

Towards Understanding Intuition and Reason in Paranormal Beliefs

Marjaana Lindeman

Introduction

When the British anthropologist Sir James Frazer (1854–1941) set out to study the cult of Diana of Aricia, the Roman goddess of the hunt, he eventually ended up with a continuum theory of thinking. He supposed that ways of thinking had developed from magic, through religion, to science over the course of human history. He also wondered whether this kind of development would continue in the future and concluded that "we cannot tell" (Frazer, 1922/1963, p.827).

Now, after a century, we know the answer. Scientific education has not eliminated supernatural beliefs. In the country with the world's best universities, the United States, there are far more astrologers than astronomers (Gilovich, 1991). In Finland, whose education system has been rated as one of the best in the world, nearly half of the population thinks that angels exist and that death may not be final (The Church Research Institute, 2016). The question of why well-educated individuals still believe in the supernatural is intriguing. Why does the supernatural still captivate even though an exciting and more realistic scientific worldview is available?

Many scientists have been interested in paranormal beliefs, and their multifaceted manifestations, explanations and correlates have received much research attention. Good reviews of the studies in this area are available to the interested reader (e.g., Bering, 2011; Hood, 2009; Irwin, 2009; Vyse, 2014). Books for a wider audience are also worthy of attention (e.g., Hutson, 2012; Shermer, 2011). These works discuss several issues that are not addressed in the present review, including biological and demographic variables and the impact of threat, personality, education and social environment on beliefs.

The focus of the present chapter is in themes that have not been explored in depth in previous work. Due to the advancements in dual-process theories of higher cognition and domain-specific cognition, the research focus of the research has expanded to analytical and intuitive thinking, and to the content of beliefs. Because the number of such studies has rapidly increased in recent years and has offered new insight, my aim here is to review and discuss paranormal beliefs in terms of these lines of research.

For purposes of simplicity, I will sometimes speak here about believers vs. skeptics, although believing is obviously a non-dichotomic phenomenon. Several concepts have been in use to describe the same type of beliefs. Despite their different etymologies, the concepts ‘paranormal,’ ‘magical,’ ‘superstitious’ and ‘supernatural’ have been shown to mean the same thing (Lindeman & Svedholm, 2012) so I will use the terms interchangeably. The concept of ‘religious’ is slightly different. Although belief in the supernatural is the key defining attribute of religiosity, religions also bring with them non-supernatural doctrines, rituals, art and politics, as well as social, moral and emotional aspects, whereas nothing comparable exists with other supernatural beliefs.

I begin negligently, without defining the beliefs, because it has turned out to be a difficult task. Initially, superstitious, paranormal, supernatural and magical beliefs were seen simply as mistakes. This definition is unusable, because in that case, the belief that New York is a city in Texas should be classified as a superstition. Defining beliefs as that which violate the fundamental and scientifically founded principles of nature does not help, either. The belief that color is an attribute of a material object contradicts the laws of physics, but it is not a paranormal belief (color is an interpretation that our brain makes about light energy).

Although defining paranormal beliefs has been difficult, the difference between them and other beliefs is intuitively easy to detect. For some reason, everyone knows that believing in ghosts is quite different from an incorrect conception of color. Some scholars even defined

the paranormal as phenomena that most members of society would recognize as falling into this category (Campbell, 1996). However, the reason why identification is easy, did not attract attention.

Paranormal Beliefs and Dual-Process Theories of Reasoning

The idea that human thinking is not a singular system is not new. The notion of diverse thinking systems has gone through different variations over the centuries, including the ancient Greek philosophers' distinctions between the rational soul and other souls, and the French scientist Blaise Pascal's (1623–1662) timeless quote” The heart has its reasons, which reason does not know". Perhaps closest to the present perspective was the English philosopher, William of Ockham (1287–1347), who distinguished reason from faith, and stated radically that scientific explanations should be made without references to the supernatural because the supernatural is simply a question of faith.

Kahneman and Tversky's Nobel Prize-winning work on heuristic decision making (Kahneman, 2011; Tversky & Kahneman, 1974), and increased knowledge about the human mind and its evolutionary origins overall, has greatly advanced our understanding of dual processing in higher cognition. In recent times, dual-process theories have been proposed in several fields of psychology, including social, developmental, personality and cognitive psychology, as well as cognitive neuroscience (Evans & Stanovich, 2009; Evans, 2008). Two dual-process theories, in particular, have been applied to research on paranormal beliefs. Here I refer to them as the Epsteinian approach and the process approach.

