between to allow visual focus. To encourage engagement, and following Hawkins and Hoch (1992) participants were asked to rate how easy the trivia items were to understand, from 1 to 7. Of the 32 trials, 8 were item/face combinations that were only seen once. An additional 8 item/face combinations are seen 3 times each (24 trials). 4 groups of stimuli were created to counterbalance repetitions, sources, and items. Details of counterbalancing can be found in Appendix B. Order was randomized for all participants.

Distracter task: Participants read a paragraph giving some information about optical illusions. Toward the end of the text were special instructions for how to answer the question about the optical illusion on the following page. This served the dual purpose of distracting the participant

from practicing semantic memory as well as allowing us to screen out participants who were not paying attention.

Test phase. Participants were shown 32 trivia items, without the faces. Half of these items were the items seen in the study phase either once or three times. The remaining 16 items were novel items. The participants were instructed to rate the items between certainly false and certainly true, on a scale between 1 as “certainly false” and 6 as “certainly true.”

All 32 items were shown in random order, followed by 4 catch items, which were either obviously true or obviously false, to allow us to screen out participants who were not paying attention. These items were shown at the end of the phase rather than interspersed so as to not interrupt the relative ease and familiarity of test items.

Count phase: Participants were then given the question, “Not including this section, over the course of the survey, how many times have you seen this statement before?” Each item shown at test was shown again, in a random order, with the answer options between 0 and 9 times.

Participants were asked about their suspicions, filled out a short demographics section, debriefed, and thanked.

3.3 Results

63 participants were dropped because they failed to correctly answer at least 1 of the 5 catch questions. An additional 7 participants were dropped due to suspicions about the hypothesis, leaving $N=73$, between the ages of 19 and 60, $M=34.64$, $SD=9.88$.

3.3.1 Truth ratings:

Table 7 summarizes the truth ratings for three levels of exposure: items not seen at study (0), seen once (1) and seen three times (3).

A within-subject ANOVA was run, with number of repetitions at study (3 levels) and group (4 levels) as independent variables, and truth score as the dependent variable. There was a main effect of number of repetitions at study $F(2,138)=31.35$, $p<.001$, $\eta_p^2 = .3$, but no main effect of group $F(3,69)=1.9$, $p=.14$, $\eta_p^2 = .08$, and no interaction between the two $F(6,138)=1.36$, $p=.23$, $\eta_p^2 = .04$.

Follow-up, paired two tailed t-tests were conducted using Bonferroni adjusted alpha levels of .025 per test (.05/2) revealed that there was a significant difference between items that had not been seen at study ($M=3.66$, $SD= 1.07$) and items that had been seen once at study ($M=4.17$, $SD= 1.34$)

$t(110)=5.01, p<.001, d=0.8, 95\% \text{ CI } [-.7, -.33]$ but no significant difference between items seen once or 3 times ($M=4.25, SD=1.18$) at study $t(143.64)=.52, p=.6, d=.09, 95\% \text{ CI } [-.2, .06]$.

Furthermore, there were no effects of age, sex, or education, all $ps>.25$, but there was a main effect of race, $p<.01$, though with all results in the same direction as the hypothesis and combined findings above. Details may be found in the Appendix B.

3.3.2 Estimation of source number

The fluency effect may occur if people are unaware of the repetition and just experience the ease of processing and fluency without knowing why. As a manipulation check, we tested to see if people did indeed perceive the difference in number of presentations.

Table 8 summarizes the estimate of number of times items had been seen at three levels of actual exposure: items not seen at study (0), seen once (1) and seen three times (3).

Participants generally overestimated the number of times they had seen the statements, with a mean difference of 1, $SD=.95$ between estimated number of views and actual number of views. Participants were asked how many times they had seen the statement before in the study, ignoring the current section, but this instruction may have been ignored, as otherwise participants were very accurate. There was a .81 correlation between the estimated number of sources and the actual number, $r(217)=.81, 95\% \text{ CI } [.76, .85], p<.001$.

In terms of the effects of estimated number of sources on truth ratings, we found a positive correlation, $r(217)=.28, 95\% \text{ CI } [.15, .40], p<.001$.

3.4 Discussion

We replicated a classic finding of repetition paradigms, that items seen at both study and test are considered more plausible than items seen only once at test. By contrast, the manipulation of number of exposures at study (3 versus 1 presentation) did not have any effect on truth ratings.

4. Study 2

4.1 Rationale

This study was designed to test to see if the truth effect would occur again, this time with the repeated sentences paired with different faces instead of the same face as in study 1. This is an important distinction, as in previous studies it may be that the truth effect was elicited because

participants tacitly assumed that their experience of fluency was due to multiple sources providing a consensus account. In this version, the multiple sources are clearly different people.

4.2 Methods

4.2.1 Participants

153 participants were recruited on the Amazon Mechanical Turk website, between the ages of 20 and 66, $M = 32.67$, $SD = 9.07$. Of these participants, 68 were women and 103 identified as White/Caucasian.

4.2.2 Materials

Same as in study 1.

4.2.3 Design and procedure

The design followed the same pattern as study 1, with a study, distraction task, test, and then count phase. As before, the study phase had 32 trials of face/trivia pairs. Of the 32 trials, 8 were item/face combinations that were only seen once. An additional 8 items were seen 3 times each, each time paired with a different face (24 trials). Order was randomized for all participants.

4.3 Results

Participants were dropped if they failed to correctly answer at least 1 of the 5 catch questions or if they were suspicious about the hypothesis, leaving $N = 101$, between the ages of 20 and 66, $M = 34.4$, $SD = 9.5$.

4.3.1 Truth ratings

Table 9 summarizes the truth ratings for three levels of exposure: items not seen at study (0), seen once (1) and seen three times (3).

A within-subject ANOVA was run, with number of repetitions at study (3 levels) and group (4 levels) as independent variables, and truth score as the dependent variable. There was a main effect of number of repetitions at study $F(2,194) = 40.04$, $p < .001$, $\eta_p^2 = .29$ but no main effect of group $F(3,97) = 1.64$, $p = .14$, $\eta_p^2 = .05$ and no interaction between the two $F(6,194) = .65$, $p = .69$, $\eta_p^2 = .01$.

Follow-up paired, two tailed t-tests were conducted using Bonferroni adjusted alpha levels of .025 per test ($.05/2$) which revealed that there was a significant difference between items that had not been seen at study ($M = 3.71$, $SD = .46$) and items that had been seen once at study ($M = 4.22$, $SD =$

.71) $t(100) = -7.22, p < .001, d = 0.85, 95\% \text{ CI } [-.65, -.37]$ but no significant difference between items seen once or 3 times ($M = 4.29, SD = .82$) at study $t(100) = -1.25, p = .21, d = 0.09, 95\% \text{ CI } [-.18, .04]$.

To look at this data in a slightly different way, we also ran a paired t-test, with sentence as the matching variable, and mean truth score for 1 repetition or mean truth score for 3 repetitions for those sentences. There was not a significant difference in the scores for 1 rep ($M=4.18, SD=.29$) and 3 reps ($M=4.21, SD=.35$) conditions; $t(15)=-0.38, p = 0.7, d = 0.08, 95\% \text{ CI } [-.18, .13]$

Furthermore, there were no effects of age, sex, race, education, or income all $ps > .25$.

4.3.2 Estimation of source number

Table 10 summarizes the estimate of number of times items had been seen at three levels of actual exposure: items not seen at study (0), seen once (1) and seen three times (3).

Participants generally overestimated the number of times they had seen the statements, with a mean difference of .98 between estimated number of views and actual number of views.

Participants were asked how many times they had seen the statement before in the study, ignoring the current section, but this instruction may have been ignored, as otherwise participants were very accurate.

There was a .78 correlation between the estimated number of views and the actual number, $r(301) = .78, 95\% \text{ CI } [.73, .82], p < .001$

In terms of the effects of estimated number of views on truth ratings, we found a positive correlation, $r(301) = .22, 95\% \text{ CI } [.11, .32], p < .001$.

4.4 Discussion

As in study 1, the illusory truth effect was found. Despite the trivia being repeated by novel sources, instead of the same source as in study 1, there was still no difference in truth rating between one and three repetitions. However, while the source faces were rated as relatively memorable, they were still new faces that the participant had no particular relationship to or reason to remember, as compared to people in their actual lives or of any significance socially. It may be that the faces of strangers are not enough to elicit an additional boost for the repeated statements.

5. Study 3

This study was designed to test to see if the truth effect would occur with again, this time with the repeated sentences paired with different celebrity faces instead of unknown faces. Celebrity faces

should serve both to be more salient and more easily remembered, and serve as a better proxy for people who you might actually encounter and track over time, as opposed to unknown strangers.

5.1 Methods

5.1.1 Participants

189 participants were recruited on the Amazon Mechanical Turk website, between the ages of 18 and 82, $M = 33.8$, $SD = 10.11$. Of these participants, 91 were women and 147 identified as White/Caucasian.

5.1.2 Materials

Celebrity faces were found by searching Google for “Most famous celebrities” and using the suggested list. As most of the top celebrities were white men, additional searches for black and/or female celebrities were also conducted until there were equal numbers of White male, white female, black male, and black female celebrities in the list. Photos were selected for each celebrity in which the subject was facing the camera, with a smile or a neutral expression, and a plain, light colored background, and cropped to be from the neck up into a square shape.

5.1.3 Design and procedure

The design was the same as in study 2, with the new pictures.

5.2 Results

Participants were dropped if they failed to correctly answer at least 1 of the 5 catch questions, leaving $N = 129$, between the ages of 18 and 82, $M = 34.68$, $SD = 10.37$.

5.2.1 Truth ratings

Table 11 summarizes the truth ratings for three levels of exposure: items not seen at study (0), seen one (1) and seen three times (3).

A within-subject ANOVA was run, with number of repetitions at study (3 levels) and group (4 levels) as independent variables, and truth score as the dependent variable. There was a main effect of number of repetitions at study $F(2,250) = 48.5$, $p < .001$, $\eta_p^2 = .28$ but no main effect of group $F(3,125) = 1.0$, $p = .39$, $\eta_p^2 = .02$, and no interaction between the two $F(6,250) = .76$, $p = .60$, $\eta_p^2 = .01$.

Follow-up paired, two tailed t-tests were conducted using Bonferroni adjusted alpha levels of .025 per test ($.05/2$) revealed that there was a significant difference between items that had not been seen at study ($M = 3.71$, $SD = .44$) and items that had been seen once at study ($M = 4.20$, $SD = .75$)

$t(128) = -7.11, p < .001, d = .8, 95\% \text{ CI } [-.62, -.35]$ while the difference between items seen once or 3 times at study was not significant ($M = 4.29, SD = .73$), $t(128) = -1.9, p = .0596, d = .11, 95\% \text{ CI } [-.17, 0]$.

To look at this data in a slightly different way, we also ran a paired t-test, with sentence as the matching variable, and mean truth score for 1 repetition or mean truth score for 3 repetitions for those sentences. The sentences that were totally new at test were not comparable, of course. There was not a significant difference in the scores for 1 rep ($M=4.15, SD=.28$) and 3 reps ($M=4.25, SD=.33$) conditions; $t(15)=-0.1, p = 0.17, 95\% \text{ CI } [-.25, .05], d=.33$.

Furthermore, there were no effects of age, sex, race, education, or income all $ps > .16$

5.2.2 Estimates of repetition

Table 12 summarizes the estimate of number of times items had been seen at three levels of actual exposure: items not seen at study (0), seen once (1) and seen three times (3).

Participants generally overestimated the number of times they had seen the statements, with a mean difference of .84 between estimated number of views and actual number of views.

(Participants were asked how many times they had seen the statement before in the study, ignoring the current section.)

There was a .77 correlation between the estimated number of views and the actual number, $r(385) = .77, 95\% \text{ CI} [.73, .82], p < .001$

(In terms of the effects of estimated number of sources on truth ratings, we found a positive correlation, $r(385) = .37, 95\% \text{ CI} [.28, .45], p < .001$.

5.3 Discussion

While this study had slightly more power than study 2 and used familiar celebrity faces, the results were very similar. The difference between being seen once at study and 3 times at study was tending toward significance, but did not quite reach it, despite these advantages. Given the robust difference between items that were not seen at study and those that were, it may be that with our population and materials, the contrast between seen and unseen obscures a difference between

6. Study 4

This study was designed to test to see if the truth effect would occur with again, this time without new items at test or count. This change was made as it is possible that in our previous studies, the

extreme difference in familiarity and fluency between the seen and unseen items could have hidden the effect for the smaller difference between items seen once or three times. By removing the relatively less fluent items, it may be possible to see an effect that was previously drowned out. Celebrity faces were used again, as in Truth03.

6.1 Methods

6.1.1 Participants

186 participants were recruited on the Amazon Mechanical Turk website, between the ages of 20 and 66, $M = 33.59$, $SD = 10.04$. Of these participants, 93 were women and 142 identified as White/Caucasian.

6.1.2 Materials, design and procedure.

Design was the same as Study 3, except for that in the test and count phase, all items were the ones that had been seen at study. There were no new items introduced.

6.2 Results

Participants were dropped if they failed to correctly answer at least 1 of the 5 catch questions, or if they answered all remaining questions with the same value, leaving 112 participants between the ages of 21 and 66, $M = 34$, $SD = 10.09$. Of these participants, 53 were women and 93 identified as White/Caucasian.

6.2.1 Truth ratings

Table 13 summarizes the truth ratings for two levels of exposure: seen one time (1) and seen three times (3).

A within-subject ANOVA was run, with number of repetitions at study (2 levels) and group (4 levels) as independent variables, and truth score as the dependent variable. There was a no main effect of number of repetitions at study $F(1,108) = 0.97$, $p = .33$, $\eta_p^2 = .01$, and no main effect of group $F(3,108) = 1.32$, $p = .27$, $\eta_p^2 = .04$ and no interaction between the two $F(3,115) = .33$, $p = .81$, $\eta_p^2 = .01$.

There was an interaction between race and repetitions, due to the one participant in one race group, $F(5, 77) = 4.61$, $p < .001$, but with that participant removed, there were no effects of age, sex, race, education, or income all $ps > .08$ (income).

6.2.2 Estimate of number of repetitions

Table 14 summarizes the estimate of number of times items had been seen at three levels of actual exposure: items not seen at study (0), seen once (1) and seen three times (3).

Participants generally overestimated the number of times they had seen the statements, with a mean difference of .84 between estimated number of views and actual number of views. The 1.41 difference in estimates of numbers of presentations, between the 1 and 3 presentation conditions, was statistically significant, $t(222, \text{two-tailed})=11.45$, 95% CI [1.167, 1.652], $p<.0001$, $d=1.53$.

There was a correlation between the estimated number of views and the actual number, $r(222) = .6$, 95% CI [.52, .68], $p = <.001$.

There was no correlation between the estimated number of views and the truth score $r(222) = .05$, 95% CI [-.08, .18], $p = .43$.

6.3 Discussion

This is a direct confirmation of the effects found in studies one through three, that the truth estimate is strongly affected by the study-test repetition, but not (or very weakly) by intra-list repetition at study, even if the sources are clearly distinctive.

7. General Discussion

In studies 1 through 4, we were able to replicate the truth effect, with participants giving greater credence to trivia that they had encountered previously in the experiment, compared to novel trivia items. However, manipulating the number of repetitions at study did not have an effect on the truth rating, whether the source were the same (study 1), different (study 2), distinctively different (study 3), or when there were no new items that might have been interfering with a perception of the number of sources (study 4). Our manipulation check revealed that the participants were aware of the repetition, but that this did not prevent the boost in truth ratings.

Overall, then, these results align with previous research indicating that the truth effect is due to enhanced fluency (Begg, et al., 1992; Dechêne, et al., 2010; Reber & Schwarz, 1999; Whittlesea & Leboe, 2003) and results showing that source manipulations may have an effect, but that the effects are independent from the influence of familiarity and or fluency (Dechêne, Stahl, Hansen, & Wänke, 2010).

So it seems that the fluency created by repeated exposure to an item is not simply an effect of an implicit interpretation of repeated items as coming from distinct sources. Naturally, the results do not eliminate the possibility that such a consensus effect is at work.

Introduction to Paper 4

In the following paper, we turn to a connection linked more closely with actual witchcraft ideas; that of misfortune, the perception of agency, and minimally counter intuitive concepts. We look to see if misfortune is intuitively linked with agency and if such a connection is more memorable than alternatives. Finally, we look to see if minimally counterintuitive agents are more or less memorable as agents of misfortune.

Paper 4: Misfortune, Agency, and Minimal Counter-Intuitiveness

Abstract:

In four studies, the relationship between misfortune and agency is investigated. In Study 1, a reaction time methodology revealed that participants more quickly determine if an agent caused or did not cause a misfortune, compared to impersonal forces, which took longer for them to categorize. In Study 2, we found that agents are better remembered than impersonal forces of both positive and negative events, though there is an independent main effect for negative events to be better remembered than positive events. In Study 3, we found that MCI agents are better remembered than intuitive agents, and that there is no effect of whether the agent helped or hurt the protagonist in a story. There was also no significant main effect of threat or MCI context. In a follow-up study (study 4) we found that even when the MCI agents are not included in the story, for these particular materials, there is no effect on memory if the intuitive agents help or harm the main protagonist.

Introduction

Witchcraft beliefs have been prevalent throughout time and across the world. In particular, people believe that others magically cause harm to occur to individuals or communities. We believe three factors may be particularly relevant to how these ideas are seemingly natural and memorable enough to be stable in culture. Specifically, we hypothesize that witchcraft beliefs may arise in part due to the tendency to err on the side of agency detection/mind detection and be remembered due to their minimally counter-intuitive and threatening nature.

Witches are an excellent example of minimally counterintuitive concepts (MCI). These types of concepts are ones that we can mostly understand using the evolved intuitions we generally rely on, the cognitive heuristics and biases that let us quickly and easily navigate our worlds. For example, we have a theory of mind that gives us an intuitive sense of mental states and allows us to explain and predict how humans in our environment will think, act, and feel. These intuitions, particularly at the level of domain knowledge, shape our expectations of the world around us. Minimally counter intuitive concepts are ones that are generally understandable and predictable using these intuitions, with one or two violations of our expectations (Boyer, 2001). Such concepts are often seen in religious content. These MCI concepts are particularly memorable and attention grabbing compared to maximally counter-intuitive concepts (that violate many intuitions) and purely natural concepts (Boyer, 2003; Boyer & Ramble, 2001). There are many different types and levels of

intuitions that guide us, and it is currently unclear what types of intuitive violations are the most effective at boosting memory and attention or what exactly is predicted by MCI theory especially as regards real religious belief systems, (Purzycki & Willard, 2016), but witchcraft seems a clear enough case, especially as the object that we are trying to understand, rather than make broader predictions.

Witches are largely intuitive to us, in that we can make predictions about them based on our usual understanding of folk biology, theory of mind, and social reasoning. They are not, however, fully intuitive, but rather violate expectations by performing magic and harming others in ways with which we do not deeply understand. This magic takes different forms and methods in different cultures, and so the particular types of intuitive violation are variable locally. In the Western imagination, for example, witches are able to fly, despite not having the requisite physiology. These sorts of minimal violations make witches memorable, perhaps especially in comparison to more mundane explanations of misfortune and tragedy. When both types of explanation for an event are proffered, it is possible that the MCI concept will be more memorable and thus also more likely to survive transmission in culture, though to our knowledge, this has not yet been directly tested.

Agency

Witches are not just minimally counter intuitive, but are more specifically minimally counter intuitive agents. Agency is another important concept in the literature on memorability, attention, and specifically in explaining religious experience and cultural transmission. These different literatures ask different questions and have different emphases, but a common theme rapidly emerges: agency is powerful. Error management in evolutionary time perhaps led humans to readily interpret ambiguous signals as agents (Hyperactive Agency Detection Device or HADD) (Barrett, 2004) though agency may or may not be secondary to intentionality or mind perception (Lisdorf, 2007; Willard, 2017). Hyperactive agency detection may lead people to find agents or minds, including supernatural agents, with only small cues indicating their presence (Barrett, 2004). The cues can take many different forms and may be separable cognitive phenomena. Agency may be inferred based on perceptual biases (Guthrie, 1995; van Elk, 2013, 2015; van Elk, et al., 2016) which may be very different from the tendency to see minds (Epley, et al., 2008; Waytz, et al., 2010).

In another approach, it is argued that anthropomorphic representations are likely to become stable because they activate powerful inferences for mentalistic accounts of behavior, while also being counter-intuitive, and thus getting an attention and memory boost as described above (Boyer,

1996). Furthermore, “when people explain salient misfortune without mentioning supernatural agents, they still assume agents as causally involved (Boyer, 2003).” The connection to witchcraft beliefs is clear. If bad things happen, people may naturally assume that an anthropomorphic and supernatural character was involved. A witch concept fits this bill, and may also be more likely to be remembered and transmitted.

Threat, negativity, and misfortune

The widespread belief in witches may also be tied specifically to a human penchant for the negative. In a wide range of cognitive domains, from low to high level, threat information has an advantage over non-threat information (Roy F Baumeister, et al., 2001; Fessler, et al., 2017; P. Rozin & E. B. Royzman, 2001). In asking questions about the naturalness of witchcraft, it is particularly interesting to note that certain types of processing and memory can be enhanced by a threatening context (Kang, et al., 2008; Kazanas & Altarriba, 2017; Nairne & Pandeirada, 2008, 2010; Nairne, et al., 2007; Olds, Lanska, & Westerman, 2014; Soderstrom & McCabe, 2011; Weinstein, et al., 2008) but see (A. C. Butler, Kang, & Roediger III, 2009; Olds, et al., 2014). There are intriguing but mixed results with the few studies that include MCI agents like zombies and demons as part of this survival context, as compared to unspecified predators as part of the survival context (Kazanas & Altarriba, 2017; Soderstrom & McCabe, 2011). It is not clear why in one study the MCI agent threat context enhanced memory and in the other it did not, but this work suggests that there is something to investigate.