The Epsteinian Approach

Cognitive-experiential self-theory. One of the most popular theories of the two ways of knowing is Epstein's cognitive-experiential self-theory (CEST), a combined theory of cognition and personality (Epstein, 2010; Epstein & Pacini, 1999; Pacini & Epstein, 1999). According to CEST, humans operate with two information-processing systems that have

different operating rules: the experiential system, also known as the intuitive system, and the rational system, also known as the analytical system. The experiential and the rational systems are proposed to operate synchronously under most circumstances, wherein people are only aware of what appears to them to be a single process. However, under other circumstances, as in conflicts between 'reason' and 'the heart,' the different qualities of the two thinking systems become apparent.

The experiential system is assumed to be an evolutionarily old, primarily nonverbal, and automatically operating cognitive system. According to CEST, experiential/intuitive information processing is holistic, associative and concrete. It is based primarily on experiences: Namely, experiences – either direct or vicarious – are the only reality in the system. The experiential system encompasses all phenomena that are based on non-analytical information processing, for instance irrational fears and superstitions, and especially all kinds of intuitions. In CEST, an intuition is aptly defined as a sense of knowing without knowing how one knows.

Rational/analytical processes, in turn, are described as evolutionarily recent, mostly conscious, and affect-free verbal processes that result in explicit, deliberative knowledge. Concepts of truth and reality are based on logical considerations and evidence, rather than personal experiences. Whereas intuitive processes help us to learn from experience, and behave automatically and effectively with minimal cognitive effort, analytical processes can operate at higher levels of abstraction, can correct intuitive biases as well as enable the transmitting of information and the progression of knowledge.

CEST helps us to understand paranormal beliefs in two ways. First, early empirical findings on paranormal believers' ways of thinking and the co-existence of two conflicting beliefs, all thus far conducted along separate lines of research, can be incorporated into one framework. Second, several studies on paranormal beliefs have used the Rational-

Experiential Inventory and have provided important information about believers' and skeptics' thinking styles.

Early empirical work. According to CEST, superstitious thinking has the same attributes as intuitive thinking in general (Epstein, 2010). Of these attributes, associative and holistic thinking in particular have received much research attention, and the findings have been unambiguous. Although not based on CEST, a host of studies have shown that more than nonbelievers, believers connect two or more things liberally together in their minds, resulting in impressions of causality, contagion and covariation (reviews: Rozin & Nemeroff, 2002; Wiseman & Watt, 2006). For example, believers rate randomly paired words (e.g., elephant-banana) as being more closely and meaningfully related than do skeptics (Mohr, Graves, Gianotti, Pizzagalli, & Brugger, 2001).

Moreover, many scholars have mentioned that a special sense of holism – an extreme form of outspread associations – characterizes superstitious and magical thinking. This feeling has been described as a sense of global totality, undivided unity, an interconnected cosmos and a fundamental relation between a human being and the universe (Malinowski, 1948/1992; Piaget, 1929/1951). In support of these ideas, one study showed that, whereas other participants accepted the existence of chance and randomness in the universe, members of a New Age (spiritualist) community believed in a fully determined universe and the unity between self and events in the outside world: "It's not outside, it's all the same," as one interviewee said (see also Farias, Claridge, & Lalljee, 2005; Lesser & Marilyn, 1985, p. 68).

CEST also emphasizes the conflict between intuitive and rational beliefs, an observation that has a long history in studies on paranormal beliefs. Decades ago, Mauss (1902/1972) wrote that in magic the individual does not reason, or if he does, this reasoning is unconscious. (Tylor, 1871/1974) argued that magic is felt and lived rather than thought. In the report on his ethnographic studies on the Trobriand Islands in New Guinea, Malinowski

(1948/1992) described his bafflement upon finding that people can have two so completely contradictory beliefs about one thing. He found, for example, that the Trobrianders believed that the spirit of the dead, Baloma, impregnates women if they bath in a lagoon and that becoming pregnant in other ways is not possible. At the same time, however, the Trobrianders knew that a man and a woman have to be together to make conception possible.

A similar co-existence of supernatural and rational beliefs has been observed in contemporary studies, for example in beliefs about the nature of death (Astuti & Harris, 2008), illness (Legare & Gelman, 2008) and biological processes (Lindeman & Saher, 2007). Subbotsky has obtained relevant evidence in many experiments. In one of his studies, adult participants believed in scientific explanations rather than in the experimenter's magic spells when asked verbally what had caused a piece of plastic to be badly scratched after it had been put in a box. When the participants were asked to put their hands in the box, however, they felt more anxious and requested the experimenter not to repeat the magic spell (Subbotsky, 2001).

Many things develop in the same way, by adding new material alongside old content. Our nervous system is hierarchically built, layered like a cake (Peters, 2013), and our body hair stands up when we are cold although we nowadays have more efficient shields against low temperatures. Similarly, studies on learning show that in many cases, science education does not replace intuitive misconceptions and that the misconceptions can coincide with rational knowledge (e.g., Reiner, Slotta, Chi, & Resnick, 2000; Shtulman & Harrington, 2015).

Nonetheless, paranormal beliefs are more paradoxical than many other beliefs: people often know that their beliefs are irrational and unreasonable, and that the superstitious rituals they engage in do not work (Epstein & Pacini, 1999; Risen, 2016; Rozin & Nemeroff, 2002). Paranormal beliefs are thus unlike any other incorrect beliefs, as people typically do not

believe in the things they consider unbelievable or use expedients they consider to be unworkable.

Rational-Experiential Inventory (REI). One of the main arguments of CEST is that individuals differ in the degree to which they rely on experiential and rational information processing. Because assessment methods for individual differences were lacking, Epstein, Pacini, Denes Raj, and Heier (1996) developed the Rational-Experiential Inventory. Nowadays, the original REI (Epstein et al., 1996) or its newer versions (Norris & Epstein, 2011; Pacini & Epstein, 1999) constitute one of the most common methods in studies on the relationship between intuitive and analytical thinking and paranormal beliefs.

The REI has two subscales. The Rationality subscale is based on the Need for Cognition scale (NfC, Cacioppo, Petty, Feinstein, & Jarvis, 1996) which assesses engagement in and enjoyment of effortful cognitive activity. The scale includes statements such as 'I enjoy problems that require hard thinking' and 'I prefer complex to simple problems.' The concept of rationality in the subscale name is misleading because, as several scholars have mentioned, enjoying thinking does not imply rationality (Petty, Briñol, Loersch, & McCaslin, 2009; Svedholm & Lindeman, 2013; Yates & Chandler, 2000). One can enjoy contemplating nonsense, after all. Therefore here I will use the original and well-established scale name, Need for Cognition.

Items in the other subscale, Faith in Intuition (FI), were generated by Epstein and his colleagues to assess the extent to which individuals depend on gut feelings when making decisions and follow their heart as a guide for actions. Example items include 'I like to rely on my intuitive impressions' and 'I trust my initial feelings about people.' According to CEST, intuitive and analytical thinking styles are not opposites on one continuum but rather two independent dimensions. A person can thus be high or low in one or both styles. In support of this argument, several studies have shown a lack of correlation between NfC and

FI scores (e.g., Barr, Pennycook, Stolz, & Fugelsang, 2015; Pennycook, Cheyne, Koehler, & Fugelsang, 2016; Pretz & Tetz, 2007).

Epstein et al. (1996) were the first to show that when superstitions increase, Need for Cognition decreases and Faith in Intuition increases. Most subsequent results have replicated these findings. The positive relationship between Faith in Intuition and paranormal beliefs has typically been strong, with correlations usually ranging from .35 to .50. The association between need for cognition and paranormal beliefs is negative but weaker, with correlations seldom reaching a value higher than -.25 (e.g., Aarnio & Lindeman, 2007; Epstein et al., 1996; Lindeman & Svedholm-Häkkinen, 2016; Lobato, Mendoza, Sims, & Chin, 2014; Svedholm & Lindeman, 2013).

As a whole, the studies demonstrate quite clearly that people who believe in supernatural phenomena do not enjoy intellectual challenges and prefer to follow their instincts and rely on their intuition. Cognitive motivation to analyze one's thinking and the available information, as measured by the Need for Cognition scale, seems to decrease the beliefs but the correlation is not very strong.

The Process Approach

'Process approach' refers here to Evans and Stanovich's model of Type 1 and Type 2 processes, previously called System 1 and System 2 (Evans & Stanovich, 2013; Stanovich, West, & Toplak, 2010). Evans and Stanovich are dual-process scholars who first developed their theories independently but have recently integrated their work. This line of research differs from the Epsteinian approach in important respects. Evans (2009) has argued that researchers often confuse these two approaches. He writes that the two types of cognitive processes simply cannot be equated with such personality characteristics as intuitive and analytical thinking styles, and continues: "I fail to understand how systems and styles can be

combined (...) in this way" (p. 36). Although we have fallen into this confusion in our research group as well, it is easy to concur with this remark.