Also interesting to the study of witchcraft is that negative social information is also privileged in terms of attention at different levels, in terms of behavioral outcomes such as stigmatization, and in belief as demonstrated by how negative stereotypes form comparatively quickly and show greater resistance to change than positive stereotypes (Roy F Baumeister, et al., 2001; Kurzban & Leary, 2001; Pratto & John, 2005; Skowronski & Carlston, 1989). A negative, threatening, or even ambiguous environment can also trigger social reasoning, whereby negative events seem to be more likely to be attributed to a person’s doing (Morewedge, 2009). An unpredictable environment also makes people more likely to anthropomorphize (Waytz, et al., 2010).

In the following studies, we turn to a connection linked more closely with actual witchcraft ideas; that of misfortune and the perception of agency. We look to see if misfortune is intuitively linked

with agency and if such a connection is more memorable than alternatives. Finally, we look to see if minimally counterintuitive agents are more or less memorable as agents of misfortune.

Study 1: Reaction Time

Rationale

We hypothesize that people should have an intuitive understanding that agents can and do cause things to happen in the world, and particularly that misfortune is easily understood as being caused by an agent, as opposed to an impersonal force.

Materials:

Following Baumard and Chevallier's methodology investigating immanent justice beliefs (2012) participants read a story about a scenario and a subsequent misfortune. Participants were asked to say if the scenario caused the misfortune. For instance, in the causal agent condition, participants read the following story: Sam is a successful defense lawyer. Joe is the prosecuting lawyer and is worried about Sam's ability to sway a jury. The day before the trial, he arranges for Sam to be given some spoiled food. Sam gets food poisoning. [break] Joe gave Sam spoiled food. [break] That is why Sam got food poisoning. The participant was trained to respond either Yes (that is why Sam got food poisoning) or No (That is not why Sam got food poisoning). (See Appendix C for training materials and below for the full list of vignettes) We manipulated the presence of an agent in the scenario and measured the reaction time to the final statement in the story, regarding the misfortune.

We looked at the response latencies when the misfortune in the story is caused by an agent vs. an impersonal environmental condition. We also looked at the response latency difference when the misfortune in the story is NOT caused by the agent or impersonal environmental condition described in the story. Please see Table 15 for clarification of these four different possibilities.

We predicted that participants would be slower to reject the stories about an agent causing misfortune than the story about the impersonal force causing misfortune. We predicted this because we suspect that people tend to think that agents cause misfortune, so in order to correctly reject the story, they will have to inhibit their intuition about the agent, which should slow down the reaction time in the agent compared to impersonal force conditions. We also expect that people

will be faster to accept the story about an agent causing misfortune than the story about an impersonal force causing misfortune.

Design and procedure

All participants began with practice stories, followed by the 2 test stories. The progress is self-paced. There were 5 practice stories, each telling about a misfortune (e.g. “Steve is a food lover. When someone offers him pastries, he cannot resist. He eats ten of them and gets sick.”) The participant presses the space bar to continue and sees one element of the situation repeated that could be a cause of the misfortune (e.g. Steve ate too many pastries) and presses the space bar to continue. The participant then reads a sentence describing a possible causal relationship between the previous statement and the misfortune (That is why he got sick.) and must choose “Yes” or “No” by pressing pre-specified keys (A or L, counter balanced by participant, A shows up in Inquisit as 30 and L shows up at 38).

The two test stories followed immediately in the same format. Each test story came in 4 variations. Each variation follows the same pattern: 1) description of the scenario then 2) the misfortune. The scenario is different in each case, but the misfortune is the same. In two of the variations, the scenario is about an agent, and in two variations the scenario is about an impersonal force. After the participant read the vignette, they were asked if the thing described in the scenario caused the misfortune.

In two variations we expect the answer to be “yes” (e.g. eating the pastries did cause Steve to become sick) and in two versions we expect the answer to be “no.” “John wished for Mark to get hurt. [break] That is why Mark broke his leg.”

Each participant only saw one variation of each of the two stories (break and food poisoning) and saw one variation in which the scenario was about an agent and the other in which the scenario was about an impersonal force.

Participants were randomly assigned to be in the condition which the scenario did or did not cause the misfortune. Order was counterbalanced. Thus, the participants either responded “yes” (did cause) to both stories or “no” (did not cause) to both stories in the test phase if answering correctly.

Participants then filled out a short demographics questionnaire. The average time for the study, including instructions and demographics, was 4 minutes and 57 seconds.

Materials

See Table 16 and 17 for the “break story” and “food story” respectively

Participants

204 participants (122 male, 82 female) were recruited from the United States via the Amazon Mechanical Turk Website. Participants were between the ages of 18 and 72, with an average age of 32.37, $SD=11.26$. However, 24 participants were dropped due to answering one of the test questions incorrectly, such as saying that the refrigerator in perfect working condition caused food poisoning. Of the questions that were answered incorrectly, the majority were in the Impersonal scenarios, where people said that the impersonal scenario did not cause the misfortune, when they should have answered “yes”. Please see Table 18 for the types of mistakes made and the percentage of mistakes that the type represents.

After dropping participants who made such errors, as well as non-native English speakers, we were left with 168 participants, (97 male, 71 female.) The youngest participant was 18 and the oldest was 72. The mean age was 32.82, $SD=11.63$. 135 participants self-identified as White.

Results:

Descriptive results of correct responses (all times are in milliseconds) can be found in Table 19.

Response time was not a normal distribution, with Shapiro-Wilk tests significant at $<.001$, A log₁₀ transformation was performed on response time, which improved normality to $p=.02$. There were no outliers at the 1.5 interquartile range away from the median.

Tests of non-essential variables: gender, ethnicity, regression on age, etc.

I ran a Mixed ANOVA, with the log transformed response time for the different causes (Agent and Impersonal) as a within subjects factor and sex, age, ethnicity, and religion as between subject factors. There was a main effect of age $F(1,125)=12.95, p<.001$, with response time increasing with age. This relationship may be seen in Figure 10. There were no other main effects or interactions, all $p>.09$

I ran a Mixed ANOVA, with the log transformed response time for the different causation type (Agent and Impersonal) as within subject factors and response valence (yes and no) and story (“food” and “break”) as between subject factors. The main effect of causation type showed a statistically significant difference between Agent and Impersonal response times, $F(1,164) = 8.91$, $p < .01$, showing that participants responded more quickly when the scenario was about an agent ($M=1486.17$, $SD=697.17$) than when it was impersonal ($M=1613.31$). There was also a main effect of story, $F(1,164)=13.24$, $p < .001$, with story “Break” having a mean response time of 1453.21, SD 670.77, and “Food” story taking significantly longer $M=1646.68$, $SD=805.12$. There was no main effect of response valence (yes/no), $F(1, 164) = 3.15$, $p = .08$, with yes $M=1457.21$, $SD=702.87$, no $M=1632.27$, $SD= 775.35$

There was also an interaction between response valence (yes/no) and story, (values in Table 20) $F(1, 164) = 11.4$, $p < .001$. It appears that participants were very quickly able to tell that the scenario in the “break” story caused the misfortune, and that this drives the effect.

There were no other two-way interactions (all $p > .2$).

Discussion:

The results of this study remain ambiguous. Overall, participants were faster to reason about agents than about impersonal forces, and when participants made mistakes, which were rare, they were more often about impersonal forces than about agents.

This advantage for reasoning about agents is in line with our hypothesis and existing findings in the literature, though our specific hypothesis was not supported. We predicted that participants would be slower to reject agents than impersonal forces as the cause of misfortune, and while the data was in that direction, the difference was not significant. This may be because reasoning about agents is easier than reasoning about impersonal forces in general, which may disguise the effect of interest.

Study 2 (Misfortune- Memory)

Rationale

We hypothesize that people should have an intuitive understanding that agents can and do cause things to happen in the world, and particularly that misfortune is easily understood as being caused by an agent, as opposed to an impersonal force. In Study 1 we examined this through a reaction time methodology, in an attempt to tap into intuitions. Attempts to redesign this general methodology were met with difficult to resolve impedances. An alternative way to examine the

hypothesis is through a memory methodology, where we would expect agent-caused misfortunes to be better remembered than non-agent caused misfortunes. Such a result is expected based on our hypothesis, but also because previous studies have found an advantage for agency. For instance, Mesoudi, Whiten, & Dunbar (2006) found a transmission advantage of social information over asocial information, which is in line with our agency hypothesis. Therefore, we will also examine non-misfortune stories, caused by agents and non-agents. We expect that the agent caused positive events will be better remembered than non-agent caused positive events, as in previous studies, but that the effect will be stronger for the misfortune events.

Materials:

All participants will read a similar story, with the following introduction:

There was a woman named Sarah who lived in a pretty little house with her husband and two children, whom she loved very much. They had a small farm and were able to support themselves off of what they grew. Sarah was happy and content.

One year, the rain stopped coming, and the crops stopped growing, and Sarah and her family grew hungry. All of her neighbors were in the same situation and couldn't help each other. Sarah made the difficult decision to leave her house and her land behind, and go with her family to try to find a way to survive. They packed a few belongings, and started walking.

On Sarah's journey, many different things happened.

The introduction is followed by 8 different events, 4 of which are misfortunes, 4 of which are positive. Of the 4 misfortunes, 2 are caused by an agent and 2 are caused by an impersonal force. Of the 4 positive events, 2 are caused by an agent and 2 are caused by an impersonal force. For instance, one story set contains the following events:

Misfortune Impersonal (MI): While she was walking, a root tripped her, and she fell down and broke her wrist.

MI2: Sarah went to a doctor, but she didn't get any help because the doctor was out of medicine.

Misfortune Agent (MA) Sarah asked for food at the next village, but her family went hungry because the people in the village would not share with her.

MA2: Villagers were standing on a cliff, throwing rocks into the road. A rock hit Sarah in the head and made her bleed.

Positive Impersonal (PI): Sarah was very cold. The sun started shining brightly on Sarah, and she felt warm again.

PI2: Sarah was so hungry she thought she would die, but then luckily she found some berries. It wasn't much, but it was enough to keep going.

Positive Agent (PA): Things were very grim and Sarah felt sad, but when she was walking, other travelers starting singing and she felt cheered.

PA2: When she went to the next village, there was a big celebration and the people gave her family a little food to share.

There are a total of 4 story sets to ensure that there is nothing special about the chosen stories that might explain an effect. Story set A is presented above. In Story set B, the same events occur, but if in story set A the event was caused by an agent, in Story set B, the event is caused by an impersonal force, and vice versa. For example, story set A contains the Misfortune Impersonal event "While she was walking, a root tripped her, and she fell down and broke her wrist." Story set B contains the Misfortune Agent event "While she was walking, a man shoved her, and she fell down and broke her wrist." In all cases, the event is described in an equal number of words.

Story sets C and D are also symmetrical in regard to agent/impersonal cause, but are completely novel events. All story sets can be found in the Appendix C.

Design and procedure

Participants are informed that this is a study about how people remember stories. After reading the same introduction, participants read one of 4 different story sets, each containing 8 events. After reading the same conclusion, participants perform a distraction/attention check task. They are then informed that the study is about memory for story events, and they will be asked to remember as many events as possible. They are then told that if they are in the top 25% of participants for memory, they will receive a bonus. They are given a form to fill out, with space for information about the introduction, a line for each story event "Story Event 1: _____" an area for bonus events and conclusion. The participants then fill out a demographics section, including a 6-item intrinsic religious scale.

Results

195 participants (111 male, 84 female) were recruited from the United States via the Amazon Mechanical Turk Website. Participants were between the ages of 18 and 77, with an average age of 36.29, $SD=12.81$. However, 16 participants were dropped due to answering one of the distraction/attention check questions incorrectly, where the participant had to indicate where a specific item was in a visually similar field and another 4 were dropped for answering a distraction task question more quickly than was possible (under 10 seconds), and another 5 were dropped because they did not remember any of the 8 items that they had read. This left 170 participants (93 male, 77 female) between the ages of 18 and 77, with an average age of 37.6, $SD=13.14$.

Memory performance

Of the 8 items that participants read, they remembered an average of 5.66 stories, $SD=1.78$, with 4 participants remembering only 1 of the items and 28 participants remembering all 8 items.

We looked at the memory results by item, using the percentage of participants who remembered the items as the DV. These may be found in Table 21.

A repeated measures ANOVA was run, with agency as the within subject measure (2 levels: agent or impersonal, with story item as “subject”) and misfortune (2 levels: negative or positive) as a between subject measure, and percentage of participants who remembered the story as the dependent variable. There was a main effect of misfortune $F(1,14) = 19.38$, $p < .001$, $\eta_p^2 = .58$ with negative events being better remembered ($M= 80$, $SD = 9$) than positive events ($M=62$, $SD=11$), 95% CI [.1, .25] and a main effect of agency $F(1,14) = 5.5$, $p = .03$, $\eta_p^2 = .28$ with stories caused by agents ($M=75$, $SD=14$) being better remembered than stories caused by impersonal forces ($M=68$, $SD= 13$), 95% CI [.01, .13] but no interaction between the two $F(1,14) = .006$, $p = .94$.

(A participant level analysis was not possible as there was not a true scale with only 2 items per cell.)

Study 3: Misfortune and MCI/normal agents- Memory

Rationale

Following up on study 2, in which agents or impersonal forces cause good or bad things to happen to a character in a story, in this study, we pit MCI agents against intuitive agents causing good or bad things to happen. We hypothesize that MCI-negative events will be more memorable than MCI-positive events, and that intuitive negative events will be more memorable than intuitive positive

events. Intuitive negative events should be less memorable than MCI negative events, but no difference is expected between intuitive negative and MCI-positive.

Context may also be relevant here in a few ways. The events in the story can be framed as a matter of survival, which may enhance certain types of processing and memory. A popular paradigm involves inviting participants to imagine themselves in a survival scenario and then having them rate words based on the relevance or usefulness of the words in that survival situation. A control group rates words based on their pleasantness or performs some other deep processing task without imagining a survival scenario. In a surprise memory task, participants who were in the survival priming condition are found to remember words better than in the pleasantness/other control condition (Kang, et al., 2008; Kazanas & Altarriba, 2017; Nairne & Pandeirada, 2008, 2010; Nairne, et al., 2007; Soderstrom & McCabe, 2011; Weinstein, et al., 2008) but see (A. C. Butler, et al., 2009). Furthermore, the greater the threat, the greater the memory advantage (Olds, et al., 2014).

Therefore, we will also vary the threat level of context in which the MCI, intuitive, negative, and positive events take place.

If MCI concepts gain some of their memory advantage from the difficulty in incorporating them into the predictive framework, this may be at least partially disrupted when MCI concepts and ideas are normalized by the story context. When the story context sets the reader up to expect unusual things, the memory for MCI items is reduced compared to readers who were set up to expect standard things (Upal, 2005).

Therefore, one of four contexts will be randomly assigned. The contexts are designed to manipulate if the participants expect MCI content and if there is a survival context. Thus, the contexts are 1) MCI, survival context 2) MCI, non-survival context, 3) Intuitive, survival context, 4) Intuitive non-survival context.

Following (Boyer & Ramble, 2001) each of the 4 cells have 6 items. First, the participants read one of 4 introductions (Survival-MCI, Non-survival-MCI, Survival-normal, Non-survival-normal). The main part of the story are 24 short events, describing a person in the form "There is a person who could ____" followed by a sentence describing how the person used that ability to either help or hurt the main character, Sarah. Each participant read about 12 people with MCI and 12 people with Intuitive abilities. In each category, six of the people help Sarah and six people hurt Sarah. The order of the stories is randomized.

Furthermore, for each person described in the story, there is a between subject control, where some participants will read about the person helping Sarah and other participants will read about the person harming Sarah.

Materials

Contextual information

Survival, MCI context: Sarah was a young woman, living a normal American life. She worked 9-5 and spent time with friends. One weekend, she went hiking in the mountains alone and came across a strange little hut. Inside, she found a door that opened into a different, magical world. Strangely compelled, she stepped through the door and found that there was no way back! She was scared, all alone in a new and strange place, with no friends, money, food, and only a small water bottle.

Non-survival, MCI context: Sarah was a young woman, living a normal American life. She worked 9-5 and spent time with friends. One weekend, she went hiking in the mountains alone and found a strange little amulet. Strangely compelled, she held it up to her heart and found it that could take her into a different, magical world. She could go there and back whenever she wanted to, using the amulet. She had water, food, survival supplies, and was excited to explore this new and strange place.

Survival, normal context: Sarah was a young woman, living a normal American life. She worked 9-5 and spent time with friends. One weekend, she went hiking in the mountains alone and got lost. She was out in the middle of nowhere and became totally disoriented in a fog and didn't know how to find her way back. She kept moving and consumed all her supplies. When the fog lifted, she was scared, all alone in a new and strange place, with no friends, money, food, and only a small water bottle.

Non-Survival, normal context: Sarah was a young woman, living a normal American life. She worked 9-5 and spent time with friends. One weekend, she went hiking in the mountains alone. She had studied maps of the area and was looking forward to seeing the different landmarks and type of landscape. She packed a lot of food and water and survival supplies and went out to see someplace she had never been. She was excited to explore this new and strange place.

On her journey, she encountered many people and creatures. Please read these events carefully.

Agents

Participants were then presented with information about 6 of each of the following types of agents: Nice MCI Agent, Nice Intuitive Agent, Mean MCI Agent, Mean Intuitive Agent

The full list of agents and events may be found in Appendix C.

Design and Procedure

Participants (N=200) are recruited from Amazon Mechanical Turk. Participants are instructed to read carefully as they will have to answer questions later on.

Participants are randomly allocated into 1 of 4 story conditions (Survival-MCI, Non-survival-MCI, Survival-normal, Non-survival-normal).

Participants are then randomly allocated to receive 1 of 2 possible sets of stories. All participants read 24 short events, describing a person in the form “There is a person who could _____” followed by a sentence describing how the person used that ability to either help or hurt the main character, Sarah. Each participant read about 12 people with MCI and 12 people with Intuitive abilities. In each category, six of the people help Sarah and six people hurt Sarah. The order of the stories is randomized. For each person described in the story, there is a between subject control, where some participants will read about the person helping Sarah and other participants will read about the person harming Sarah.

Participants are given a 2 minute math task, in which they receive a bonus for answering 20 simple math questions correctly in the time allotted. After 2 minutes, they are forced to continue to the next section.

The participants are then informed that they will receive a bonus if they are in the top half of participants for memory. They are given a form to fill out, asking them to remember as many of the 24 characters as they can. The form is in the format: “There was a person who could _____” Did this person help or hurt Sarah? How?

Finally, the participant will fill out a demographics and religious inventory, before moving on to complete an unrelated task for another experiment.

Coding

The memory was coded as correct if the participant correctly remembered what the person could do, without requiring the memory to be correct in valence or in terms of how that ability was used.

More specific answers were accepted, as long as they alluded to the ability, while vague answers were generally coded as incorrect. However, when the response was potentially correct but the ability was ambiguous, such as “used magic” and then the second part of the answer was used to differentiate. If in telling what the person specifically did that helped or hurt Sarah, the participant revealed their correct memory for the ability, this was accepted. See Table 22 for examples.

Results

203 participants (107 male, 96 female) were recruited from the United States via the Amazon Mechanical Turk Website. Participants were between the ages of 18 and 70, with an average age of 35, $SD=11.64$. However, 22 participants were dropped because they did not remember any of the 24 items that they had read and one more was dropped for not answering at least 3 simple addition problems in 2 minutes. This left 180 participants (96 male, 84 female) between the ages of 18 and 70, with an average age of 34.82, $SD=11.51$

Memory performance

Of the 24 items that participants read, they remembered an average of 8.87 stories, $SD=5.56$, with 4 participants remembering only 1 of the items and 7 participants remembering all 24 items.

(Memory was thus slightly worse than in the Boyer & Ramble, 2001 study on which this is based. The students in that sample remembered an average of 10.22 stories, $SD = 3.56$).

We looked at the average number of events remembered in each category (out of a possible 6). This may be found in Table 23 and is depicted visually in Figure 11.

A mixed, repeated measures ANOVA was run, with score out of 6 stories as the dependent measure, with (2 levels: MCI vs Intuitive) x (2 levels: negative or positive) as the within subject measure and introduction (4 levels: Survival-MCI, Safe-MCI, Survival-Intuitive, Safe-Intuitive) and religion as between subjects. There was a main effect of MCI $F(1,172) = 119.5$, $p < .001$, $\eta_p^2 = .39$ with MCI agents being better remembered ($M=2.64$, $SD = 1.64$), 95% CI [2.47, 2.81] than intuitive agents ($M=1.8$, $SD=1.67$), 95% CI [1.63, 1.97] but no main effect of valence $F(1,172) = 0.12$, $p = .73$, no main effect of religion $F(1,172) = .005$, $p = .94$, and no main effect of introduction $F(3,172) = .72$, $p = .54$. There was also one interaction, between MCI and introduction, $F(3, 172)=3.33$, $p=.021$, $\eta_p^2 = .39$

Post-hoc examination revealed that despite this interaction, in all introduction conditions, MCI agents were better remembered than Intuitive agents, with the greatest difference in mean responses between the Safe-Intuitive introduction (Mean difference=1.2) and the survival-Intuitive condition (mean difference = .54), and participants who read the safe-Intuitive introduction also

had the highest overall memory scores ($M=2.37$) out of 6. The details may be found in Table 24 and is depicted visually in Figure 12.

Additionally, an analysis was performed with the story agent as the within-subjects variable, looking to see if the negative or positive action influenced the number of participants who remembered that agent. A paired- t -test confirmed the findings from the above ANOVA that there was no effect of valence, $t(23)=0.3$, $p=.76$, Negative $M=33.5$, $SD=8.13$, Positive $M=33.08$, $SD=9.66$

Study 4: Misfortune and normal agents- Memory

Rationale

Following up on Study 3 (Misfortune04), in which MCI agents and intuitive agents cause good or bad things to happen, in this study, we look to see if the intuitive agents show a main effect for valence in the absence of the MCI agents. We hypothesize that the negative actions by the agents will make them more memorable than the positive actions and that the threat context will enhance this effect.

Therefore, one of two contexts will be randomly assigned: 1) Intuitive, survival context, 2) Intuitive non-survival context.

First, the participants read one of two introductions: (1) Intuitive, survival context, 2) Intuitive non-survival context). The main part of the story is 12 short events, using all of the intuitive items from Study 3 (Misfortune04).

Furthermore, for each person described in the story, there is a between subject control, where some participants will read about the person helping Sarah and other participants will read about the person harming Sarah.

Materials

Materials were the same as in the previous study, though all MCI materials were removed.

Design and Procedure

New participants ($N=147$) were recruited from Amazon Mechanical Turk and perform the same tasks as in the previous study, without the MCI items or introductions.

Results

147 participants (72 male, 75 female) were recruited from the United States via the Amazon Mechanical Turk Website. Participants were between the ages of 21 and 69, with an average age of 35.5, $SD=11.04$. However, 12 participants were dropped because they did not remember any of the 12 items that they had read. This left 135 participants (69 male, 66 female) between the ages of 21 and 69, with an average age of 36.01, $SD=11.30$

Memory performance

Of the 12 items that participants read, they remembered an average of 6.09 agents, $SD=3.3$, with 7 participants remembering only 1 of the agents and 11 participants remembering all 12 agents. (Memory was thus slightly better as a percentage of stories remembered, though slightly worse as a raw score than in the Boyer & Ramble, 2001 study on which this is based, though they had more stories to remember (24). The students in that sample remembered an average of 10.22 stories, $SD = 3.56$). This is also slightly better as a percentage of stories remember than the last study, though very close, and slightly worse as a raw score.

We looked at the average number of agents remembered in each category (out of a possible 6). See Table 25.

There was a no difference in the scores for the negative versions of the sentences ($M=3.04$, $SD=1.81$) and the positive versions ($M=3.04$, $SD=1.7$); $t(11)=0$, $p = 1$.

We also examined the results using a within subjects design, by giving each participant a score to reveal if each individual remembered more positive or negative agents, calculated by giving them +1 point for each negative agent they remembered and giving -1 for each positive agent they remembered. This resulted in a mean score of 0 ($SD=1.18$). A one sample t-test revealed no difference from 0, $t(134)=1$ ($CI -.20:.20$) indicating no memory preference for positive or negative agents. See Figure 13.

Though we were primarily interested in whether the agent would be remembered, we also asked participants if the agent they remembered had helped or hurt the protagonist. As described above, the participants remembered an equal number of agents who had actually helped and who had actually hurt the protagonist, but participants showed a positivity bias in their memory of the agent's behavior. For example, in one of the stories, there was a person who could make medicine from plants. In the positive version of the story, the potion made the protagonist strong and in the negative version of the story, the potion made the protagonist weak. While most participants

remembered the agent and the event correctly, a number of participants remembered the agent who could make potions, but misremembered the valence as being positive (incorrectly remembering that the agent had made her a medicine to get well instead of correctly remembering that the potion made her weak). The individual scores based on the participants' reports of the valence of their memory, rather than whether they were correct or incorrect, were calculated the same way as above, with one point for every negative event that they remembered and -1 point for every positive event that they remembered. The mean score was $-.44$ ($SD=1.64$). A one sample t-test revealed this to be significantly less than 0, $t(146)=-3.2$, $p<.01$, and therefore significantly positively biased. See Figure 14.

We also looked to see if there was any effect of introduction or of religiosity. See Table 26 for the religion and mean valence scores and Table 27 for the introduction type and valence scores.

An ANOVA was run, with individual memory valence as the dependent measure and religion and introduction as between subject variables. There was no effect of introduction $F(1,131)=.34$, $p=.56$, or of religion $F(1,131)2.06$, $p=.15$, nor was there any interaction $F(1, 131)=1.4$, $p=.24$.

There was no effect of gender, age, education level or income, all $<.25$.

General Discussion

The combination of these 4 studies reveals a more complicated picture of the interactions between misfortune, minimal counter intuitiveness, and agency than hypothesized. While there is evidence that each element may contribute to ease of causal reasoning and/or to memory, it remains to be determined when these effects occur alongside one another or provide in additional effect. Future research may examine the difference between agents that are inherently agents of misfortune and agents that may choose to use their powers for good or ill. Further, it may be that these studies should be replicated in places with real ongoing threat, as the online participants may not be invested or moved by the threats presented here. This is still an important finding as it speaks to the boundary conditions of when witchcraft beliefs are likely to arise and/or become stable. If witchcraft beliefs are natural, they may only be natural under circumstances that truly arouse fear.

Conclusion

Summary and possible connections

The preceding chapters are intended to suggest that there are cognitively natural aspects to the belief in witches as an explanation for misfortune. Existing work in the cognitive science of religion, such as agency detection, attractors in story transmission, death priming, and intuitive beliefs about ritual efficacy all can potentially contribute to witchcraft beliefs. The threat perception literature contributes to this understanding, showing that negative information is particularly powerful and persuasive and has many effects that can potentially promote witchcraft beliefs in individuals and in a culture. Finally, the impact of coalitional psychology cannot be overstated. Coalitional attentions and motivations make witchcraft ideas particularly powerful and difficult to reject in a social context.

To this existing research, we contributed the preceding papers, showing additional aspects of natural cognition that may contribute. We see that there may be reputational benefits for people who share threat information, such that they are seen as more competent and better partners than people who share other sorts of information. This may motivate and contribute to the spread of witchcraft ideas, in as much as those ideas are seen as relevant and believable threat information. However, in a paper that was not included here, we also saw that the motivation to transmit threat information is not consistent (van Leeuwen, Parren, Miton, & Boyer, 2016). This may actually help explain the results of papers one and two, in that threat information is not generally spread to just anyone, but more to close friends. This tendency may be reflected in the positive evaluations that participants had about sources of threat information. It may be that since people tend to be sensitive about with whom they share threat information, when someone does share threat information, it could serve as a positive signal about the relationship that the receiver can tap into.

Future studies may look more at the connections between these findings, especially as it may help reconcile the apparently contradictory findings in the transmission of threat related information literature. In some studies, threat seems to provide a transmission boost, such as a study of retweets on (Twitter) where threat information seems to be particularly powerful as a predictor of transmission, with threat content being transmitted three times as often as non-threat content (Altshteyn, 2014). However, in other studies, positivity is privileged. For example, New York Times articles are emailed more often if they arouse positive affect, rather than negative (Berger & Milkman, 2012). Our own work shows similarly mixed results in hypothetical face-to-face interactions.

These three papers differ in a number of ways, making it difficult to untangle the causes of the results from an armchair. However, it seems clear that context matters and in particular, the relationship between the transmitter and the receiver of the information matters. In the Twitter study, people who retweeted information were putting it out into the world fairly indiscriminately, to all of their followers and random digital passersby. In contrast, emails from the New York Times tend to go to one person, as though to say, “this in particular made me think of you in particular.” We hypothesize in our paper that spreading threat information may be a social support recruitment strategy for people, particularly for people who are low in social support or coalitional safety. If this holds, it may be that when people are using threat information to boost their own reputation, they prefer to cast a wide net. However, in our study, the people who shared the threat related information did not have the option of sending it to multiple recipients. This is worth following up on as reputation may be managed by showing everyone, not just the people vulnerable to the particular threat, that the sender cares about the safety and wellbeing of others. Even if the goal is to impress someone who lives in the city, for example, I might still tweet about a danger particular to living in the countryside. By doing so, I plausibly reach an at-risk audience, while signaling my care and consideration for my followers in general, and thus possibly improving my reputation with the city dweller. This would not be a possible strategy when sending threat information directly. In the emailing of news pieces, the sender would have to individually evaluate the risk of the recipient and the closeness of their personal relationship to determine appropriateness. A positive story would perhaps be sent more frequently because it need not directly relate to the recipient and the threshold for closeness of the relationship may be lower for positive information. Clearly, further work is needed to test these suggestions.

This discussion and our research about the specific ways in which sharing threat information can boost reputation via perceived competence fits into a larger literature on reputation and social status management, including around religious belief and prosocial tendencies in particular. For example, it has been proposed that evidence of a sincere belief in the same or similar morally-concerned Gods may be used to infer a stranger’s prosocial intentions, even in the absence of direct reputational information (Norenzayan & Gervais, 2012). Participants in experimental trust games tend to trust religious people more than others, especially if they are religious themselves (Tan & Vogel, 2008). This type of moralizing high god is often not present in societies with strong witchcraft traditions, though they also co-exist with a great deal of frequency. People also tend to actually be quite cooperative in these sorts of trust games and it has been argued convincingly that this uncalculating

cooperation is also used as a reputation enhancing signal of trustworthiness (Jordan, Hoffman, Nowak, & Rand, 2016).

This is also directly related to the concepts of defector punishment and third-party punishment in the study of the evolution of cooperation. Free-riding, such as taking from a communal pot without putting something in, needs to be deterred for the defense of a cooperative society or network. However, punishment itself can be costly compared to letting someone else in the group do the punishing of the defector. Particularly interesting then is the finding that people punish selfishness in cooperation games, even when that selfishness does not directly negatively affect them. This difficulty seems to also be managed by reputational means, by which the third-party punisher gains credibility as a good and unselfish partner themselves, leading to a net gain (Jordan, Hoffman, Bloom, & Rand, 2016).

Witchcraft can also be looked at in this way, and indeed, Evans-Pritchard and other anthropologists proposed that witchcraft accusations may be a way to punish non-cooperative members of a community (Evans-Pritchard, 1937). Witchcraft accusations may be partly sparked by reputationally motivated desire to see one's own mistakes as someone else's fault and/or by a tendency to see agency behind misfortune, but the piling on by others may be more a matter of cooperative signaling. As mentioned in the introduction, by not standing against an accused witch, a community member may be seen as a witch sympathizer or a witch themselves, with disastrous social consequences. By condemning the accused, the community member potentially signals that they are a good member of the group and would not cheat the system.

Interestingly, recent research in rural China has provided evidence against the claim that accused witches are non-cooperative members of society (Mace et al., 2018). Accused witches were socially ostracized but also formed networks of support with other accused witches and their families. In cooperation and trust games, these accused witches were as cooperative within their own networks as were the members of the non-accused broader community. This led the authors to conclude that witchcraft beliefs do not serve a function in promoting prosociality, but rather are about managing interpersonal issues related to things such as jealousy or spite. However, as Jillian Jordan pointed out in her review of the study, it seems that some of the villagers did not believe that the accused witches were actually threatening, but rather avoided them out of social fear or condemned them in order to signal their own status as someone not accused (Jordan, 2018). Though this study came out after I had described the possible chain of cognitively natural events that could lead to the stabilization of witchcraft beliefs, the new data fits neatly within the model. People may stand with the accuser rather

than the accused for reputational reasons as well as credulous ones. Given the importance of reputation and social support in human societies, it should come as no surprise that issues of reputation management are relevant at numerous places along the witchcraft accusation timeline.

We also looked at the role of source tracking in the promotion of belief, given that people do tend to transmit things that they themselves believe. Contrary to our expectations, in variations of the traditional truth effect paradigm, source information did not have an effect. It may be that these studies were still too far removed from usual communication to bear much application. For instance, if people are really gossiping, source tracking may be much more salient than when discussing irrelevant trivia. However, it is worth considering the possibility that this truth effect could play out in witchcraft accusations, with a few loud, repetitive voices having a disproportionate effect. This indeed may be the case especially if speaking against those voices risks being seen as siding with malevolent forces. Future research should look at more ecologically valid cases.

In our final set of studies, we looked more closely at the type of threat information that is more closely related to witchcraft rumors, with the combination of agency and misfortune and minimal counter intuitiveness. If misfortune is more easily understood as caused by an agent and such explanations are better remembered than alternative accounts, it may help explain why witchcraft beliefs are so powerful and widespread, even when there are competing biological explanations provided. Minimally counter intuitive agents are also better remembered than intuitive agents, though it is unclear how this relates to threat or misfortune.

Put together, these findings begin to sketch a possible chain of motivations and propensities that lead to the stabilization of witchcraft beliefs. When a misfortune occurs, as they so often do, people seek explanation. Explanations that come to mind quickly and automatically may often involve an agent as a causal force. Such explanations may then be the only ones that are proposed, or they may compete with alternatives. If someone hears both an agentive explanation and a non-agentive explanation, they are more likely to remember the agentive one. Agents are also better remembered if they are minimally counterintuitive, as opposed to intuitive, as is the case in witchcraft explanations. While these may not be additive effects, one may act as a failsafe for the other.

It is not clear what would motivate that person to share the explanation for the misfortune (the threat information that a minimally counterintuitive agent caused a bad thing to happen.) It may be

that the topic is salient in local communities and comes up naturally and easily and is thus not pitted against positive information in the same way it was in paper 3. If so, the person would share the explanation they remembered, the agentic explanation, and it seems particularly likely that they would share that information with friends. This act of sharing threat information may actually serve to strengthen the relationship or establish a connection, as suggested by the results reported in papers 1 and 2. This strengthening of relationships may itself be a motivating factor in the spread of threat information, though that remains to be established. This chain may then repeat, with the recipient again being more likely to remember the agentic explanation and then more likely to pass it on themselves. In such a way, and in combination with the other aspects of religious, threat, and coalitional cognition described in the introduction, witchcraft beliefs may become stable under the right conditions.

Limitations and Future Directions

Of course, there is a lot of work to do to establish that this proposed chain resembles the way witchcraft ideas spread, both in terms of further experimental work, but also in on-the-ground observation. We will look first at some of the next steps for our experimental work, closely related to the current projects, before looking at how these studies can come to have a closer relationship to one another and to real world observations. First, however, it is worth addressing some general points about the approach to research used here.

As is clear from the above summary and the body of the dissertation, the topic of “cognition and witchcraft” is very wide ranging. This has both advantages and disadvantages. Just about any page or paragraph of this work could have been expanded to be an entire dissertation, but I made the decision to attempt to tackle a broad topic. This necessitated less depth of engagement with some of the singular particularities. This was the case even of the most experimentally thorough of our investigations. In the case of our first papers, looking at the way that threat information may provide a reputational boost, we tried out a number of different controls and alternative hypotheses based on our intuitions and on feedback from colleagues about the most plausible objections to our formulation. However, this approach perhaps suffered for being limited in scope. There is additional work and literature that suggests other alternatives and formulations that we could use to follow up with to improve the rigor of our exploration of alternatives to our hypothesis. Future work may allow for such an expansion, though we may also hope that other interested parties may challenge our research with their own. Overall, the research presented here

has attempted to serve as an interdisciplinary approach to a cross-cultural phenomenon but this could and should have been done more thoroughly.

Perception of sources of threat-related information

The studies on the perception of sources of threat-related information provide what we believe to be a good foundation for understanding the possibility of a reputational motivation for the transmission of such information. However, they are just that; foundations and suggestions of possibility. There is a lot to do to fully establish the connection between the findings of our two papers and the cognitive naturalness of witchcraft. There are many ways to expand, but in particular, I would like to extend the range of participants and the type of threat information. Our studies looked at professional relationships and discussion of different types of products and experiences. This had a number of advantages, including a clear delineation of the roles and motivations of the transmitter and target of the information, relevance and familiarity to participants from the United States. However, it will be necessary to establish that our results extend beyond these parameters.

One particularly interesting avenue would to examine the perception of sources that share threatening social information as opposed to other negative or neutral social information. This presents challenges in terms of establishing believability and convincing social relationships in an experimental context. Consider the difference between someone sharing product threat information and social threat information. There is little reason to lie about a product's flaws. Sharing a social threat, on the other hand, could more easily be construed as for the speaker's benefit. Perhaps they have something personal against the other person or place. Furthermore, by gossiping, or being perceived as a gossip, they may signal that they are a potential threat too. Despite these challenges, it will be an important avenue of investigation, as gossip is a central feature of human cooperation and also more closely resembles the type of threat information that is shared in witchcraft discussions. One possible approach is to design materials similar to those in papers one and two, but with a longer narrative to explain the context. Participants may be asked to imagine that they are moving to a new city, where they already have two friends. The two friends do not know each other, but share information, including social information, about the new town directly to the participant. Between the friend who shares threat information and the one who shares equally useful negative or neutral social information, which friend will the participant consider more competent or concerned for their welfare?

Threat information can come from many sources and be about many different things. Eventually, I would like to test a wide enough range that we can be confident that the findings from studies 1 and 2 are generalizable, or so that we can be clear about the boundary conditions of the phenomenon. Additionally, it would be particularly helpful to recruit a wider, cross-cultural sample. It will be especially important to test the perception of sources of threat information of more extreme types with a sample that has real life experience with the regular presence of life-threatening risks.

Transmission studies

As with the TRI studies, the transmission studies described above (not included in this dissertation) provide an important step forward on a long road. One of the key contributions in these studies is also one of the key limitations. Our transmission studies show clear evidence that the target influences transmission intentions. We are, of course, not the first to demonstrate this but it is a factor that is often missing from similar studies. However, while we included target, the context was neither terribly believable nor was the information particularly relevant. Amazon Mechanical Turk was again a good place to start, but future studies would benefit from more naturalistic settings and topics, both in areas of low-threat and particularly in areas where threats and threat information are more central to everyday life.

Another approach I would like to take would also help us draw a closer connection between the first two papers and other transmission work. One advantage of the materials we used in the first two papers was the grounded and clear relationship between the transmitter and the recipient of the information. However, we have not yet reversed the roles using those same materials. I would like to use the product descriptions from the first two papers, but instead of asking which source is more competent or a better partner, put the participant in the role of the transmitter and ask which information they would choose to use in their materials if it was their company or product. If the participants choose to generally transmit the non-threat related information to strangers and acquaintances, as was their inclination in some of our other transmission studies, it would be very helpful information in understanding the dynamics at play. Such a result would lend credence to the suggestion that participants see threat information as a signal of a close and trusted relationship, particularly as they wouldn't make the same transmission decision to strangers or mere acquaintances. Alternatively, if the participants generally are motivated to transmit the threat information, it would be a suggestion that we should turn our attention to the different types of threat information and relationships between people in order to understand why sometimes threat is transmitted and sometimes not.

Further, the mixed results of the social provision scale and connection to threat transmission found in that paper is intriguing. Low social provision among men was correlated with a higher transmission rate of the threat information in study 3, though this was not the case for women, and no such results were found in study 4 using very different materials. This may have just been a statistical fluke, but further investigation is merited. First, we need to use the social provision scale in studies that have a clearer relationship between the participant and the recipient of the transmitted information, with clear relevance of the threat information. Additionally, and in particular, I would like to extend the research to include people who rely on one another in a more thorough way. When people work directly and cooperatively with their fellows for their basic survival, what sort of transmission decisions would they make?

Misfortune and Agency

The misfortune, agency, and minimal counter intuitiveness paper is perhaps the most closely related to the content of witchcraft related rumors. In support of other literature, we found that agency, minimal counter intuitiveness, and negativity can be privileged either in speed of reaction, or in memorability. The possible interactions between these main effects remain to be further explored, but for now, it seems that they are not additive privileges as we had suspected they might be, at least for an MTurk population. This population provides a strong test and should there have been an interaction between agency/negativity/MCI content for people in the United States living in relative safety, it would have spoken to how deep the interaction lies in human nature. Given that this was not what we found, there remain a number of different possibilities. It may be that in all populations, agency, MCI, and negativity only provide so much of a memory boost, and no more. It may be that good witches are just as catchy a concept as bad witches, and indeed, witch doctors, medicine magic, and benevolent deities are also widespread. It may also be, however, that the felt/experienced levels of threat must be high enough or real enough to trigger an interaction effect. It would be possible to look at this by investigating different populations or by using a paradigm that invites the participant to imagine themselves in the scenario, rather than read about someone else. I would also like to look more closely at the different stages of rumor transmission and see where misfortune and agency have an effect and where they do not. Our strongest evidence comes from memory, which is clearly an essential element of transmission, particularly in oral cultures. However, we would like to look more at how the ideas are produced and when/if agency explanations seem more plausible than others and how ambiguous causality is spread or maintained.

One method will to examine the hypothesis is through the serial reproduction methodology pioneered by Bartlett, (1932) and more recently used by others to examine cultural topics related to our hypothesis. Mesoudi, Whiten, & Dunbar (2006) found a transmission advantage of social information over asocial information, which is in line with our agency hypothesis. Miton, Claidière, & Mercier (2015) used the transmission methodology to explain cognitive advantages for bloodletting practices, which, like witchcraft beliefs, are widespread but not scientifically supported. Eriksson & Coultas (2014) found that disgusting stories had an advantage and Bebbington et al. (2016) found that negative stories have an advantage over positive stories, which is interesting in terms of understanding the transmission of misfortune stories. While these studies are promising and suggestive, it remains to be seen specifically if negative information is preferentially transmitted when caused by an agent. There are two different ways of examining this possibility. First is the relative rate of faithful transmission of unambiguous events, and second is the transformation of ambiguous events. We predict that negative events caused by agents will survive better than negative events caused by impersonal forces and that negative events that are ambiguous in what caused them will be resolved to be attributed to agents over the course of a transmission chain. Furthermore, this research will benefit from more precision in terms of what constitutes MCI concepts and contexts. This will expand the research project considerably, which may prove

Fieldwork

In addition to a great deal of experimental work that needs to be done, ideally we should supplement such work with fieldwork and observational studies. It would be very interesting to go back to South Africa and to map the epidemiology of particular witchcraft rumors and accusations. Who spreads such information to whom and how do those people feel about one another? What are the stressors in the lives of people who transmit witchcraft rumors? How much social support do they have and how much do they need? Situating our experimental data with a wide variety of participants within a clearer map of the real life phenomenon would be incredibly beneficial.

Final Thoughts

In sum, I believe that witchcraft is an exciting and under-researched topic in cognitive science circles. There is a broad and suggestive set of findings from the cognitive science of religion, threat detection, and coalitional psychology literatures. I believe that our studies contribute to the project of understanding how witchcraft ideas arise and become stable in some cultures, under the right

conditions. We are, however, only at the beginning of investigating the various factors that we believe are at play and hope to continue to investigate these issues in the future.