According to this approach, Type 1 and Type 2 processes have only a few defining attributes. Type 1 processes are autonomous processes which do not require working memory or controlled attention whereas Type 2 processing rely heavily on working memory. Other attributes, such as those described by the Epsteinian approach, are regarded only as correlates of the two processes. Examples of Type 1 processes include the behavioral regulation of emotions, evolutionary modules for solving adaptive problems, implicit learning processes and overlearned associations. Type 1 processes yield default responses unless higher-order, Type 2 reasoning processes do not intervene with these judgments and improve or correct them. Type 2 thinking enables uniquely human facilities, such as hypothetical thinking, mental simulation and consequential decision making.

Applying the process model to paranormal belief

To understand the relationship between analytical thinking and paranormal beliefs, Stanovich's tripartite model of mind is particularly useful. The model divides Type 2 processes further into algorithmic and reflective processes (Stanovich, 2009; Stanovich, 2012; Stanovich & West, 1997). Algorithmic-level processes refer to variations in cognitive abilities, that is, in optimal and maximal performance which is typically assessed with intelligence tests or other cognitive aptitude tests. As we do not constantly use our full intellectual resources and do not try to reach our highest potential in everyday life, examining typical reasoning is at least as important as examining maximum performance. In the tripartite model, typical reasoning processes are known as 'reflective processes.' They are thinking styles, or thinking dispositions, which reflect one's epistemic values and attitudes towards knowledge and the acquisition of information.

Reflective processes. Reflective processes correspond with Epsteinian-type thinking styles but with one essential qualification. In Stanovich's model, both intuitive and analytical thinking styles are characterized as Type 2 processes, whereas in the Epsteinian approach, the intuitive thinking style is usually discussed together with automatic and unconscious Type 1 processes. Stanovich's model thus makes it clear that when we ask people whether they prefer to rely on their intuition and trust their hunches, we are examining Type 2 epistemic styles, not intuitive processes per se. Although the concepts related to epistemic styles and Type 1 and 2 processes are often misused, most scholars, I believe, understand the difference and have interpreted their empirical findings properly.

Epstein's and Stanovich's models differ also in the number of thinking styles they deal with. Whereas the Epsteinian approach has examined two independent thinking styles, faith in intuition and need for cognition, Stanovich has focused on reflective thinking, a style close to need for cognition.

Stanovich (2012) describes people with strong reflective thinking as individuals who collect information before making up their minds, seek various points of view before drawing conclusions, think extensively about problems before responding and calibrate the degree of strength of their opinions to the degree of evidence available. To assess reflective processes, Stanovich and his colleagues have developed two tests that have been used in research on paranormal belief, the Argument Evaluation Test (AET, Stanovich & West, 1997) and the Actively Open-Minded Thinking scale (AOT, Sá, West, & Stanovich, 1999).

AET assesses a person's ability to evaluate the objective quality of several arguments (e.g., Whether welfare system should be drastically cut back in size.). The test has several phases and the quality of the arguments has to be determined by expert judges, so only a few researchers have used AET in studies on paranormal beliefs. Stanovich and West (1997) found that those with a high reliance on argument quality displayed significantly lower scores

on a superstitious thinking scale than other participants. Similarly, Gray and Gallo (2016) found that skeptics were better than believers at evaluating the quality of the arguments presented. Also, in our study, those who were good at evaluating arguments believed less in astrology, telepathy and other paranormal phenomena than other participants (Svedholm & Lindeman, 2013).

In studies on paranormal beliefs and analytical thinking style, the strongest associations have been observed for actively open-minded thinking. The AOT scale includes 41 statements, for example 'Changing your mind is a sign of weakness' (reverse coded), 'There are basically two kinds of people in this world, good and bad' and 'No one can talk me out of something I know is right.' Overall, actively open-minded thinking indicates openness to new ideas, spending a great deal of time on problems before giving up, and willingness to change one's beliefs and to switch perspectives (Sá et al., 1999). The correlations between AOT and adults' disbelief in superstitions have been as strong as approximately .50 (Sá, Kelley, Ho, & Stanovich, 2005; Svedholm & Lindeman, 2013) and between .30 - .40 among children (Kokis, Macpherson, Toplak, West, & Stanovich, 2002; Toplak, West, & Stanovich, 2014). Thus it seems that actively open-minded thinking captures something essential to paranormal beliefs, and taps critical thinking better than the Need for Cognition scale.