References

- Adinkrah, M. (2011). Child witch hunts in contemporary Ghana. *Child abuse & neglect, 35*(9), 741-752.
- Allport, G. W., & Postman, L. (1947). The psychology of rumor.
- Allport, G. W., & Postman, L. J. (1947). *The psychology of rumor*. New York: H. Holt and company.
- Altshteyn, I. (2014). Evidence for a warning bias in information transmission in social networks.
- André, J.-B., & Baumard, N. (2011). The evolution of fairness in a biological market. *Evolution, 65*(5), 1447-1456.
- André, J.-B., & Baumard, N. (2012). Social opportunities and the evolution of fairness. *Journal of theoretical biology*.
- Arkes, H. R., Hackett, C., & Boehm, L. (1989). The generality of the relation between familiarity and judged validity. *Journal of Behavioral Decision Making, 2*(2), 81-94.
- Ashforth, A. (2001). *AIDS, witchcraft, and the problem of power in post-apartheid South Africa*: Citeseer.
- Ashforth, A. (2002). An epidemic of witchcraft? The implications of AIDS for the post-apartheid state. *African Studies, 61*(1), 121-143.
- Bacon, F. T. (1979). Credibility of repeated statements: Memory for trivia. *Journal of Experimental Psychology: Human Learning and Memory, 5*(3), 241.
- Barclay, P. (2016). Biological markets and the effects of partner choice on cooperation and friendship. *Current Opinion in Psychology, 7*, 33-38. doi: <http://dx.doi.org/10.1016/j.copsy.2015.07.012>
- Barkow, J. H., Cosmides, L., & Tooby, J. (Eds.). (1992). *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*. New York: Oxford University Press.
- Barrett, J. L. (2004). *Why would anyone believe in God?* : AltaMira Press.
- Barrett, J. L., & Lanman, J. A. (2008). The science of religious beliefs. *Religion, 38*(2), 109-124.
- Barrett, J. L., & Lawson, E. T. (2001). Ritual intuitions: Cognitive contributions to judgments of ritual efficacy. *Journal of cognition and culture, 1*(2), 183-201.
- Bartlett, F. C. (1932). Remembering: An experimental and social study. *Cambridge: Cambridge University*.
- Baumard, N., & Chevallier, C. (2012). What goes around comes around: The evolutionary roots of the belief in immanent justice. *Journal of cognition and culture, 12*(1-2), 67-80.
- Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of General Psychology, 5*(4), 323-370.
- Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of general psychology, 5*(4), 323.
- Baumeister, R. F., & Leary, M. R. (1995). The need to belong: desire for interpersonal attachments as a fundamental human motivation. *Psychological bulletin, 117*(3), 497.
- Bebbington, K., MacLeod, C., Ellison, T. M., & Fay, N. (2017). The sky is falling: evidence of a negativity bias in the social transmission of information. *Evolution and Human Behavior, 38*(1), 92-101.
- Begg, I. M., Anas, A., & Farinacci, S. (1992). Dissociation of processes in belief: Source recollection, statement familiarity, and the illusion of truth. *Journal of Experimental Psychology: General, 121*(4), 446.
- Behringer, W. (2004). *Witches and witch-hunts: A global history*: Polity.
- Berger, J., & Milkman, K. L. (2012). What makes online content viral? *Journal of marketing research, 49*(2), 192-205.
- Bering, J. (2013). *The God instinct: The psychology of souls, destiny and the meaning of life*: Nicholas Brealey Publishing.
- Bernard, S., Harris, P., Terrier, N., & Clément, F. (2015). Children weigh the number of informants and perceptual uncertainty when identifying objects. *Journal of experimental child psychology, 136*, 70-81.

- Bigler, R. S., Jones, L. C., & Lobliner, D. B. (1997). Social categorization and the formation of intergroup attitudes in children. *Child development*, 68(3), 530-543.
- Bliege Bird, R., & Power, E. A. (2015). Prosocial signaling and cooperation among Martu hunters. *Evolution and Human Behavior*, 36(5), 389-397. doi: 10.1016/j.evolhumbehav.2015.02.003
- Blumberg, J. (2007, 2011). A Brief History of the Salem Witch Trials, from <http://www.smithsonianmag.com/history/a-brief-history-of-the-salem-witch-trials-175162489/>
- Bogart, L. M., Wagner, G., Galvan, F. H., & Banks, D. (2010). Conspiracy beliefs about HIV are related to antiretroviral treatment nonadherence among African American men with HIV. *JAIDS Journal of Acquired Immune Deficiency Syndromes*, 53(5), 648-655.
- Bond, R. (2005). Group size and conformity. *Group Processes & Intergroup Relations*, 8(4), 331-354.
- Bonhomme, J. (2012). The dangers of anonymity: Witchcraft, rumor, and modernity in Africa. *HAU: Journal of Ethnographic Theory*, 2(2), 205-233.
- Boyd, R., & Richerson, P. J. (1988). *Culture and the evolutionary process*: University of Chicago press.
- Boyer, P. (1996). What makes anthropomorphism natural: Intuitive ontology and cultural representations. *Journal of the Royal Anthropological Institute*, 83-97.
- Boyer, P. (2001). *Religion explained: The evolutionary origins of religious thought*: Basic books.
- Boyer, P. (2003). Religious thought and behaviour as by-products of brain function. *Trends in cognitive sciences*, 7(3), 119-124.
- Boyer, P. (In Prep). Why Do People Try To Explain Misfortune? and, Why do it in terms of agents?
- Boyer, P., & Bergstrom, B. (2011). Threat-detection in child development: An evolutionary perspective. *Neuroscience & Biobehavioral Reviews*, 35(4), 1034-1041.
- Boyer, P., & Parren, N. (2015). Threat-related information suggests competence: a possible factor in the spread of rumors. *PloS one*, 10(6), e0128421.
- Boyer, P., & Petersen, M. B. (2012). The naturalness of (many) social institutions: Evolved cognition as their foundation. *Journal of Institutional economics*, 8(1), 1.
- Boyer, P., & Ramble, C. (2001). Cognitive templates for religious concepts: Cross-cultural evidence for recall of counter-intuitive representations. *Cognitive Science*, 25(4), 535-564.
- Buss, D. M., & Kenrick, D. T. (1998). Evolutionary social psychology.
- Butler, A. C., Kang, S. H., & Roediger III, H. L. (2009). Congruity effects between materials and processing tasks in the survival processing paradigm. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 35(6), 1477.
- Butler, A. C., Stephanie A, Kang, S. H., & Roediger III, H. L., Jeanette. (20092017). Congruity effects between materials and processing tasksDid our ancestors fear the unknown? The role of predation in the survival processing paradigmadvantage. *Journal of Experimental Psychology: Learning, Memory, and CognitionEvolutionary Behavioral Sciences*, 3511(61), 147783.
- Callan, A. (2007). 'What else do we Bengalis do?' Sorcery, overseas migration, and the new inequalities in Sylhet, Bangladesh. *Journal of the Royal Anthropological Institute*, 13(2), 331-343.
- Chaiken, S., Liberman, A., & Eagly, A. H. (1989). Heuristic and systematic information processing within and beyond the persuasion context. In J. S. Uleman, J. A. Bargh, J. S. Uleman & J. A. Bargh (Eds.), *Unintended thought*. (pp. 212-252). New York, NY, US: Guilford Press.
- Claidière, N., & Sperber, D. (2007). The role of attraction in cultural evolution. *Journal of cognition and culture*, 7(1), 89-111.
- Cosmides, L., & Tooby, J. (2005). Neurocognitive adaptations designed for social exchange. *The handbook of evolutionary psychology*, 584-627.
- Cosmides, L., Tooby, J., Fiddick, L., & Bryant, G. A. (2005). Detecting cheaters. *Trends in cognitive sciences*, 9, 505-506.
- Cotter, E. M. (2008). Influence of emotional content and perceived relevance on spread of urban legends: A pilot study. *Psychological Reports*, 102(2), 623-629.

- Crawford, M. T., Sherman, S. J., & Hamilton, D. L. (2002). Perceived entitativity, stereotype formation, and the interchangeability of group members. *Journal of personality and social psychology*, 83(5), 1076.
- Dechêne, A., Stahl, C., Hansen, J., & Wänke, M. (2010). The truth about the truth: A meta-analytic review of the truth effect. *Personality and social psychology review*, 14(2), 238-257.
- Difonzo, N., & Bordia, P. (2007). *Rumor psychology. Social and organizational approaches*. Washington, DC: American Psychological Association.
- Douglas, M. (1966). *Purity and danger; an analysis of concepts of pollution and taboo*. New York,: Praeger.
- Douglas, M. (2013). *Witchcraft confessions and accusations*: Routledge.
- Eisenberger, N. I., Lieberman, M. D., & Williams, K. D. (2003). Does rejection hurt? An fMRI study of social exclusion. *Science*, 302(5643), 290-292.
- Epley, N., Waytz, A., Akalis, S., & Cacioppo, J. T. (2008). When we need a human: Motivational determinants of anthropomorphism. *Social cognition*, 26(2), 143-155.
- Eriksson, K., & Coultas, J. C. (2014). Corpses, maggots, poodles and rats: Emotional selection operating in three phases of cultural transmission of urban legends. *Journal of Cognition and Culture*, 14(1-2), 1-26.
- Esses, V. M., Dovidio, J. F., Jackson, L. M., & Armstrong, T. L. (2001). The immigration dilemma: The role of perceived group competition, ethnic prejudice, and national identity. *Journal of Social issues*, 57(3), 389-412.
- Evans-Pritchard, E. E. (1937). *Witchcraft, magic and oracles among the Azande*: Oxford: Clarendon Press.
- Fandrich, I. J. (2007). Yorùbá influences on Haitian vodou and New Orleans voodoo. *Journal of Black Studies*, 37(5), 775-791.
- Faulkner, J., Schaller, M., Park, J. H., & Duncan, L. A. (2004). Evolved disease-avoidance mechanisms and contemporary xenophobic attitudes. *Group Processes & Intergroup Relations*, 7(4), 333-353.
- Fessler, D. M. (2006). Steps toward an evolutionary psychology of a culture-dependent species.
- Fessler, D. M., Holbrook, C., & Dashoff, D. (2016). Dressed to kill? Visible markers of coalitional affiliation enhance conceptualized formidability. *Aggressive behavior*.
- Fessler, D. M., Pisor, A. C., & Holbrook, C. (2017). Political orientation predicts credulity regarding putative hazards. *Psychological Science*.
- Fessler, D. M., Pisor, A. C., & Navarrete, C. D. (2014). Negatively-biased credulity and the cultural evolution of beliefs. *PloS one*, 9(4), e95167.
- Fessler, D. M. T., Pisor, A., & Navarrete, C. D. (2014). Negatively-biased credulity and the cultural evolution of beliefs. *PLoS One*, 9(4), e95167.
- Fu, F., Tarnita, C. E., Christakis, N. A., Wang, L., Rand, D. G., & Nowak, M. A. (2012). Evolution of in-group favoritism. *Scientific reports*, 2, 460.
- Gerard, H. B., Wilhelmy, R. A., & Conolley, E. S. (1968). Conformity and group size. *Journal of personality and social psychology*, 8(1p1), 79.
- Gershman, B. (2016). Witchcraft beliefs and the erosion of social capital: Evidence from Sub-Saharan Africa and beyond. *Journal of Development Economics*, 120, 182-208.
- Goette, L., Huffman, D., & Meier, S. (2006). The impact of group membership on cooperation and norm enforcement: Evidence using random assignment to real social groups.
- Guthrie, S. E. (1995). *Faces in the clouds: A new theory of religion*: Oxford University Press.
- Harris, P. L. (2012). *Trusting what you're told: How children learn from others*: Harvard University Press.
- Harris, P. L., & Lane, J. D. (2014). Infants understand how testimony works. *Topoi*, 33(2), 443-458.
- Haselton, M. G., & Buss, D. M. (2000). Error management theory: A new perspective on biases in cross-sex mind reading. *Journal of Personality and Social Psychology*, 78(1), 81-91.

- Hasher, L., Goldstein, D., & Toppino, T. (1977). Frequency and the conference of referential validity. *Journal of verbal learning and verbal behavior*, 16(1), 107-112.
- Hastie, R., & Kameda, T. (2005). The robust beauty of majority rules in group decisions. *Psychological review*, 112(2), 494.
- Hawkins, S. A., & Hoch, S. J. (1992). Low-involvement learning: Memory without evaluation. *Journal of Consumer Research*, 19(2), 212-225.
- Hayes, K. E. (2007). Black magic and the academy: macumba and Afro-Brazilian “orthodoxies”. *History of Religions*, 46(4), 283-315.
- Heath, C. (1996). Do people prefer to pass along good or bad news? Valence and relevance of news as predictors of transmission propensity. *Organizational behavior and human decision processes*, 68(2), 79-94.
- Heath, C., Bell, C., & Sternberg, E. (2001). Emotional selection in memes: the case of urban legends. *Journal of personality and social psychology*, 81(6), 1028.
- Henkel, L. A., & Mattson, M. E. (2011). Reading is believing: The truth effect and source credibility. *Consciousness and cognition*, 20(4), 1705-1721.
- Hilbig, B. E. (2009). Sad, thus true: Negativity bias in judgments of truth. *Journal of Experimental Social Psychology*, 45(4), 983-986.
- Hilbig, B. E. (2012). How framing statistical statements affects subjective veracity: Validation and application of a multinomial model for judgments of truth. *Cognition*, 125(1), 37-48.
- Holbrook, C., Sousa, P., & Hahn-Holbrook, J. (2011). Unconscious vigilance: worldview defense without adaptations for terror, coalition, or uncertainty management. *Journal of personality and social psychology*, 101(3), 451.
- Jong, J., Bluemke, M., & Halberstadt, J. (2013). Fear of death and supernatural beliefs: developing a new Supernatural Belief Scale to test the relationship. *European Journal of Personality*, 27(5), 495-506.
- Jong, J., & Halberstadt, J. (2016). *Death Anxiety and Religious Belief: An Existential Psychology of Religion*: Bloomsbury Publishing.
- Jong, J., Ross, R., Philip, T., Chang, S.-H., Simons, N., & Halberstadt, J. (2017). The religious correlates of death anxiety: A systematic review and meta-analysis. *Religion, Brain & Behavior*, 1-17.
- Jordan, J. J. (2018). Which accusations stick? *Nature Human Behaviour*, 2(1), 19.
- Jordan, J. J., Hoffman, M., Bloom, P., & Rand, D. G. (2016). Third-party punishment as a costly signal of trustworthiness. *Nature*, 530(7591), 473.
- Jordan, J. J., Hoffman, M., Nowak, M. A., & Rand, D. G. (2016). Uncalculating cooperation is used to signal trustworthiness. *Proceedings of the National Academy of Sciences*, 113(31), 8658-8663.
- Kahneman, D., Roy F, Tversky, A., Ellen, Finkenauer, C., & Vohs, K. D. (19842001). Choices, values, and framesBad is stronger than good. *American psychologistReview of general psychology*, 395(4), 341323.
- Kang, S. H., McDermott, K. B., & Cohen, S. M. (2008). The mnemonic advantage of processing fitness-relevant information. *Memory & Cognition*, 36(6), 1151-1156.
- Kazanas, S. A., & Altarriba, J. (2017). Did our ancestors fear the unknown? The role of predation in the survival advantage. *Evolutionary Behavioral Sciences*, 11(1), 83.
- Kidder, T. (2003). *Mountains beyond mountains: healing the world: the quest of Dr. Paul Farmer*: New York: Random House.
- Koning, N. (2013). Witchcraft beliefs and witch hunts. *Human nature*, 24(2), 158-181.
- Kumkale, G. T., Albarracín, D., & Seignourel, P. J. (2010). The effects of source credibility in the presence or absence of prior attitudes: Implications for the design of persuasive communication campaigns. *Journal of Applied Social Psychology*, 40(6), 1325-1356.

- Kurzban, R., & Leary, M. R. (2001). Evolutionary origins of stigmatization: the functions of social exclusion. *Psychological bulletin*, 127(2), 187.
- Kurzban, R., Tooby, J., & Cosmides, L. (2001). Can race be erased? Coalitional computation and social categorization. *Proceedings of the National Academy of Sciences*, 98(26), 15387-15392.
- Legare, C. H., & Gelman, S. A. (2008). Bewitchment, biology, or both: The co-existence of natural and supernatural explanatory frameworks across development. *Cognitive Science*, 32(4), 607-642.
- Legare, C. H., & Gelman, S. A. (2009). South African children's understanding of AIDS and flu: Investigating conceptual understanding of cause, treatment and prevention. *Journal of cognition and culture*, 9(3), 333-346.
- Legare, C. H., & Souza, A. L. (2012). Evaluating ritual efficacy: Evidence from the supernatural. *Cognition*, 124(1), 1-15.
- Lickel, B., Miller, N., Stenstrom, D. M., Denson, T. F., & Schmader, T. (2006). Vicarious retribution: The role of collective blame in intergroup aggression. *Personality and social psychology review*, 10(4), 372-390.
- Lienard, P., & Boyer, P. (2006). Whence Collective Rituals? A Cultural Selection Model of Ritualized Behavior. *American Anthropologist*, 108(4), 814-827.
- Liénard, P., & Boyer, P. (2006). Whence collective rituals? A cultural selection model of ritualized behavior. *American Anthropologist*, 108(4), 814-827.
- Lienard, P., & Lawson, E. T. (2008). Evoked culture, ritualization and religious rituals. *Religion*, 38(2), 157-171.
- Lisdorf, A. (2007). What's HIDD'n in the HADD? *Journal of cognition and culture*, 7(3), 341-353.
- Mace, R., Thomas, M. G., Wu, J., He, Q., Ji, T., & Tao, Y. (2018). Population structured by witchcraft beliefs. *Nature Human Behaviour*, 2(1), 39.
- Macfarlane, A. (1970). Witchcraft in Tudor and Stuart Essex. *Witchcraft confessions and accusations*, 81-99.
- McCauley, R. N., & Lawson, E. T. (2002). *Bringing ritual to mind: Psychological foundations of cultural forms*: Cambridge University Press.
- McElreath, R., Lubell, M., Richerson, P. J., Waring, T. M., Baum, W., Edsten, E., . . . Paciotti, B. (2005). Applying evolutionary models to the laboratory study of social learning. *Evolution and Human Behavior*, 26(6), 483-508.
- Mercier, H. (in prep). Informational Conformity: How good are we at aggregating convergent opinions?
- Mesoudi, A., Whiten, A., & Dunbar, R. (2006). A bias for social information in human cultural transmission. *British Journal of Psychology*, 97(3), 405-423.
- Miguel, E. (2005). Poverty and witch killing. *The Review of Economic Studies*, 72(4), 1153-1172.
- Mitchell, J. P., Dodson, C. S., & Schacter, D. L. (2005). fMRI evidence for the role of recollection in suppressing misattribution errors: The illusory truth effect. *Journal of Cognitive Neuroscience*, 17(5), 800-810.
- Mitchell, J. P., Sullivan, A. L., Schacter, D. L., & Budson, A. E. (2006). Misattribution errors in Alzheimer's disease: The illusory truth effect. *Neuropsychology*, 20(2), 185.
- Morewedge, C. K. (2009). Negativity bias in attribution of external agency. *Journal of Experimental Psychology: General*, 138(4), 535.
- Morgan, T., Rendell, L., Ehn, M., Hoppitt, W., & Laland, K. (2012). The evolutionary basis of human social learning. *Proceedings of the Royal Society of London B: Biological Sciences*, 279(1729), 653-662.
- Morgan, T. J., Laland, K. N., & Harris, P. L. (2015). The development of adaptive conformity in young children: effects of uncertainty and consensus. *Developmental science*, 18(4), 511-524.
- Nairne, J. S., & Pandeirada, J. N. (2008). Adaptive memory: Is survival processing special? *Journal of Memory and Language*, 59(3), 377-385.

- Nairne, J. S., & Pandeirada, J. N. (2010). Adaptive memory: Ancestral priorities and the mnemonic value of survival processing. *Cognitive psychology*, *61*(1), 1-22.
- Nairne, J. S., Thompson, S. R., & Pandeirada, J. N. (2007). Adaptive memory: survival processing enhances retention. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *33*(2), 263.
- Navarrete, C. D., Kurzban, R., Fessler, D. M., & Kirkpatrick, L. A. (2004). Anxiety and intergroup bias: Terror management or coalitional psychology? *Group Processes & Intergroup Relations*, *7*(4), 370-397.
- Navarrete, C. D., McDonald, M. M., Asher, B. D., Kerr, N. L., Yokota, K., Olsson, A., & Sidanius, J. (2012). Fear is readily associated with an out-group face in a minimal group context. *Evolution and Human Behavior*, *33*(5), 590-593.
- Nelissen, R. M. A., & Meijers, M. H. C. (2011). Social benefits of luxury brands as costly signals of wealth and status. *Evolution and Human Behavior*, *32*(5), 343-355. doi: 10.1016/j.evolhumbehav.2010.12.002
- Noë, R., & Hammerstein, P. (1994). Biological markets: supply and demand determine the effect of partner choice in cooperation, mutualism and mating. *Behavioral Ecology and Sociobiology*, *35*(1), 1-11. doi: 10.1007/bf00167053
- Norenzayan, A., & Gervais, W. M. (2012). The cultural evolution of religion. *Creating consilience: Integrating science and the humanities*, 243-265.
- Olds, J. M., Lanska, M., & Westerman, D. L. (2014). The role of perceived threat in the survival processing memory advantage. *Memory*, *22*(1), 26-35.
- Olsson, A., Ebert, J. P., Banaji, M. R., & Phelps, E. A. (2005). The role of social groups in the persistence of learned fear. *Science*, *309*(5735), 785-787.
- Parish, J. (2011). West African witchcraft, wealth and moral decay in New York City. *Ethnography*, *12*(2), 247-265.
- Parish, J. (2013). Chasing Celebrity: Akan Witchcraft and New York City. *Ethnos*, *78*(2), 280-300.
- Peeters, G., & Czapinski, J. (1990). Positive-negative asymmetry in evaluations: The distinction between affective and informational negativity effects. *European Review of Social Psychology*, *1*, 33-60.
- Peters, K., Kashima, Y., & Clark, A. (2009). Talking about others: Emotionality and the dissemination of social information. *European Journal of Social Psychology*, *39*(2), 207-222.
- Pezzo, M. V., & Beckstead, J. W. (2006). A multilevel analysis of rumor transmission: Effects of anxiety and belief in two field experiments. *Basic and Applied Social Psychology*, *28*(1), 91-100.
- Pietraszewski, D. (2013). What is group psychology? Adaptations for mapping shared intentional stances. *Navigating the social world: What infants, children, and other species can teach us*, 253-257.
- Pietraszewski, D., Curry, O. S., Petersen, M. B., Cosmides, L., & Tooby, J. (2015). Constituents of political cognition: Race, party politics, and the alliance detection system. *Cognition*, *140*, 24-39.
- Poulton, R., Davies, S., Menzies, R. G., Langley, J. D., & Silva, P. A. (1998). Evidence for a non-associative model of the acquisition of a fear of heights. *Behaviour Research and Therapy*, *36*(5), 537-544. doi: 10.1016/s0005-7967(97)10037-7
- Pratto, F., & John, O. P. (1991). Automatic vigilance: The attention-grabbing power of negative social information. *Journal of Personality & Social Psychology*, *61*(3), 380-391.
- Pratto, F., & John, O. P. (2005). Automatic Vigilance: The Attention-Grabbing Power of negative Social Information. *Social cognition: key readings*, 250.
- Purzycki, B. G., & Willard, A. K. (2016). MCI theory: a critical discussion. *Religion, Brain & Behavior*, *6*(3), 207-248.
- Rachman, S. (1991). Neo-conditioning and the classical theory of fear acquisition. *Clinical Psychology Review*, *11*(2), 155-173. doi: 10.1016/0272-7358(91)90093-a

- Reber, R., & Schwarz, N. (1999). Effects of perceptual fluency on judgments of truth. *Consciousness and cognition*, 8(3), 338-342.
- Roggeveen, A. L., & Johar, G. V. (2002). Perceived source variability versus familiarity: Testing competing explanations for the truth effect. *Journal of Consumer Psychology*, 12(2), 81-91.
- Rozin, P., Andrew C, Royzman, E. B., Sean HK, & Roediger III, H. L. (20012009). Negativity bias, negativity dominance, Congruity effects between materials and contagion processing tasks in the survival processing paradigm. *Personality Journal of Experimental Psychology: Learning, Memory, and social psychology review Cognition*, 535(46), 296-3201477.
- Rozin, P., & Royzman, E. (2001). Negativity bias, negativity dominance, and contagion. *Personality and Social Psychology Review*, 5, 296-320.
- Rozin, P., & Royzman, E. B. (2001). Negativity bias, negativity dominance, and contagion. *Personality and social psychology review*, 5(4), 296-320.
- Salathé, M., & Bonhoeffer, S. (2008). The effect of opinion clustering on disease outbreaks. *Journal of The Royal Society Interface*, 5(29), 1505-1508.
- Schindler, K. (2010). Social capital and post-war reconstruction: Evidence from northern Mozambique. *Berlin: German Institute for Economic Research*. Accessed February, 1, 2013.
- Schram, R. (2010). Witches' wealth: witchcraft, confession, and Christianity in Auhelawa, Papua New Guinea. *Journal of the Royal Anthropological Institute*, 16(4), 726-742.
- Scott-Phillips, T. C. (2017). A (simple) experimental demonstration that cultural evolution is not replicative, but reconstructive—and an explanation of why this difference matters. *Journal of cognition and culture*, 17(1-2), 1-11.
- Sherman, J. W., & Bessenoff, G. R. (1999). Stereotypes as source-monitoring cues: On the interaction between episodic and semantic memory. *Psychological Science*, 10(2), 106-110. doi: 10.1111/1467-9280.00116
- Skowronski, J. J., & Carlston, D. E. (1989). Negativity and extremity biases in impression formation: A review of explanations. *Psychological bulletin*, 105(1), 131.
- Soderstrom, N. C., & McCabe, D. P. (2011). Are survival processing memory advantages based on ancestral priorities? *Psychonomic Bulletin & Review*, 18(3), 564-569.
- Sørensen, J. (2007). Acts that work: A cognitive approach to ritual agency. *Method & Theory in the Study of Religion*, 19(3), 281-300.
- Sperber, D. (2000). An objection to the memetic approach to culture. *Darwinizing culture: The status of memetics as a science*, 163-173.
- Sperber, D., Clément, F., Heintz, C., Mascaró, O., Mercier, H., Origgi, G., & Wilson, D. (2010). Epistemic vigilance. *Mind & Language*, 25(4), 359-393.
- Sperber, D., & Hirschfeld, L. A. (2004). The cognitive foundations of cultural stability and diversity. *Trends in cognitive sciences*, 8(1), 40-46.
- Stadler, J. (1996). Witches and witch-hunters: Witchcraft, generational relations and the life cycle in a Lowveld village. *African Studies*, 55(1), 87-110.
- Stadler, J., Tracy. (1996). Witches and witch-hunters: Witchcraft, generational relations and Mountains beyond mountains: healing the life cycle in a Lowveld village world: the quest of Dr. Paul Farmer. *African Studies*, 55(1), 87-110.
- Stadler, J. J. (2003). The young, the rich, and the beautiful: Secrecy, suspicion and discourses of AIDS in the South African lowveld. *African journal of AIDS research*, 2(2), 127-139.
- Stephan, W. G., Ybarra, O., Martinez, C. M., Schwarzwald, J., & Tur-Kaspa, M. (1998). Prejudice toward immigrants to Spain and Israel: An integrated threat theory analysis. *Journal of Cross-Cultural Psychology*, 29(4), 559-576.

- Stubbersfield, J. M., Tehrani, J. J., & Flynn, E. G. (2014). Serial killers, spiders and cybersex: Social and survival information bias in the transmission of urban legends. *British Journal of Psychology*. doi: 10.1111/bjop.12073
- Tajfel, H., Billig, M. G., Bundy, R. P., & Flament, C. (1971). Social categorization and intergroup behaviour. *European Journal of Social Psychology*, 1(2), 149-178.
- Tan, J. H., & Vogel, C. (2008). Religion and trust: An experimental study. *Journal of Economic Psychology*, 29(6), 832-848.
- Tenkorang, E. Y., Gyimah, S. O., Maticka-Tyndale, E., & Adjei, J. (2011). Superstition, witchcraft and HIV prevention in sub-Saharan Africa: The case of Ghana. *Culture, health & sexuality*, 13(9), 1001-1014.
- Thomas, F. (2007). 'Our families are killing us': HIV/AIDS, witchcraft and social tensions in the Caprivi Region, Namibia. *Anthropology & medicine*, 14(3), 279-291.
- Thomas, K. (1997). *Religion and the decline of magic : studies in popular beliefs in sixteenth and seventeenth century England*. New York: Oxford University Press.
- Tooby, J., & DeVore, I. (1987). The reconstruction of hominid behavioral evolution through strategic modeling. In W. Kinzey (Ed.), *Primate models of hominid behavior* (pp. 183-237). New York: SUNY Press.
- Upal, M. A. (2005). *Role of context in memorability of intuitive and counterintuitive concepts*. Paper presented at the Proceedings of the Cognitive Science Society.
- van Elk, M. (2013). Paranormal believers are more prone to illusory agency detection than skeptics. *Consciousness and cognition*, 22(3), 1041-1046.
- van Elk, M. (2015). Perceptual biases in relation to paranormal and conspiracy beliefs. *PloS one*, 10(6), e0130422.
- van Elk, M., Rutjens, B. T., van der Pligt, J., & Van Harreveld, F. (2016). Priming of supernatural agent concepts and agency detection. *Religion, Brain & Behavior*, 6(1), 4-33.
- van Leeuwen, F., Parren, N., Miton, H., & Boyer, P. (2016). Individual Choose-to-Transmit Decisions Reveal Little Preference for Transmitting Negative or High-Arousal Content. *Journal of cognition and culture*.
- Vasquez, E. A., Wenborne, L., Peers, M., Alleyne, E., & Ellis, K. (2015). Any of them will do: In-group identification, out-group entitativity, and gang membership as predictors of group-based retribution. *Aggressive behavior*, 41(3), 242-252.
- Walker, C. J., & Blaine, B. (1991). The virulence of dread rumors: A field experiment. *Language & Communication*, 11(4), 291-297.
- Wallot, S., O'Brien, B. A., Hausmann, A., Kloos, H., & Lyby, M. S. (2014). The Role of Reading Time Complexity and Reading Speed in Text Comprehension. *Journal of Experimental Psychology: Learning, Memory, and Cognition*.
- Waytz, A., Morewedge, C. K., Epley, N., Monteleone, G., Gao, J.-H., & Cacioppo, J. T. (2010). Making sense by making sentient: effectance motivation increases anthropomorphism. *Journal of personality and social psychology*, 99(3), 410.
- Weinstein, Y., Bugg, J. M., & Roediger, H. L. (2008). Can the survival recall advantage be explained by basic memory processes? *Memory & Cognition*, 36(5), 913-919.
- Whittlesea, B. W., & Leboe, J. P. (2003). Two fluency heuristics (and how to tell them apart). *Journal of Memory and Language*, 49(1), 62-79.
- Willard, A. K. (2017). *Understanding the Mind of God: The role of anthropomorphism as motivated cognition in explaining supernatural belief*. Paper presented at the American Academy of Religion, Boston.

- Williams, J. L., Skinner, C. H., Floyd, R. G., Hale, A. D., Neddenriep, C., & Kirk, E. P. (2011). Words correct per minute: The variance in standardized reading scores accounted for by reading speed. *Psychology in the Schools, 48*(2), 87-101.
- Williams, K. D., Cheung, C. K., & Choi, W. (2000). Cyberostracism: effects of being ignored over the Internet. *Journal of personality and social psychology, 79*(5), 748.
- Withnall, A. (2017, February 3, 2017). Care worker who rescued Nigerian 'witch' boy recreates photo for his first week of school, *Independent*.
- Woody, E., & Szechtman, H. (2011a). Adaptation to potential threat: the evolution, neurobiology, and psychopathology. *Neuroscience and Biobehavioral Reviews, 35*(4), 1019-1033.
- Woody, E., & Szechtman, H. (2011b). Adaptation to potential threat: the evolution, neurobiology, and psychopathology. *Neurosci Biobehav Rev, 35*(4), 1019-1033.
- Yamagishi, T., Jin, N., & Kiyonari, T. (1999). Bounded generalized reciprocity. *Adv Group Process, 16*, 161-197.
- Yamagishi, T., & Mifune, N. (2008). Does shared group membership promote altruism? Fear, greed, and reputation. *Rationality and Society, 20*(1), 5-30.

Tables

Table 1. Paper 1, Study 1: Key passages that differ between TRI and NEU versions of the descriptions of three situations

	Threat content (TRI)	Neutral content (NEU)
Trekking	[...] There are leeches that cling to your feet and can give you very serious deep burns. [...]	[...] There are many species of colorful birds and flowers. [...]
Computer Program	[...] If you press control keys during installation, the software may damage your hard disk. [...]	[...] During installation the program will check your hard disk is in good condition and report on how reliable it is. [...]
Cooking	[...] If left to simmer too long the meat will turn bitter. [...]	[...] You can leave all this in the fridge overnight. [...]

Table 2. Paper 1, Study 1: Proportion of participants (%) who chose threat-related source, neutral source, and “don’t know” for each of the situations described.

	Threat	Neutral	Don't Know
Trekking	73.0	21.6	5.4
Program	68.5	26.1	5.4
Cooking	55.9	40.5	3.6

Table 3. *Paper 1, Study 2: TRI and NEG items used in three text-sets*

	Threat content (TRI)	Negative content (NEG)
Trekking	[...] There are leeches that cling to your feet and can give you very serious deep burns. [...]	[...] The Amazon is the poorest region of Brazil, with fewer schools, cities and roads than any of the other regions. [...]
Computer program	[...] If you press control keys during installation, the software may damage your hard disk. [...]	[...] The program can take a long time to master because the instruction manual is very complex. [...]
Cooking	[...] If left to simmer too long the wildebeest meat will turn very bitter. [...]	[...] Some people don't like this kind of stew because it looks gray, which they don't find appetizing. [...]

Table 4. *Paper 1, Study 3: Proportion of participants (%) who chose the threat-related source, negative source, and “Don’t know” for each of the vignettes.*

	Threat	Negative	Don’t know
Trekking	71.3	24.8	3.9
Computer program	72.9	24.0	3.1
Cooking	60.5	34.9	4.7

Table 5. *Paper 1, Study 3: Key sentences that differ between the threat and negative versions of the descriptions of three situations.*

	Threat content	Negative content
Seaside resort	[...] The gates are locked after 12am so you may be locked out unless you warn the staff of the time you will come back. [...]	[...] The resort is located on a narrow dirt road, and is less easily accessible than other places on the coast. [...]
Diapers	[...] If you fold the sides first the baby's pee may leak outside the diaper, and cause rashes and infection. [...]	[...] The adhesive straps at the end of the side folds often do not stick, so you may have to start all over again. [...]
Washer	[...] The very high speed Ultra-Spin may damage delicate fabrics, use only regular spin speed for these clothes. [...]	[...] The Mehlen 250, because of all these features, is of course more expensive than regular washers with the same washing volume. [...]

Table 6. *Paper 1, Study 3: Proportion of participants (%) who chose the threat-related source, neutral source, and “Don’t Know” for each of the different situations described.*

	Threat	Negative	Don’t know
Seaside resort	42.5	57.5	0.0
Baby diapers	48.8	51.2	0.0
Washer	66.9	33.1	0.0

Table 7. *Paper 3, Table 1: Table 7 Paper 3, Study 1, Number of Presentations and Truth Rating*

Number of Presentations at study	Mean truth rating	SD
0	3.66	1.07
1	4.18	1.24
3	4.25	1.18

Table 8. *Paper 3, Table 2: Study 1 Estimate of Number of Views*

Number of presentations at study	Correct number in phase “count” (study + test)	Subjects’ estimates of number of times seen: M (SD)	Subjects’ estimates of truth: M (SE)
0	1	2.11 (44)	3.66 (.13)
1	2	3.22 (.66)	4.18 (.15)
3	4	4.55 (.91)	4.25 (.14)

Table 9. Paper 3, Table 3, Study 2: Number of Presentations and Truth Rating

Number of Presentations at study	Mean truth rating	SD
0	3.71	.46
1	4.22	.71
3	4.29	.81

Table 10. *Paper 3, Study 2: Estimate of Number of Views*

Number of Reps at study	Correct number in phase “count” (study + test)	Subjects’ estimates of number of times seen: M (SD)	Subjects’ estimates of truth: M (SD)
0	1	2.16 (.63)	3.71 (.46)
1	2	3.27 (.72)	4.22 (.71)
3	4	4.53 (.90)	4.29 (.82)

Table 11. *Paper 3, Study 3: Number of Presentations and Truth Rating*

Number of presentations at study	Mean truth rating	SD
0	3.71	.44
1	4.20	.75
3	4.29	.73

Table 12. *Paper 3, Study 3: Estimate of Number of Views at Three Levels of Actual Exposure*

Number of Reps at study	Correct number in phase “count” (study + test)	Subjects’ estimates of number of times seen: M (SD)	Subjects’ estimates of truth: M (SD)
0	1	1.95 (.55)	3.71(.44)
1	2	3.08 (.87)	4.20 (.75)
3	4	4.48 (1.0)	4.29(.73)

Table 13. *Paper 3, Study 4: Number of Presentations and Truth Rating*

Number of presentations at study	Mean truth rating	SD
1	4.10	.63
3	4.15	.62

Table 14. *Paper 3, Study 4: Estimate of Number of Views at Three Levels of Actual Exposure*

Number of presentations at study	Correct number in phase “count” (study + test)	Subjects’ estimates of number of times seen: M (SD)	Subjects’ estimates of truth: M (SD)
1	2	3.13 (.87)	4.10 (.63)
3	4	4.54 (.97)	4.15 (.62)

Table 15. Paper 4: Example of 4 Conditions, in Which an Agent or Impersonal Scenario is Presented and in Which the Scenario Did or Did Not Plausibly Cause the Misfortune

		Within Subjects	
		Agent scenario	Impersonal scenario
Expected answer Yes (caused misfortune)	Mark works at a high intensity business. John is jealous of Mark and one morning, he comes in to work early to wax the stairs outside of Mark's office, in order to make him slip and fall. When Mark comes to work, he slips on the stairs and breaks his leg. John made the stairs slippery. That is why Mark broke his leg. (yes or no)	Mark works at a high intensity business. One morning, the stairs leading to Mark's office have just been cleaned, which makes them slippery. When Mark comes to work, he slips on the stairs and breaks his leg. The stairs leading to Mark's office are slippery. That is why Mark broke his leg. (yes or no)	
	Mark works at a high intensity business. John is jealous of Mark and one morning, wishes that Mark would have an accident. When Mark comes to work, he slips on the stairs and breaks his leg. John wished for Mark to get hurt. That is why Mark broke his leg. (yes or no)	Mark works at a high intensity business. The stairs leading to Mark's office are clean and dry. When Mark comes to work in his own building, he slips on the stairs and breaks his leg. The stairs leading to Mark's office are clean and dry. That is why Mark broke his leg. (yes or no)	

Table 16. Paper 4: Materials, "Break" Story in 4 Conditions

		Within Subjects	
		Agent scenario	Impersonal scenario
Expected answer Yes	<p>Mark works at a high intensity business. John is jealous of Mark and one morning, he comes in to work early to wax the stairs outside of Mark's office, in order to make him slip and fall. When Mark comes to work, he slips on the stairs and breaks his leg.</p> <p>John made the stairs slippery.</p> <p>That is why Mark broke his leg.</p>	<p>Mark works at a high intensity business. One morning, the stairs leading to Mark's office have just been cleaned, which makes them slippery. When Mark comes to work, he slips on the stairs and breaks his leg.</p> <p>The stairs leading to Mark's office are slippery.</p> <p>That is why Mark broke his leg.</p>	
Expected answer No	<p>Mark works at a high intensity business. John is jealous of Mark and one morning, wishes that Mark would have an accident. When Mark comes to work, he slips on the stairs and breaks his leg.</p> <p>John wished for Mark to get hurt.</p> <p>That is why Mark broke his leg.</p>	<p>Mark works at a high intensity business. The stairs leading to Mark's office are clean and dry. When Mark comes to work in his own building, he slips on the stairs and breaks his leg.</p> <p>The stairs leading to Mark's office are clean and dry.</p> <p>That is why Mark broke his leg.</p>	

Table 17. Paper 4: Materials, “Food” Story in 4 Conditions

	Within Subjects	
	Agent scenario	Impersonal scenario
Expected answer Yes	<p>Sam is a successful defense lawyer. Joe is the prosecuting lawyer and is worried about Sam’s ability to sway a jury. The day before the trial, he arranges for Sam to be given some spoiled food. Sam gets food poisoning.</p> <p>Joe gave Sam spoiled food.</p> <p>That is why Sam got food poisoning.</p>	<p>Sam is a successful defense lawyer. He eats dinner at the office. The office refrigerator is broken, and the food is spoiled. Sam does not know this and eats the food anyway. Sam gets food poisoning.</p> <p>The office refrigerator is broken.</p> <p>That is why Sam got food poisoning.</p>
Expected answer No	<p>Sam is a successful defense lawyer. Joe is the prosecuting lawyer and is worried about Sam’s ability to sway a jury. The day before the trial, he thinks about how much he wishes Sam would get sick, so he could have more time. Sam gets food poisoning.</p> <p>Joe wishes for Sam to get sick.</p> <p>That is why Sam got food poisoning.</p>	<p>Sam is a successful defense lawyer. He eats dinner at the office. The office refrigerator is in perfect working condition. Sam gets food poisoning.</p> <p>The office refrigerator is in perfect working condition.</p> <p>That is why Sam got food poisoning.</p>

Table 18. *Paper 4: Percentage of Types of Mistakes Made in Determining Causality*

	Mistakes	
	Agent scenario	Impersonal scenario
Expected answer Yes	5 answered “no” 19%	11 answered “no” 42%
Expected answer No	3 answered “yes” 12%	7 answered “yes” 27%

Table 19. *Paper 4: Descriptive Results of Response Time for Correct Responses*

	Agent	Impersonal
Response: yes	M= 1407.70	M= 1506.72
	SD= 556.00	SD=824.80
	N= 79	N= 79
Response: no	M= 1556.62	M= 1707.92
	SD=798.64	SD= 748.16
	N=89	N= 89

Note: all times are in milliseconds

Table 20. Paper 4: Response Time Interaction Between “Yes”/ “No” Response and Story

	Story : Break	Story : Food	Combined EC
Response: yes	M=1271.03 SD=492.47 N=79	M=1643.39 SD=825.62 N=79	M=1457.21 SD=702.87 N=158
Response: no	M=1614.93 SD=763.30 N=89	M=1649.61 SD=791.16 N=89	M=1632.27 SD=702.87 N=158
Combined Response	M= 1453.21 SD= 670.77 N=168	M= 1646.68 SD= 805.12 N= 168	

Table 21. *Paper 4: Percentage of Participants Who Remembered Different Types of Items*

	Negative Event	Positive Event	Combined
Agentive Cause	83% (SD 11)	67% (SD 11)	75% (SD 14)
Impersonal Cause	77% (SD 6)	57% (SD 10)	68% (SD 13)
Combined	80% (SD 9)	62% (SD 11)	71% (SD 13)