Overall, the above findings support the idea that reflective thinking hinders paranormal beliefs, or more generally, that Type 2 processes override intuitive judgments if an error is detected. However, recall that people often know that their paranormal beliefs are irrational and that their superstitious rituals do not work. In other words, people can detect an error but choose nevertheless not to correct it - a process Risen (2016) refers to as acquiescence. These findings cannot be easily explained by the original process approach. As Risen has brought up, dual process models have an unstated assumption that when people detect an error, they will correct it, but the superstition and magical thinking literature evinces that this assumption

does not always hold. To resolve this contradiction, Risen has made an important point that detection and error and correction of error such be decoupled. Analyzing the processes underlying acquiescence in future studies can shed new explanatory light on paranormal beliefs.

Algorithmic processes: intellectual abilities. Research on the relationship between paranormal beliefs and algorithmic processes, more commonly known as cognitive abilities, has a longer history than research on thinking styles. Nevertheless, the results have been more contradictory than those obtained concerning reflective processes.

To illustrate, some studies show that believers have slightly lower intelligence than skeptics (Hergovich & Arendasy, 2005; Killen, Wildman, & Wildman II, 1974; Sá et al., 2005). However, other studies suggest that paranormal beliefs are not strongly related to fluid intelligence (Stuart-Hamilton, Nayak, & Priest, 2006), verbal intelligence (Pennycook, Cheyne, Seli, Koehler, & Fugelsang, 2012) or memory tasks (a review: Gray & Gallo, 2016). Similarly, some studies indicate that believers make more probability errors than skeptics (Pennycook et al., 2012; Rogers, 2014), while other studies refute these the findings (Blackmore, 1997; Musch & Ehrenberg, 2002). Finally, some studies show that deductive reasoning errors increase as paranormal beliefs increase (Lawrence & Peters, 2004; Wierzbicki, 1985). Again, opposite findings show that having paranormal beliefs does not predict failure in logical reasoning tasks (Gray & Gallo, 2016; Lesser & Marilyn, 1985).

When considering paranormal beliefs and intellectual abilities, the Cognitive Reflection Test (CRT, Frederick, 2005) should also be mentioned as it is a much-used test in research on paranormal and religious beliefs. The CRT is a good measure of both cognitive ability and reflective thinking style (Toplak, West, & Stanovich, 2011). It assesses the tendency of individuals to suppress an intuitive and spontaneous response and to reflect on the question further to find the correct response. An example is as follows: "A bat and a ball cost \$1.10 in

total. The bat costs \$1.00 more than the ball. How much does the ball cost?" Research results quite consistently show that when paranormal beliefs increase, correct responses decrease (Bouvet & Bonnefon, 2015; Cheyne & Pennycook, 2013; Lindeman & Svedholm-Häkkinen, 2016; Pennycook et al., 2012; but see Toplak et al., 2011). The associations have not been very strong, however, possibly because doing well on the test strongly depends on cognitive abilities.

Algorithmic processes: cognitive inhibition. It is also possible that unintentional cognitive inhibition may play an important role in establishing and maintaining paranormal beliefs. Cognitive inhibition refers to the stopping or overriding of a mental process, for example suppressing unwanted or irrelevant thoughts and gating irrelevant information from working memory. It is like a guardian in the intuitive mind – in the jungle where a variety of cognitive processes and competences are likely at any moment to collide, clash, and compete (Houdé, 2000; Kipp Harnishfeger, 1995). Cognitive inhibition is one of the main features of executive functions, the key computational function of the algorithmic mind (Stanovich, 2009).

Although cognitive inhibition has received little research attention in the field of paranormal beliefs, it is noteworthy how similar the correlates of paranormal beliefs are to the correlates of decreased cognitive inhibition. Like paranormal beliefs, weak cognitive inhibition is associated with anxiety and neuroticism (a review: Nigg, 2000), feelings of threat (Linville, 1996), loose associations (White & Shah, 2006), and intuitive thinking (Moutier & Houdé, 2003). Moreover, severe breakdowns in cognitive inhibition occur in diseases that are also associated with supernatural beliefs, for example in schizophrenia (Nigg, 2000).

Although empirical evidence is limited, some studies suggest that believers in the supernatural have weaker cognitive inhibition than disbelievers. First, paranormal believers

have performed poorer than skeptics on each subscale of the Wisconsin Card Sorting Test, including perseverative errors (Lindeman, Riekkki, & Hood, 2011), the subscale most often connected with inhibitory problems. In addition, an fMRI study showed that when participants were viewing pictures inducing supernatural explanations for the stories they had read, brain regions indicating cognitive inhibition were activated more strongly in skeptics than in supernatural believers (Lindeman, Svedholm, Riekkki, Raij, & Hari, 2013).