Table 22. Paper 4: Coding Scheme Examples

Original sentence	Answer to :	Answer to :	Coded as :
	There was a person who could :	How did this person help or hurt her ?	
There was a person who could move heavy things. He pushed a big rock into Sarah's path, blocking her.	Push things	Blocked her	Correct
There was a person who could move very quietly. He snuck up on Sarah and scared her so she screamed.	Snuck up on her	Scared her	Correct
There was a person who could climb very well. He climbed to where Sarah couldn't reach and got her some fruit.	Give her fruit	Fed her	Incorrect
There was a person who could transform objects. She turned stone into food for Sarah.	Made food	Made food	Incorrect
There was a person who could transform objects. She turned stone into food for Sarah.	Do magic	Turned stone into food for Sarah	Correct

Table 23. Paper 4: Average Number of Events Remembered in Each Category (Out of a Possible 6)

	Negative Event	Positive Event
Intuitive	1.85 (SD 1.64)	1.75 (SD 1.72)
MCI	2.62 (SD 1.69)	2.66 (SD 1.60)

Table 24. *Paper 4: Memory for Intuitive and MCI agents by Context in Introduction Condition*

Introduction	MCI Agents	Intuitive Agents	Difference	Combined
Survival –MCI	2.62(1.86)	1.87(1.9)	.75	2.245
Safe-MCI	2.4(1.41)	1.51(1.47)	.89	1.955
Survival-Intuitive	2.52(1.66)	1.97(1.70)	.55	2.245
Safe-Intuitive	2.98(1.544)	1.79(1.55)	1.19	2.37

Table 25. *Paper 4: Number of Agents Remembered in Each Category (Out of a Possible 6)*

Negative Agent	Positive Agent
3.04 (SD 1.81)	3.04 (SD 1.7)

Table 26. Paper 4: Religiosity Scores and Corresponding Mean Score for Memory of Positive or Negative Agents

Religion Score	N	Mean valence score
1	55	0.18
2	18	0
3	6	0.5
4	10	-0.2
5	6	-1
6	6	-.33
7	34	-.09

Table 27. *Paper 4: Introduction Type and Valence Scores, with Negative Score Indicating Better Memory for Negative Agents*

Introduction	N	Mean valence score
1	62	0.06
2	73	-0.05

Figures

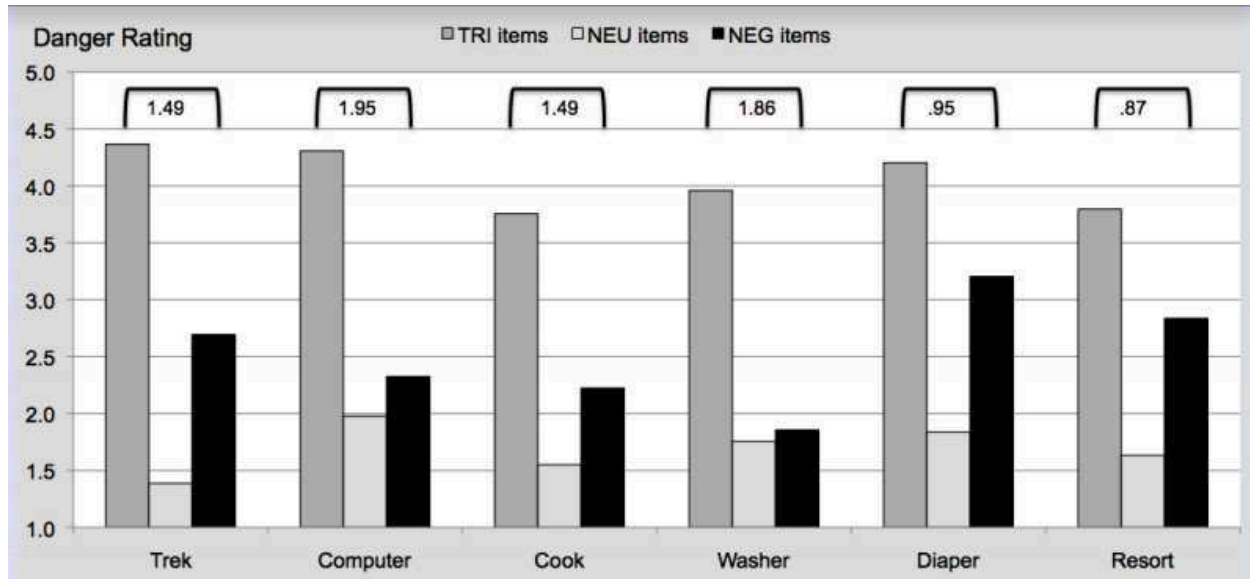


Figure 1. Pre-test results of danger ratings. For each story, ratings of TRI (threat), NEU (neutral) and NEG (negative) sentences, in terms of “mentions danger”. Brackets include effect-size (Cohen’s d) for the comparison between TRI and NEG items.

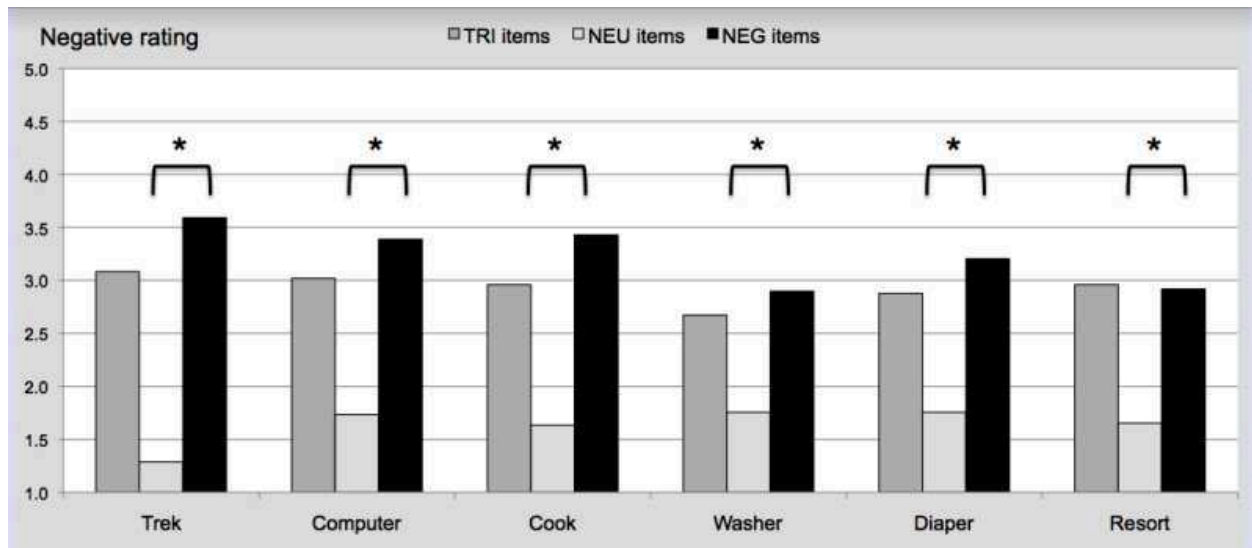


Figure 2. Pre-test results of negativity ratings. For each text-set, ratings of TRI (threat), NEU (neutral) and NEG (negative) sentences, in terms of “negative tone”.

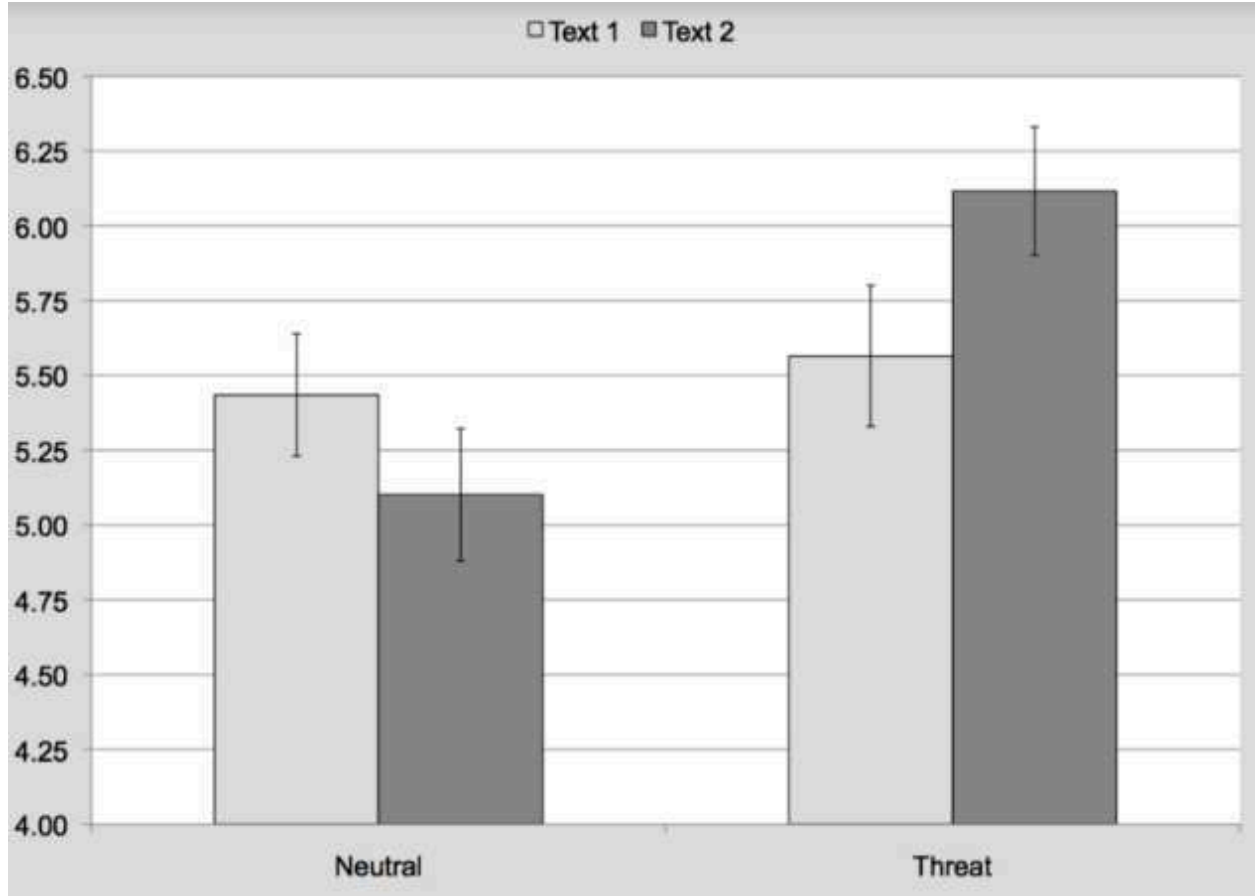


Figure 3. Study 4 usefulness ratings. Average “usefulness” rating of the neutral and threat sources, as either 1st or 2nd text presented (error-bars: 95% CI).

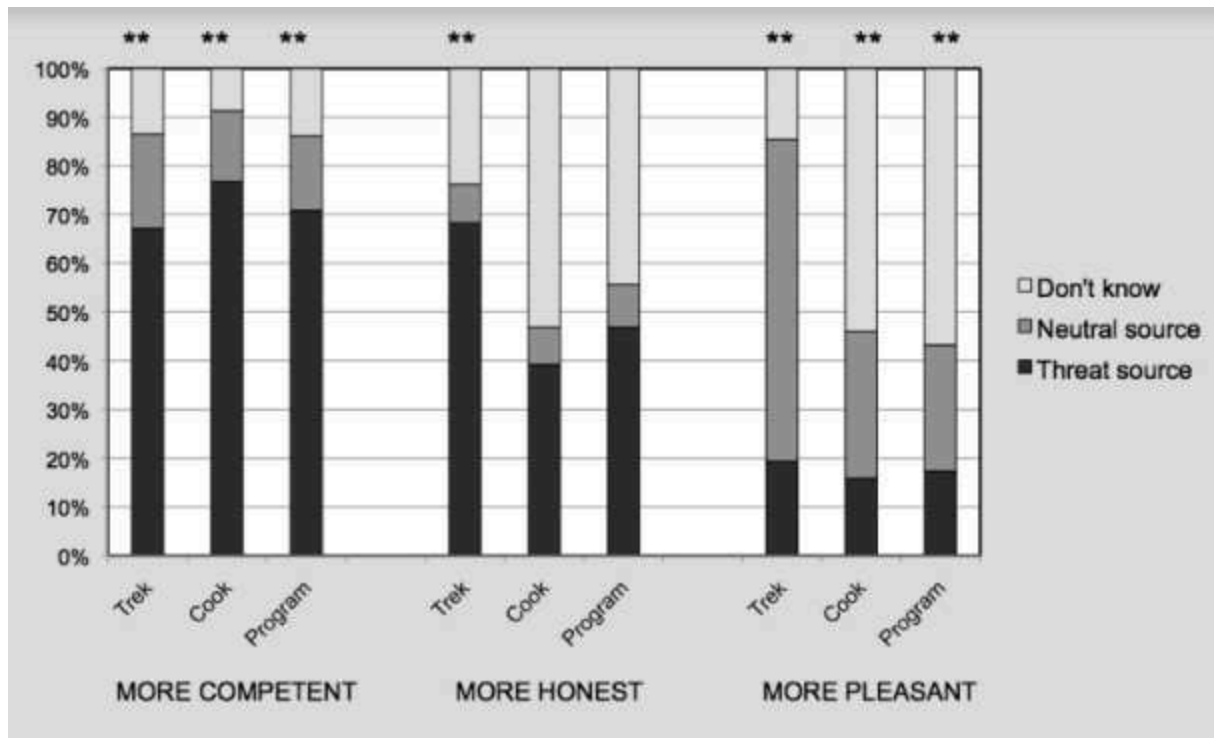


Figure 4. Study 5 Proportion of choices. Proportion of participants (%) who chose the threat or neutral source or “don’t know” as more competent, honest and pleasant in three different text-sets (**: $p < .001$).

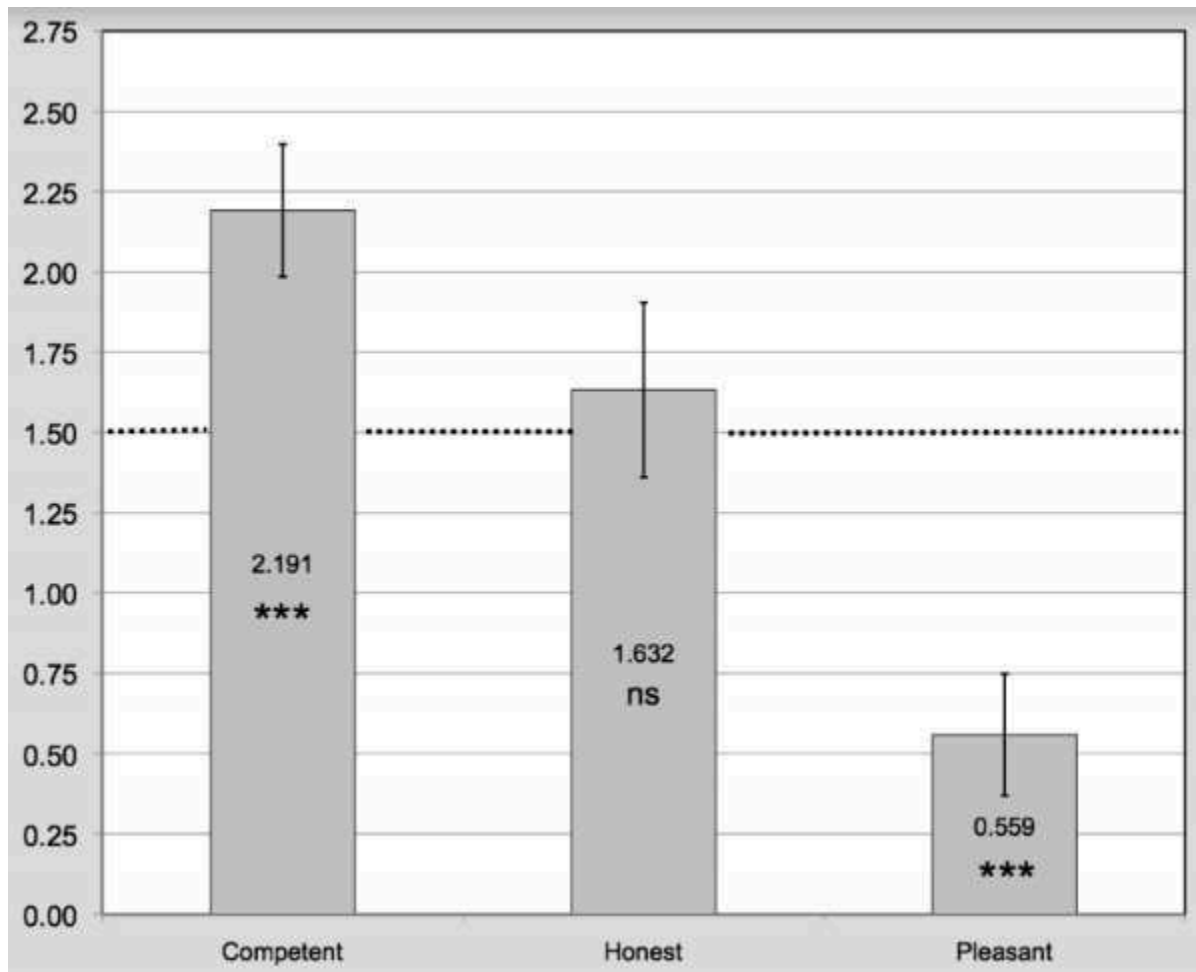


Figure 5. Study 5, Combined Scores. Combined scores for choice of the threat-source (out of maximum 3) as the source more likely to be competent, honest and pleasant (Error-bars: 95% CIs, ***: $p < .001$).

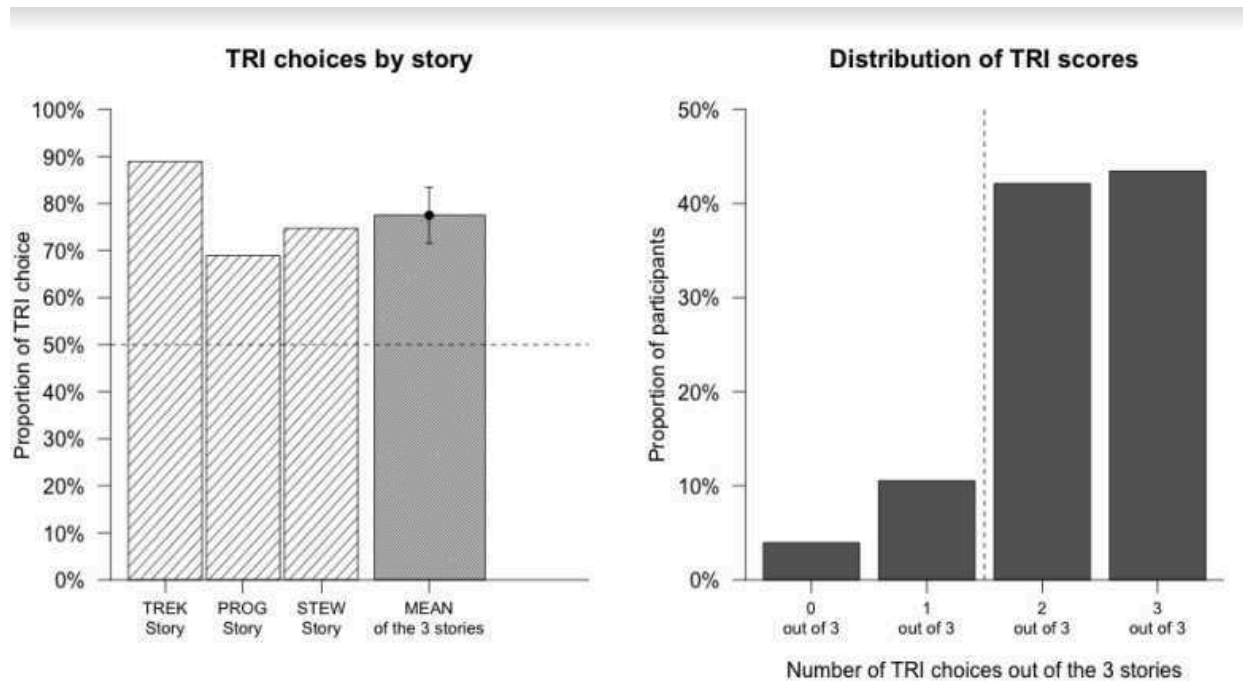


Figure 6. Paper 2, Figure 1, Results of Study 1. Results showing how often the TRI source was chosen as being more interested in the welfare of their customers, as well as overall number of times out of three that participants chose the TRI source.

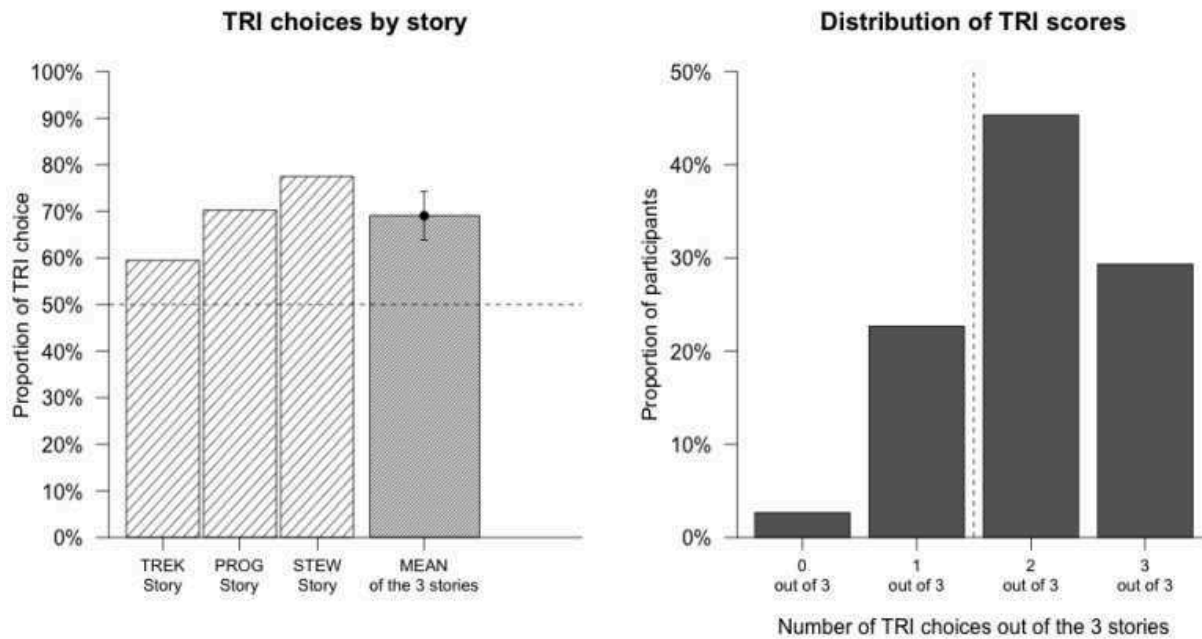


Figure 7. Paper 2, Figure 2, Results of Study 2. Results showing how often the TRI source was chosen for future help, as well as overall number of times out of three that participants chose the TRI source.