Summary

The main findings from the two dual process approaches can now be summarized as follows. The results concerning cognitive abilities are the most equivocal. On the one hand, if differences in intellectual abilities exist, the direction is usually the same in that believers show lower cognitive competence than disbelievers. On the other, the difference is small. Moreover, decreased unintentional cognitive inhibition can also predict paranormal beliefs, but the evidence is still preliminary.

Results on variations in Type 2 reflective processes are more robust: compared with skeptics, the thinking style of paranormal believers is more intuitive and less analytical. Although the association between beliefs and analytical thinking style has sometimes been weak, the tendency of believers to score low on the AOT has been exceptionally strong, implying believers' epistemological absolutism, cognitive rigidity, dogmatism, categorical thinking and resistance to belief change. However, only a few studies on paranormal beliefs have used the AOT, so future studies are needed to confirm the findings.

Caveats and Questions

Most of the above-cited results were based on bivariate correlations or comparisons between believer and skeptic groups. These results can give false impressions, for example that paranormal beliefs increase linearly with increasing Faith in Intuition and decreasing

Need for Cognition, Actively Open-minded Thinking and correct Cognitive Reflection Test responses. That is not necessarily the case, however.

First, all believers may not be intuitive thinkers and all skeptics may not be analytical thinkers. As among religious believers and non-believers (Lindeman & Lipsanen, 2016), as well as among religious, paranormal and spiritual believers (Schofield, Baker, Staples, & Sheffield, 2016), there might be different subgroups which cannot be detected with variable-centered analyses such as correlations and analyses of variance. One study has indeed revealed such unexpected groups as analytically thinking paranormal believers and skeptics who trust their intuitions (Napola, 2015). In this study, the majority of skeptics (84%) had higher need for cognition than faith in intuition, but 16% of them had the opposite. Of believers, in turn, 56% had higher faith in intuition than need for cognition, 30% had higher need for cognition than faith in intuition, and among 14% of the participants, need for cognition and faith in intuition were both high. Although the previously found trend concerning beliefs and thinking styles was hence primarily confirmed, the results remind us of the possibility that believers and skeptics are not homogenous groups but can represent subgroups which differ in their cognitive characteristics. This is plausible as many other factors affect paranormal beliefs, such as education, social environment, and personality.

Second, it would be important to know whether the various thinking styles are independent from each other or whether they overlap, and, if they do, which of the methods predict paranormal beliefs best. To address this question, I analyzed the contributions of Faith in Intuition, Need for Cognition, Actively Open-minded Thinking and correct CRT responses, by performing a regression analysis of our data ($N = 2789$ Finnish individuals (for more details about the data, see Lindeman, Svedholm-Häkkinen, & Lipsanen, 2015)). The results showed that after controlling for age and sex, high faith in intuition was by far the strongest predictor of the beliefs ($\beta = .37, p < .001$). Actively open-minded thinking ($\beta = -.18,$

$p < .001$) and correct CRT responses ($\beta = -.08, p < .001$) also made a unique contribution to the beliefs. The only variable which had no relationship with the beliefs was need for cognition ($\beta = -.01, ns$). In other words, Faith in Intuition, Actively Open-minded Thinking, and CRT performance all had independent effects on paranormal beliefs when the effects of the other thinking styles were eliminated. Although the results may imply that Need for Cognition is covered by the other scales, it is important to remember that such results are often unstable and depend heavily on the data.

The above results may highlight the possibility that Actively Open-minded Thinking, the reflective processes measured by CRT, and Need for Cognition are lower-level constructs that underlie a more general master rationality motive (MRM). MRM is a concept coined by (Stanovich, 2008; Stanovich, 2011). It is a high-level control motivational state that resides in the reflective mind and drives the search for the cognitive critique of our beliefs and for the rational integration of inconsistent and incompatible beliefs and desires. Persons with a strong MRM want their beliefs to be true, want to act in accordance with reason, and find a lack of rational integration aversive. Because MRM is proposed to be a more general cognitive disposition than actively open-minded thinking and related thinking styles, it is probable that people who are skeptical about paranormal beliefs will score high on the scale. So far, however, the scale has not been used in studies on paranormal beliefs.

Bringing all of the above-described results and arguments together, it is safe to conclude that strong intuitive thinking style and low analytical thinking style predict paranormal (supernatural, magical, superstitious) beliefs, and that both intuitive and analytical thinking styles make independent contributions to these beliefs. These findings raise one central question: are intuitive and analytical thinking sufficient to explain paranormal beliefs? For example, how do the findings on paranormal believers' strong intuitive thinking fit with the fact that intuitions can also produce ingenious works? Michael

S. Brown, who was awarded the Nobel Prize in medicine in 1985, has said that his research group went from one step to the next, and that somehow they knew which was the right way to go. "And I can't really tell you how we knew that" (cited in Claxton, 2006). Einstein said the same thing: "Words and language, whether written or spoken, do not seem to play any part in my thought processes" (Hadamard, 1954, p. 142). Of course, scientific thinking proceeds from intuitions to reflective thinking and verbalizable arguments because intuitive thinking in scientific work means a stage of thinking, not a permanent thinking style. Nonetheless, the intuitive thinking style influences a host of affairs, ranging from job type to food choice in everyday life (e.g., Akinci & Sadler-Smith, 2013; Ares, Mawad, Giménez, & Maiche, 2014). In other words, intuitive and analytical thinking styles can apply to all thought, irrespective of its content, and yet it is their peculiar content that sets paranormal beliefs apart from other unfounded beliefs. In our studies, we have explored the possibility that core knowledge confusions underlie all paranormal beliefs, and that it is these intuitive confusions that intuitive thinkers count on whereas analytical thinkers do not.

Paranormal Beliefs and Core Knowledge Confusions

The term 'core knowledge' refers to knowledge about evolutionarily important entities and processes in the world. It is knowledge that children universally learn, almost without explicit instruction and irrespective of culture, roughly at the same age early in life (Carey, 1985; Spelke & Kinzler, 2007; Wellman & Gelman, 1998).

Although the exact nature of core knowledge remains to be determined, increasing evidence suggests that what is critical when considering paranormal beliefs are the main properties that differentiate the mental from the physical – and within the physical domain, animate from inanimate, and living from lifeless. The differences can be summarized as follows. Physical phenomena are material and objective but mental phenomena (beliefs, desires and emotions) are subjective and immaterial. Animate beings can commit intentional,

purposeful acts, but inanimate entities cannot. Physical objects have an independent existence in space, while mental states do not, and they can move other objects by physical force whereas mental states also cannot. Living organisms grow and die, lifeless ones do not. And finally, access to the physical world is necessary for perception, which informs beliefs and knowledge, but desires and emotions can arise mentally without biological senses.

The vast majority of core knowledge develops by preschool age, but the differences between the domains are not at once entirely clear. Jean Piaget was among the first to demonstrate the varieties of mental-physical confusions among children. For example, when he interviewed a 7-year-old girl about the nature of a thought, the girl explained that a thought is in the head, it is white and round, and that one cannot see it because it is too far back in the mouth (Piaget, 1929/1951).

Our own research on paranormal beliefs has been inspired by how analogous children's confusions are to those found in adults' paranormal beliefs. A few examples which illustrate the similarity are given below.

Children: Children do not appreciate that biological senses, such as vision and hearing, are necessary conditions for informational access, but see knowledge as arising purely mentally within the individual, like desires (Wimmer, Hogrefe, & Perner, 1988). For example, young children might believe that a person can know which toy is hidden in a container although the person has never seen the toy (Pillow & Weed, 1997).

Adults: Belief in telepathy, clairvoyance, and precognition.

Children: Developing understanding of intentional behavior and the human manufacture of artifacts induce small children to see all kinds of things in terms of purpose and intentional design. They may think that mountains are made for climbing,

that clouds are for raining and the sun is for warmth (Kelemen, 1999; Piaget, 1929/1951).

Adults: Belief in creationism and the purpose of events.

Children: As long as knowledge of biological processes as the prerequisites of life is undeveloped, understanding the finality of death is not possible (Carey, 1985).

Although young children may understand that the dead cannot eat or drink, they tend to believe that psychological states, especially beliefs, emotions and desires, can continue after death (Bering & Bjorklund, 2004).

Adults: Belief in an afterlife.

Children: Young children have difficulties in understanding the representational nature of symbols, and tend to equate symbolic contents with the objects they represent. In (Piaget, 1929/1951) interviews, many children thought that the sun had always had its name, that the name of the sun was in the sun, and that we could see the name if we looked at the sun. The responses reveal that the children had not yet grasped the idea that symbols have no realistic connection to their referents any more than saying the word 'rain' can cause it to actually rain.

Adults: Belief in tarot cards and astrology.

Children: Before the mental-physical distinction is fully developed, children tend to believe that reality can be modified by thoughts and desires. In Vikan and Clausen's (1993) study, almost all 4–6-year-olds believed that a child who is in school could influence her mother at home only by making a wish. In another study, 3-year-olds

believed that an object could appear inside a box if they first thought about the object (Woolley & Wellman, 1993)

Adults: Belief in psychokinesis and telekinesis, i.e., the capacity of thoughts to influence physical objects.