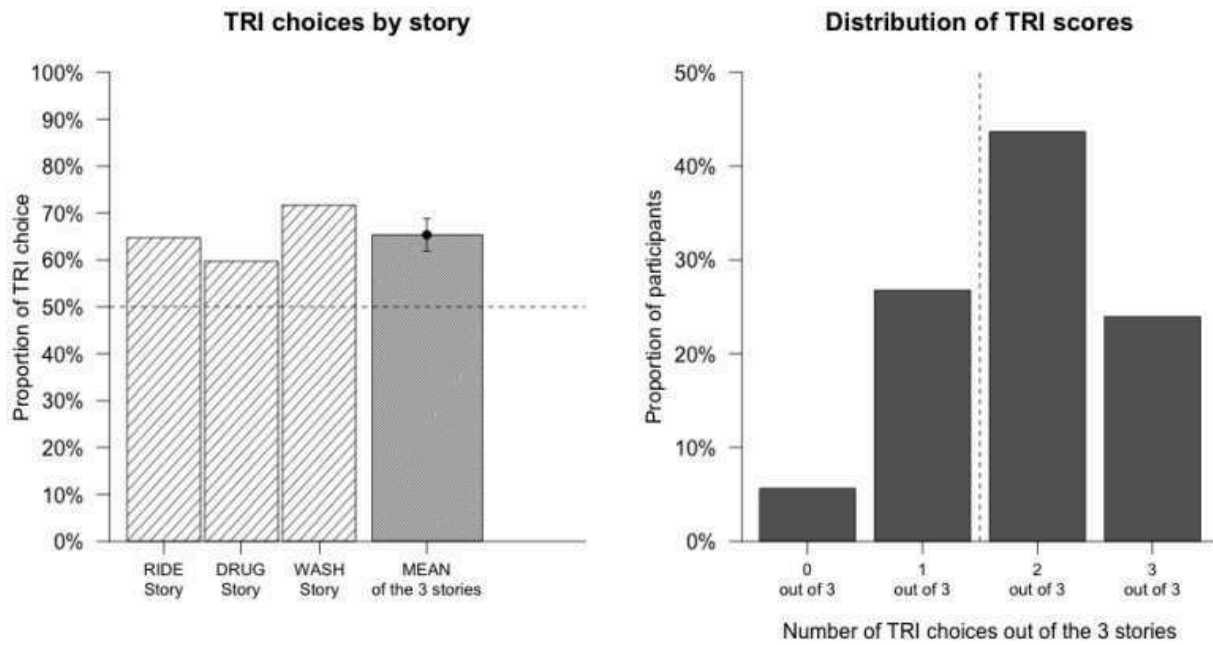


Figure 8. Paper 2, Figure 3, Results of Study 3. Results showing how often the TRI source was chosen for future help, as well as overall number of times out of three that participants chose the TRI source.

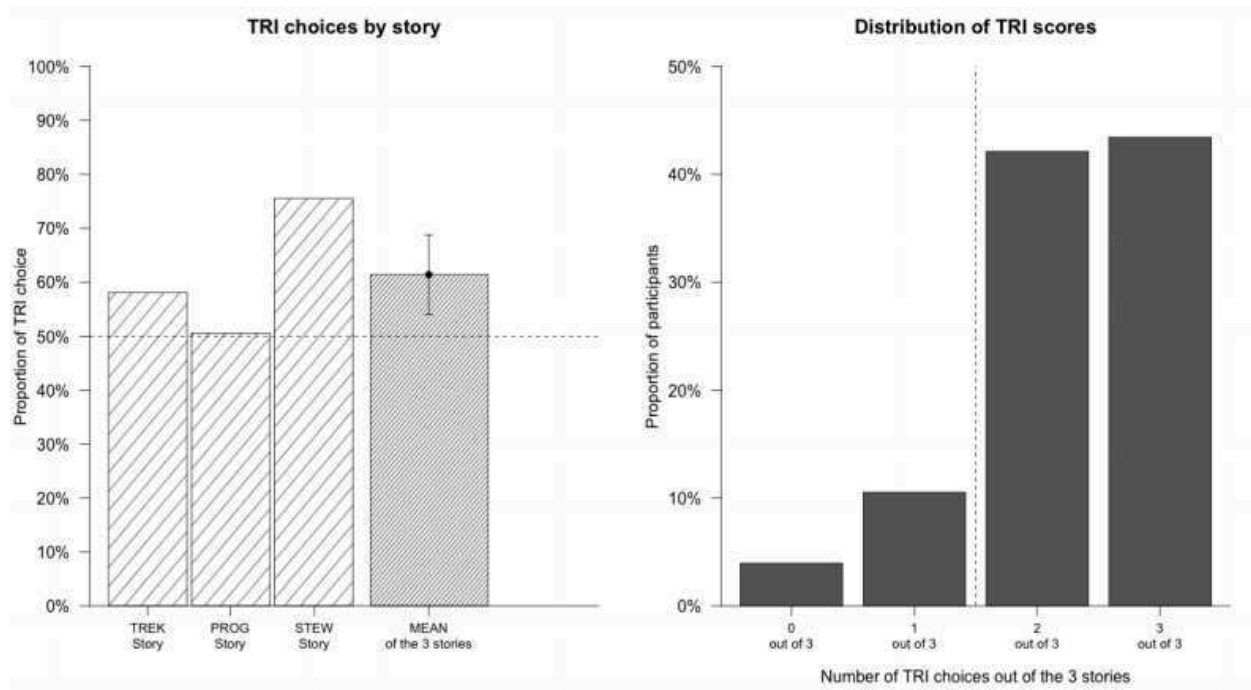


Figure 9. Paper 2, Figure 4, Results of Study 4, showing how often the TRI source was chosen for a bonus, as well as overall number of times out of three that participants chose the TRI source.

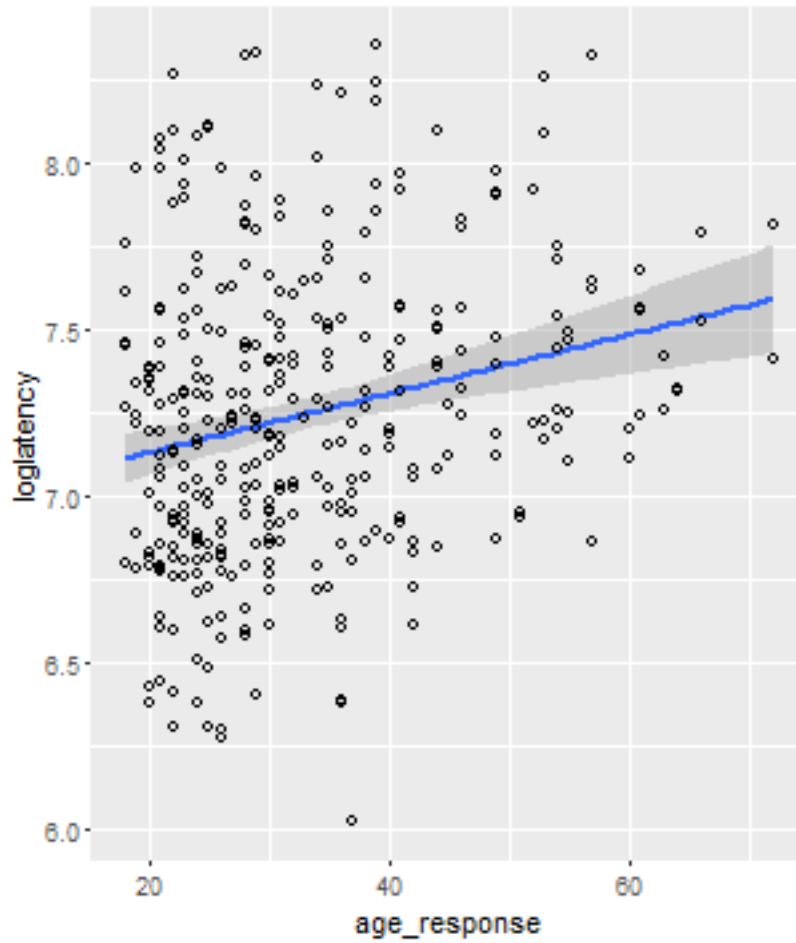


Figure 10. Paper 4, Figure 1, age and response time. Results showing the relationship between the log transformed response time and age. There was a main effect of age $F(1,125)=12.95, p<.001$, with response time increasing with age.

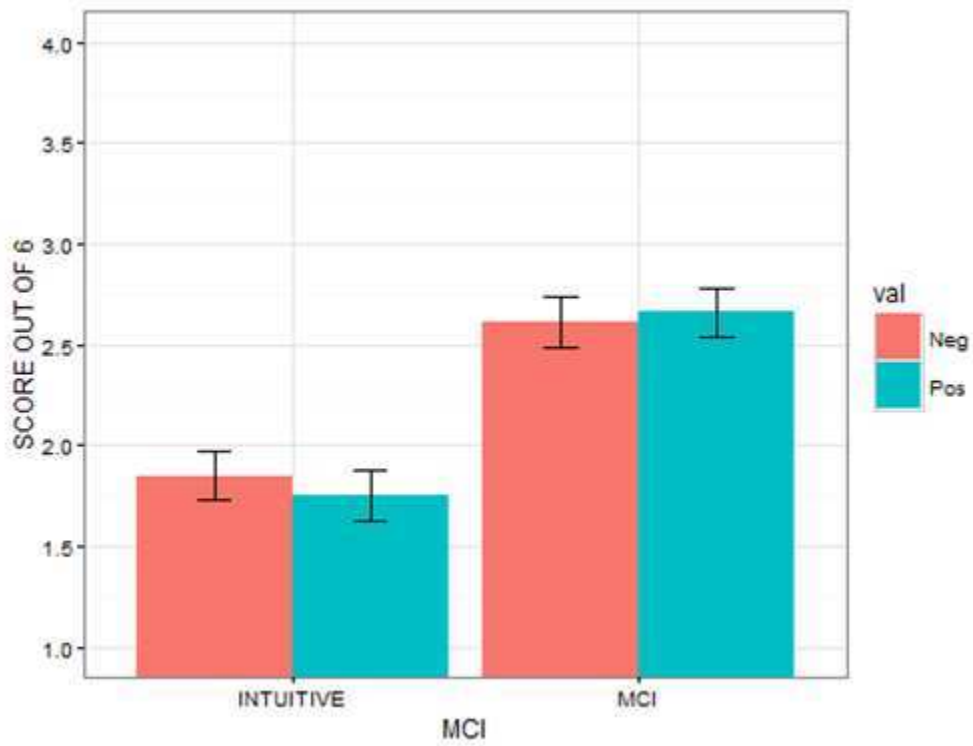


Figure 11. Paper 4, Figure 2, Memory for intuitive or MCI concepts, in negative and positive forms.

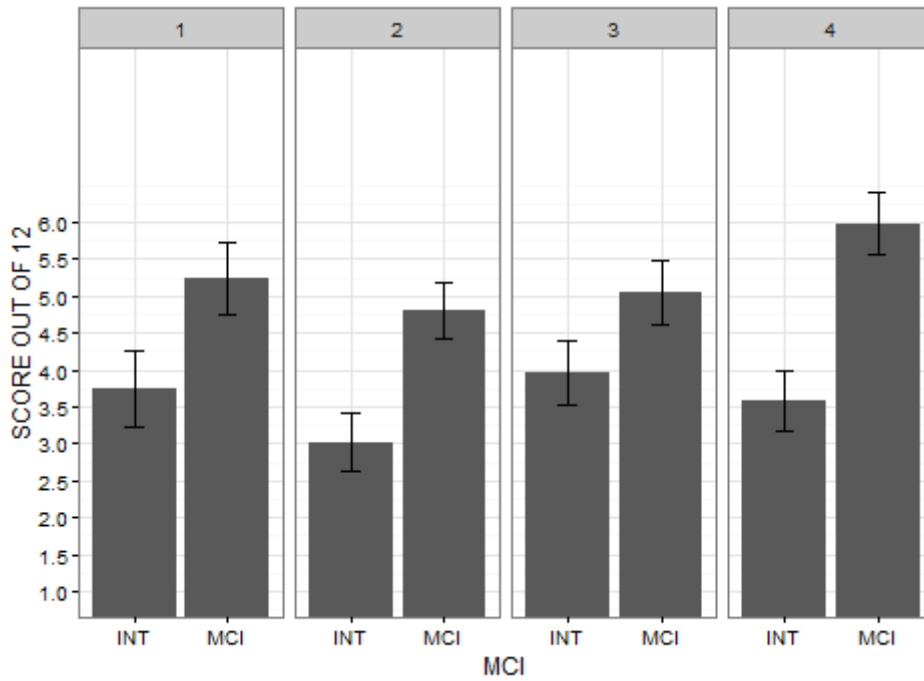


Figure 12. Paper 4, Figure 3, memory for types of agents. Agents remembered out of 6, with MCI agents and Intuitive Agents indicated on the x axis, divided by the four introductions, with 1 being Survival-MCI, 2 Safe-MCI, 3, Survival-Intuitive, and 4 Safe-intuitive

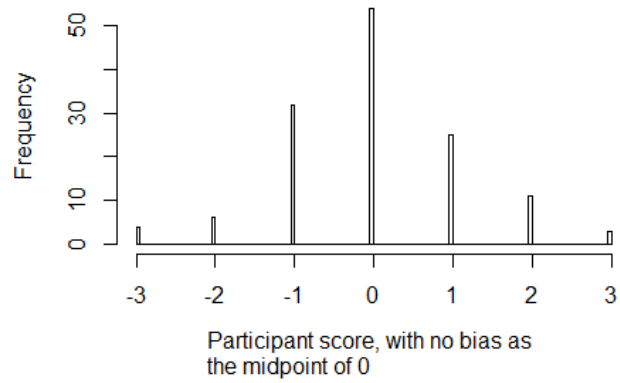


Figure 13. Overall valence of participant memory for agents, as they were depicted in the original presentation, calculated by giving them +1 point for each negative agent they remembered and giving -1 for each positive agent they remembered.

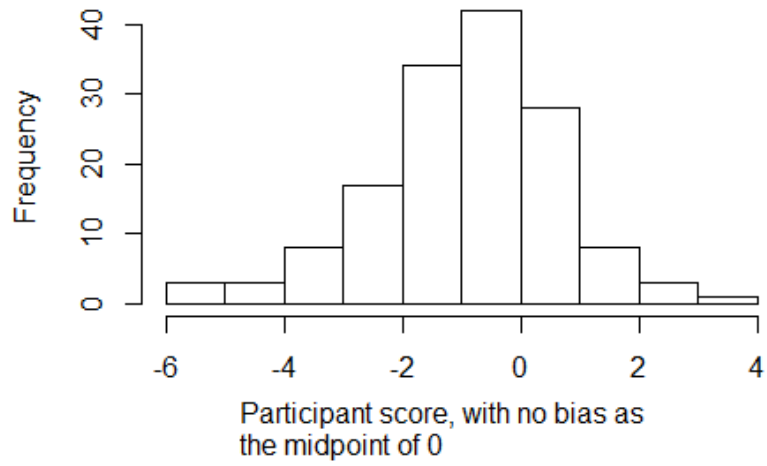


Figure 14. Valence for participants' reports of memory, rather than the true valence in the original presentation of the agents, with one point for every negative event that they reported remembering and -1 point for every positive event that they reported remembering

Appendix A: Paper 1– Complete texts used in studies 1-4.

Proper names and columns were counter-balanced in all studies.

	TRI	NEU
Amazon guide	<p>These two persons have been trained to serve as guides on a trek through the Amazon, specially for the BrazilTrek® 10 day trek through the Amazon rain forest. They both explain to you, in the text below, what to expect in this kind of trip. After reading their explanations, you will have to judge which one is better. Read attentively:</p>	
	<p>Here is the way Maria describes the trek to her clients:</p> <p>“Be prepared for the heat (always above 100F) and humidity (close to 100%). Wear light clothes.</p> <p>We will walk for about 6 miles each day. In the forest this can take about 5 hours.</p> <p>Be aware that</p> <p>There are leeches that cling to your feet and can give you very serious deep burns. But if you wear high rubber boots you will be fine.</p> <p>We will sleep on mats that most travelers say are pretty comfortable. Each evening we eat at the village refuges.</p> <p>Get in touch before the trek if you have any other questions.”</p>	<p>Here is the way Emilia describes the trek to her clients:</p> <p>“In general, we will walk for about 5 hours a day, the refuges are about 6 miles from each other.</p> <p>At the refuge you will find your mat for a comfortable night, and of course food and water.</p> <p>Very important:</p> <p>There are many species of colorful birds and flowers so you will have lots of opportunities for great pictures!</p> <p>It will be pretty hot and humid, 100F or more, and you will feel you are in a greenhouse. Only wear light clothes, given how hot it is.</p> <p>I will be happy to give you more information if you need any.”</p>

Software usage	<p>These two computer programmers, Scott and Adam, are data-base specialists. They work for the company that produces the DBXcess® data-base software. They both explain to you, in the text below, how to install the program. After reading their explanations, you will have to judge which one is better. Read attentively:</p>	
	<p>Here is the way SCOTT describes the program:</p> <p>The DBXcess® data-base will require about 100 Mbytes of disk space, and 200 Mbytes during installation. You will need to download the installer from our website, OR insert the DBXcess® DVD in your computer. Then you will have to choose whether you want a standard install or a custom one with different settings. The crucial thing is that if you press control keys during installation, the software may damage your hard disk. But if you install it from a DVD there is no such risk. The process should not take more than 15 minutes with the DVD, 25 minutes from the website.</p>	<p>Here is the way ADAM describes the program:</p> <p>There are two ways to install the DBXcess® data-base program, either from the DVD (about 15 minutes) that you received with your licence, or from our website (about 25 minutes). Your hard disk should have about 100 Mbytes of free space for the program, and twice as much free space during installation. People should know that during installation the program will check that your hard disk is in good condition and report on how reliable it is. Most people use the standard version of DBXcess® but you can customize the program during installation.</p>

<p>Cooking a stew</p>	<p>Mario and Owen just had a cooking lesson at the Great Desert restaurant in Johannesburg, South Africa, where they learned how to make the traditional South-African wildebeest and yam stew. They both explain to you, in the text below, how to make that stew. After reading their explanations, you will have to judge which one is better. Read attentively:</p>	
	<p>Here is how MARIO describes the process:</p> <p>For 6 people, you will need about 2lbs of wildebeest meat (not too lean). Cut it in roughly 1" pieces. Brown them on high heat for about five minutes. Then pour them into the casserole with 2lbs of sliced yams, and seasoning (salt, pepper, coriander), with two sliced onions. Cover with water mixed with a glass of white wine.</p> <p>Keep simmering for about two hours.</p> <p>Remember this: If left to simmer too long the wildebeest meat will turn very bitter. But if you add onion to the stew it will be just fine.</p> <p>You can find wildebeest meat in all markets in South Africa, and a few places in the United states.</p>	<p>Here is how OWEN describes the process:</p> <p>This stew is a simple mixture of sliced yams, salt and pepper and coriander, and nice pieces of wildebeest meat, not too lean. You find that in some stores in the US, and everywhere in South Africa. Take about 2lbs of meat, and the same amount of yams. You should add one or two onions. You should brown the meat first on high heat, before mixing it with the other ingredients and a glass of white wine.</p> <p>What you should remember is that</p> <p>You can leave all this in the fridge overnight. They say it is even better that way.</p> <p>Keep simmering for two hours or so.</p> <p>Serves 6.</p>

Ride	<p>These two engineers, John and Darren, both worked on the newest rollercoaster in the celebrated amusement park Wonderland™. They both explain to you, in the texts below, what to expect from this new rollercoaster. Please read both texts attentively before answering questions:</p>	
	<p>JOHN:</p> <p>This ride, the Chupacabra™, is a 130 ft high inverted rollercoaster. From this height, you have unique views of the whole park from above. “Inverted” means that the train runs under the track with the seats directly attached to the wheel carriage, letting both your arms and legs free to move. As internal organs move during such a ride, it is not advised for visitors with heart conditions or a history of epilepsy.</p> <p>Chupacabra™ has been designed especially for us.</p> <p>During the ride, the carriage speeds up to approximatively 70 miles per hour.</p> <p>The added “loop-then-dive into the water” finale also makes a ride on Chupacabra™ unforgettable!</p>	<p>DARREN:</p> <p>The Chupacabra™ ride has been designed exclusively for our park. The ride offers several sensational moments, notably a two-seconds long zero-gravity time. The average speed on ride approaches 70 miles per hour. Chupacabra™ is an inverted rollercoaster, with the train suspended from the tracks, and seats directly attached to the wheel carriage. That way, your arms and legs are free. We added water effects, especially a dive after the main loop at the end, which make a Chupacabra™ ride both incredible and high in sensations! Nevertheless, some people will find that the ride is too long, as it takes the train several minutes to reach its maximum speed. Chupacabra™ is 130 feet high, and therefore offers incredible views over the whole park.</p>

Drug	<p>These two executives of NeuPharm™, Leo and Steve, were asked to provide a non-technical description of the new drug Zomalan™ for nurses and social workers. Please read both texts attentively before answering questions:</p>	
	<p>LEO</p> <p>We designed Zomalan™ as a complement medicine in the treatment of cardio-vascular conditions, specially for mild forms of angina. Zomalan™ is not the main treatment. It was designed to allow the patients to avoid the usual side effects of angina treatment, like frequent vomiting and stomach pains. Zomalan was tested in extensive laboratory trials and clinical studies. It is very effective and the studies report no clear side-effects. Note that the tablets leave a very bitter after-taste, despite the coating, so they are not pleasant to ingest, even with fruit-juice or soda. In patients under angina treatment, the sympathetic nervous systems triggers painful spasms (stomach cramps) that result in vomiting. Zomalan™ blocks that process.</p>	<p>STEVE</p> <p>Zomalan™ is a new formula that provides much-needed help for people with mild forms of angina and other cardio-vascular diseases. It is a complement to the standard main treatment of such conditions, and serves to alleviate its usual side-effects, due to its pain-killing and anti-emetic (anti-vomiting) functions. Note that patients with stomach ulcers or other digestive conditions must not take this medicine, unless approved by their physician. Zomalan works mostly by acting on the sympathetic nervous system, blocking the spastic reactions, mostly caused by the medication, that usually cause vomiting and sharp stomach pains. Intensive lab and clinical tests of Zomalan™ have shown highly reliable efficacy and no detectable side-effects.</p>

Wash	<p>These two engineers, Chuck and Lenny, were involved in designing the new Mehlen™ washing machine. Here they explain its main features. Please read both texts attentively before answering questions:</p>	
	<p>CHUCK</p> <p>The new Mehlen 205 is the most advanced washer we have produced yet. There are more than 2000 combinations of time, temperature, spinning speed and detergent intake. One advanced feature is the ultra high speed spin cycle, that makes spinning much shorter, but does not consume more electricity than regular spin cycles. Note that the very high speed Ultra-Spin may damage delicate fabrics, so be sure to use only regular spin speed for these clothes. The main innovation concerns the optimal use of detergent and water. We have designed a new washer body, in which the rotation is inverted and the washing load is moved up and down by a plastic blade. There are special cycles for extremely delicate fabrics, with spinning as low as 30 rpm and a very gradual heating of the water.</p>	<p>LENNY</p> <p>This is the Mehlen 250, we have designed as a revolutionary washer with many new features. The Mehlen 250, because of all these features, is of course more expensive than regular washers with the same washing volume. To achieve a thorough detergent penetration and rinsing, we have designed a revolutionary system in which the washing load is both rotated in changing directions every few seconds, and pushed up and down by a plastic blade. There are cycles for instance for ultra-delicate fabrics, which not only heat the water very slowly but also slow down the spinning speed. At the opposite end, we also provide the fastest spinning cycle ever in domestic washers, which goes at about twice the maximum speed of regular machines, without using more power. The Mehlen 250 provides more than 2000 combinations, to adapt to all needs in terms of heat, load and detergents.</p>

Appendix B: Materials and Results from Paper 3

Pre-test results, full list of trivia, counterbalancing, and additional results details from paper 3

Pre-tested items

Item	Mean Truth (1-7)	SD	# of participants answering "4" on 1-7 scale	Set	N	% of participants answering "4" on 1-7 scale	WD CT
Vanuatu has a greater area than Nauru.	4.259259	0.594371	19	1	26	0.730769	7
British Summer Time begins on the first Sunday of March.	4.028571	0.746983	22	4	34	0.647059	10
The Crimean War was fought before the Boer Wars.	4.37037	0.791695	16	1	26	0.615385	9
A muon has negative electric charge.	3.794118	0.880062	19	2	33	0.575758	6
The capital of Nauru is Nauru City.	4.333333	0.960769	11	1	26	0.423077	7
The Admiral Graf Spee was a German Warship.	4.114286	0.963188	25	4	34	0.735294	8
Millennium Stadium is England's venue for our English rugby team.	4.314286	1.022437	18	4	34	0.529412	10
The 'Q' in Q-tips stands for 'quicker'.	4.259259	1.022538	13	1	26	0.5	7
The numbers on a roulette wheel add up to 777.	3.851852	1.06351	14	1	26	0.538462	10
The 'Plains of Abraham' are located near Quebec City.	4.1875	1.119836	18	3	31	0.580645	9
Australia's flag contains more stars than New Zealand's.	4.444444	1.120897	12	1	26	0.461538	8
The element 'carbon' has the highest melting point.	3.714286	1.126458	17	4	34	0.5	8
The Penny Black is an old fashioned coin.	3.657143	1.136115	20	4	34	0.588235	8
Transnistria is a disputed territory in Moldova.	4.088235	1.137985	16	2	33	0.484848	7
Joan of Arc fought at the Battle of Agincourt.	4.441176	1.185549	12	2	33	0.363636	9

When Hydrogen nuclei fuse, total mass decreases.	4.235294	1.207522	12	2	33	0.363636	7
The island of Borneo is occupied by three countries.	4.407407	1.217161	10	1	26	0.384615	9
A slug's blood is green.	4.03125	1.230903	14	3	31	0.451613	5
Rabat is the capital of Morocco.	4.114286	1.231246	20	4	34	0.588235	6
Stephenson's Rocket was the first steam locomotive.	4.205882	1.249955	9	2	33	0.272727	7
Osh is the capital city of Kyrgyzstan.	4.117647	1.273618	18	2	33	0.545455	7
The island of Malta is surrounded by the Atlantic Sea.	4.2	1.278786	14	4	34	0.411765	10
An alpha particle is identical to a helium nucleus.	4	1.302678	14	2	33	0.424242	9
The first webcam watched a coffee pot.	4.296296	1.324759	12	1	26	0.461538	7
The Parthenon was built before the Colossus of Rhodes.	4.382353	1.326072	11	2	33	0.333333	9
Mount Kilimanjaro is higher than Denali.	4.185185	1.331195	8	1	26	0.307692	6
In binary, $101 + 101 = 1010$.	3.911765	1.334113	17	2	33	0.515152	7
The Ming Dynasty was the final Chinese Dynasty.	4.294118	1.337782	9	2	33	0.272727	8
Genghis Khan's real name was Temujin.	4.470588	1.353677	17	2	33	0.515152	6
Leptons are made up of quarks.	3.882353	1.365477	17	2	33	0.515152	6
William McKinley was on the \$5000 dollar bill.	3.777778	1.368136	16	1	26	0.615385	8
William Wallace lived before King Macbeth.	3.823529	1.381053	11	2	33	0.333333	6

Paper 3: Study Phase Counterbalancing

Group	Trial	Repeat?	Sentence	Face
Group1	t01	NoRep	S01	face01
Group1	t02	NoRep	S02	face02
Group1	t03	NoRep	S03	face03
Group1	t04	NoRep	S04	face04
Group1	t05	NoRep	S05	face05
Group1	t06	NoRep	S06	face06
Group1	t07	NoRep	S07	face07
Group1	t08	NoRep	S08	face08
Group1	t09	Reptd	S09	face09
Group1	t10	Reptd	S09	face09
Group1	t11	Reptd	S09	face09
Group1	t12	Reptd	S10	face10
Group1	t13	Reptd	S10	face10
Group1	t14	Reptd	S10	face10
Group1	t15	Reptd	S11	face11
Group1	t16	Reptd	S11	face11
Group1	t17	Reptd	S11	face11
Group1	t18	Reptd	S12	face12
Group1	t19	Reptd	S12	face12
Group1	t20	Reptd	S12	face12
Group1	t21	Reptd	S13	face13
Group1	t22	Reptd	S13	face13
Group1	t23	Reptd	S13	face13
Group1	t24	Reptd	S14	face14
Group1	t25	Reptd	S14	face14

Group1	t26	Reptd	S14	face14
Group1	t27	Reptd	S15	face15
Group1	t28	Reptd	S15	face15
Group1	t29	Reptd	S15	face15
Group1	t30	Reptd	S16	face16
Group1	t31	Reptd	S16	face16
Group1	t32	Reptd	S16	face16
Group2	t01	NoRep	S16	face16
Group2	t02	NoRep	S15	face15
Group2	t03	NoRep	S14	face14
Group2	t04	NoRep	S13	face13
Group2	t05	NoRep	S12	face12
Group2	t06	NoRep	S11	face11
Group2	t07	NoRep	S10	face10
Group2	t08	NoRep	S09	face09
Group2	t09	Reptd	S08	face08
Group2	t10	Reptd	S08	face08
Group2	t11	Reptd	S08	face08
Group2	t12	Reptd	S07	face07
Group2	t13	Reptd	S07	face07
Group2	t14	Reptd	S07	face07
Group2	t15	Reptd	S06	face06
Group2	t16	Reptd	S06	face06
Group2	t17	Reptd	S06	face06
Group2	t18	Reptd	S05	face05
Group2	t19	Reptd	S05	face05
Group2	t20	Reptd	S05	face05

Group2	t21	Reptd	S04	face04
Group2	t22	Reptd	S04	face04
Group2	t23	Reptd	S04	face04
Group2	t24	Reptd	S03	face03
Group2	t25	Reptd	S03	face03
Group2	t26	Reptd	S03	face03
Group2	t27	Reptd	S02	face02
Group2	t28	Reptd	S02	face02
Group2	t29	Reptd	S02	face02
Group2	t30	Reptd	S01	face01
Group2	t31	Reptd	S01	face01
Group2	t32	Reptd	S01	face01
Group3	t01	NoRep	S17	face16
Group3	t02	NoRep	S18	face15
Group3	t03	NoRep	S19	face14
Group3	t04	NoRep	S20	face13
Group3	t05	NoRep	S21	face12
Group3	t06	NoRep	S22	face11
Group3	t07	NoRep	S23	face10
Group3	t08	NoRep	S24	face9
Group3	t09	Reptd	S25	face8
Group3	t10	Reptd	S25	face8
Group3	t11	Reptd	S25	face8
Group3	t12	Reptd	S26	face7
Group3	t13	Reptd	S26	face7
Group3	t14	Reptd	S26	face7
Group3	t15	Reptd	S27	face6

Group3	t16	Reptd	S27	face6
Group3	t17	Reptd	S27	face6
Group3	t18	Reptd	S28	face5
Group3	t19	Reptd	S28	face5
Group3	t20	Reptd	S28	face5
Group3	t21	Reptd	S29	face4
Group3	t22	Reptd	S29	face4
Group3	t23	Reptd	S29	face4
Group3	t24	Reptd	S30	face3
Group3	t25	Reptd	S30	face3
Group3	t26	Reptd	S30	face3
Group3	t27	Reptd	S31	face2
Group3	t28	Reptd	S31	face2
Group3	t29	Reptd	S31	face2
Group3	t30	Reptd	S32	face1
Group3	t31	Reptd	S32	face1
Group3	t32	Reptd	S32	face1
Group4	t01	NoRep	S17	face1
Group4	t02	NoRep	S18	face2
Group4	t03	NoRep	S19	face3
Group4	t04	NoRep	S20	face4
Group4	t05	NoRep	S21	face5
Group4	t06	NoRep	S22	face6
Group4	t07	NoRep	S23	face7
Group4	t08	NoRep	S24	face8
Group4	t09	Reptd	S25	face9
Group4	t10	Reptd	S25	face9

Group4	t11	Reptd	S25	face9
Group4	t12	Reptd	S26	face10
Group4	t13	Reptd	S26	face10
Group4	t14	Reptd	S26	face10
Group4	t15	Reptd	S27	face11
Group4	t16	Reptd	S27	face11
Group4	t17	Reptd	S27	face11
Group4	t18	Reptd	S28	face12
Group4	t19	Reptd	S28	face12
Group4	t20	Reptd	S28	face12
Group4	t21	Reptd	S29	face13
Group4	t22	Reptd	S29	face13
Group4	t23	Reptd	S29	face13
Group4	t24	Reptd	S30	face14
Group4	t25	Reptd	S30	face14
Group4	t26	Reptd	S30	face14
Group4	t27	Reptd	S31	face15
Group4	t28	Reptd	S31	face15
Group4	t29	Reptd	S31	face15
Group4	t30	Reptd	S32	face16
Group4	t31	Reptd	S32	face16
Group4	t32	Reptd	S32	face16

Paper 3: Table of responses by ethnicity

(##The N here refers to the number of items judged, not the number of individuals. For instance, there were 5 Asian identifying participants.)

Race	Reps	N	Mean Truth	SD
1 Asian	0	80	3.62	1.22
1 Asian	1	40	3.98	1.40
1 Asian	3	40	4.53	1.28
2 Black	0	96	3.39	1.36
2 Black	1	48	4.69	1.06
2 Black	3	48	4.29	1.54
3 White	0	896	3.71	1.02
3 White	1	448	4.13	1.23
3 White	3	448	4.18	1.13
4 Latino	0	80	3.45	1.09
4 Latino	1	40	4.40	1.30
4 Latino	3	40	4.62	1.10
6 Other	0	16	3.88	1.02
6 Other	1	18	4.00	.93
6 Other	3	18	4.38	1.06

Paper 3: Mean truth score by group, study 3

Group	N	Mean Truth Score	SD
A	640	3.92	1.17
B	448	4.20	1.23
C	672	3.86	1.11
D	576	3.85	1.19

Group	Repetitions at Study	Mean truth rating	SD
A	0	3.75	1.06
	1	4.04	1.38
	3	4.19	1.10
B	0	3.82	1.03
	1	4.38	1.37
	3	4.77	1.19
C	0	3.62	1.08
	1	4.14	1.08
	3	4.04	1.10
D	0	3.50	1.

		0
		8
1	4.23	1
		.
		1
		3
3	4.15	1
		.
		2
		6

Appendix C: Paper 4 materials

Stories from Study 2 (Misfortune Memory)

There was a woman named Sarah who lived in a pretty little house with her husband and two children, whom she loved very much. They had a small farm and were able to support themselves off of what they grew. Sarah was happy and content.

One year, the rain stopped coming, and the crops stopped growing, and Sarah and her family grew hungry. All of her neighbors were in the same situation and couldn't help each other. Sarah made the difficult decision to leave her house and her land behind, and go with her family to try to find a way to survive. They packed a few belongings, and started walking.

On Sarah's journey, many different things happened.

Story set A

I1 While she was walking, a root tripped her, and she fell down and broke her wrist.

A3 Sarah asked for food at the next village, but her family went hungry because the people in the village would not share with her.

I5 Sarah went to a doctor, but she didn't get any help because the doctor was out of medicine.

A7 Villagers were standing on a cliff, throwing rocks into the road. A rock hit Sarah in the head and made her bleed.

Non-misfortune stories

I9 Sarah was very cold. The sun started shining brightly on Sarah, and she felt warm again.

A11 Things were very grim and Sarah felt sad, but when she was walking, other travelers starting singing and she felt cheered.

I13 Sarah was so hungry she thought she would die, but then luckily she found some berries. It wasn't much, but it was enough to keep going.

A15 When she went to the next village, there was a big celebration and the people gave her family a little food to share.

Story set B

A2 A man pushed on her back and held her head under water. She breathed in water and choked.

I4 At the next village, they found some meat in the street and ate it, but it made them very sick because it came from animals that had been sick and died.

A6 Some villagers covered a hole with leaves, so when Sarah took a step, she fell in and broke her leg.

I8 Sarah's family built a small shelter with branches, but a lightning bolt lit it on fire and the family had to run away.

Non-misfortune stories

A10 Sarah was thirsty, but found a man who gave her water.

I12 Sarah was so tired that when she was walking, she almost stumbled and fell, but a tree happened to be there and caught her, so she could recover.

A14 Sarah was sleeping outside and very cold, but a woman gave her a blanket and she was warm enough to sleep.

I16 Sarah's family found some special leaves on the sides of the road which they chewed for energy.

Story Set C

A1 While she was walking, a man shoved her, and she fell down and broke her wrist.

I3 Sarah asked for food at the next village, but her family went hungry because the drought had killed all of the plants there too.

A5 Sarah went to a doctor, but she didn't get any help because the doctor didn't like traveling people.

I7 Rocks were falling off a crumbling cliff and into the road. A rock hit Sarah in the head and made her bleed.

Non-misfortune stories

A9 Sarah was very cold. A traveler let Sarah share her fire, and Sarah felt warm again.

I11 Things were very grim and Sarah felt sad, but when she was walking, some birds started singing and she felt cheered.

A13 Sarah was so hungry she thought she would die, but a girl gave her some berries. It wasn't much, but it was enough to keep going.

I15 When she went to the next village, there was a big celebration, so her family could find a little food that was left.

Story set D

I2 While Sarah was traveling, a branch fell on her back and held her head under water. She breathed in water and choked.

A4 At the next village, they found some meat in the street and ate it, but it made them very sick because the people had poisoned it to get rid of beggars.

I6 The wind covered a hole with leaves, so when Sarah took a step, she fell in and broke her leg.

A8 Sarah's family built a small shelter with branches, but a young man lit it on fire and the family had to run away.

Non-misfortune stories

I10 Sarah was thirsty, but found a well that gave her water.

A12 Sarah was so tired that when she was walking, she almost stumbled and fell, but a man happened to be there and caught her, so she could recover.

I14 Sarah was sleeping outside and very cold, but she buried herself in leaves and grass and was warm enough to sleep.

A16 Sarah's family met a man on the road who gave them some leaves to chew for energy.

Finally, Sarah and her family reached an area where there was plenty of food and water. Sarah and her husband were able to find a farmer who needed help. Sarah's family stayed on the farmer's land and worked for him until they were able to buy a small plot of land themselves, and start over.

Stories from Study 3

Events

MCI Agents

1

There was a person who could see into the future. He sent Sarah toward a place where there would be a terrible storm.

There was a person who could see into the future. He sent Sarah toward a place where there would be a beautiful day.

2

There was a person who could be in two places at same time. He kept showing up to scare Sarah.

There was a person who could be in two places at same time. He kept showing up to help Sarah.

3

There was a person who could walk through walls. He stole Sarah's belongings and put them in a room that had no door.

There was a person who could walk through walls. He got things for Sarah from a room that had no door.

4

There was a person who could see through the mountain. He looked through and directed Sarah on the most dangerous route.

There was a person who could see through the mountain. He looked through and directed Sarah on the most pleasant route.

5

There was a person who could fly. She flew to get Sarah some water in a hard to reach place.

There was a person who could fly. She flew to hide Sarah's water in a hard to reach place.

6

There was a person who could transform objects. She turned Sarah's food to stone.

There was a person who could transform objects. She turned stone into food for Sarah.

7

There was a person who could sing bewitching songs. He sang and made Sarah suddenly grow dizzy and confused.

There was a person who could sing bewitching songs. He sang and made Sarah suddenly feel strong and brave.

8

There was a person who could change the speed of time. She slowed down Sarah's journey during a difficult climb, so it was harder for Sarah.

There was a person who could change the speed of time. She sped up Sarah's journey during a difficult climb, so it was easier for Sarah.

9

There was a person who could turn invisible. He snuck up on Sarah and pulled her hair.

There was a person who could turn invisible. He snuck up on Sarah and left her a present.

10

There was a person who could make magic potions. He gave Sarah a potion to make her look very ugly.

There was a person who could make magic potions. He gave Sarah a medicine to make her look very beautiful.

11

There was a person who could read minds. She told everyone in town that Sarah was a terrible person.

There was a person who could read minds. She told everyone in town that Sarah was a wonderful person.

12

There was a person who could make things grow instantly. She grew a ring of trees around Sarah to trap her.

There was a person who could make things grow instantly. She grew a tree with a nest for Sarah to sleep safely in.

Intuitive agents

13

There was a person who could move heavy things. He pushed a big rock into Sarah's path, blocking her.

There was a person who could move heavy things. He moved a big rock that was blocking Sarah's path.

14

There was a person who could think fast. He tricked Sarah into wasting her time and resources.

There was a person who could think fast. He helped Sarah figure out the best way to save her time and resources.

15

There was a person who could climb very well. He took Sarah's backpack climbed to where she couldn't reach.

There was a person who could climb very well. He climbed to where Sarah couldn't reach and got her some fruit.

16

There was a person who could run very fast. He chased Sarah and she couldn't escape because he was so fast.

There was a person who could run very fast. He ran in many directions, to find Sarah the best way to go.

17

There was a person who could make clever inventions. He made a trap that Sarah fell into.

There was a person who could make clever inventions. He made a tool that helped Sarah navigate.

18

There was a person who could remember many things. He remembered the path with the most thorn bushes and quicksand and told Sarah to go that way.

There was a person who could remember many things. He remembered the path that had the most fruit trees and safe places to sleep and told Sarah to go that way.

19

There was a person who could throw stones very accurately. He threw stones at Sarah and hit her making her run away.

There was a person who could throw stones very accurately. He threw stones at birds and caught them for Sarah to eat.

20

There was a person who could make medicine from plants. He gave medicine to Sarah to make her very weak.

There was a person who could make medicine from plants. He gave medicine to Sarah to make her very strong.

21

There was a person who could control his horse very well. He tried to get the horse to kick Sarah.

There was a person who could control his horse very well. He gave Sarah a ride to the next village.

22

There was a person who could move very quietly. He snuck up on Sarah and scared her so she screamed.

There was a person who could move very quietly. He snuck up on people to spy for Sarah's benefit.

23

There was a person who could easily influence people's emotions. He spoke with Sarah and made her feel horrible about herself.

There was a person who could easily influence people's emotions. He spoke with Sarah and made her feel good about herself.

24

There was a person who could build very strong structures. He built a cage that Sarah couldn't get out of.

There was a person who could build very strong structures. He built a tent that kept Sarah safe as she traveled.