In the above examples, children and adults make category mistakes: they borrow properties of one category (e.g., physical objects) to characterize an entity in another ontological category (e.g., mental phenomena). Category mistakes are different from ordinate mistakes. If we say that a dog is ill, although it is not, we are making an ordinate mistake. If we say that a dog is an hour long, we are making a category mistake because dogs are not measured by hours but by height and weight. Similarly, if we think that the planet Venus has electromagnetic effects on the Earth, we are making an ordinate mistake. If we think that the symbolic attributes of harmony and solidarity, which astrologers have assigned to Venus, influence the Earth, we are making a category mistake.

We have earlier demonstrated that paranormal, superstitious, magical and supernatural beliefs can be best defined as core knowledge confusions (Lindeman & Svedholm, 2012). This definition has many advantages. It can integrate several constructs that have been used in separate lines of research into beliefs (e.g., animism, anthropomorphism, promiscuous teleological reasoning, spirituality, and mind-body dualism). The definition also helps us to outline which beliefs should be categorized as paranormal and which should not. For example, belief in graphology may be unfounded, but it is not superstitious because it does not include any category mistakes (for details, see Lindeman & Svedholm, 2012).

Ontological violations in supernatural beliefs are also discussed in the field of cognitive science of religion. The main tenet is that religious concepts violate a few but never many ontological assumptions about persons, animals, plants, artifacts, or natural, non-living

objects. Thus, an admiring horse or a flying cow is a supernatural concept but a chattering climbing pig is not (Atran & Norenzayan, 2005; Upala, Gonce, Tweney, & Slone, 2007). We, in contrast, have suggested that mixing the core attributes of the higher-order categories of mental and physical, animate and inanimate, and living and lifeless, rather than the number of violations, is essential. Hence, according to our framework, none of those examples are good examples of supernatural beliefs because the ability to differentiate between flying and non-flying animals, or animate beings with complex emotions and animate beings without, is not core knowledge. Moreover, I would argue that the reason why people find it easy to differentiate supernatural beliefs from other unfounded beliefs, is expressly the mix-up of the basic properties of mental and physical, animate and inanimate, and living and lifeless. That is why an incorporeal spirit feels more descriptive of the supernatural than a flying cow.

Much evidence shows that people who believe in paranormal phenomena make more ontological mistakes in core knowledge than do skeptics (Barber, 2014; Lindeman & Aarnio, 2007; Lindeman, Blomqvist, & Takada, 2012; Lindeman et al., 2008; Lobato et al., 2014; Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2015; Svedholm, Lindeman, & Lipsanen, 2010). Most of these studies have used a sentence rating task. In this task, participants are presented with statements which mix the core attributes of lifeless and living (e.g., 'Stars live in the sky'), lifeless and animate (e.g., 'Earth wants water'), inanimate and animate organisms (e.g., 'The house knows its history'), as well as mental phenomena and physical objects (e.g., 'Grief moves in the stomach').

That core knowledge confusions in particular are typical of believers is implied by findings showing that believers rate these sentences as more literally true than skeptics do. However, believers do not differ from skeptics when rating the literal truth of clearly literal sentences (e.g., "Mozart was a composer") or clearly metaphorical ones (e.g., "The surprising piece of news is a bomb"). We have also found, as might be expected, that analytical thinkers

have less ontological confusions than intuitive thinkers (Lindeman, 2011; Lindeman & Aarnio, 2007; Svedholm & Lindeman, 2013). Furthermore, confusions between mental and non-mental phenomena have even been observed in perceptual processes: more so than skeptics, paranormal believers detect illusory agents and illusory faces (Van Elk, 2013; Riecki, Lindeman, Aleneff, Halme, & Nuortimo, 2013), and attribute intentions to random movement (Riecki, Lindeman, & Raij, 2014).

An intriguing possibility is that ontological violations are side-effects of human mental design, and that they remain their autonomous power from childhood throughout life and explain supernatural beliefs among adults. This is what several scholars in cognitive science of religion have suggested (e.g., Barrett, 2000; Bering, 2006; Guthrie, 1993; Hood, 2009; Kelemen, 2004). For example, according to Guthrie (1993), seeing intentional agents is an evolutionarily based, involuntary, mostly unconscious process which produces false positives: because detecting intentional agents has been adaptive in our evolutionary past, people may notice intentional beings even in inanimate nature. In the same way, there are no false negatives in non-religious paranormal beliefs, only false positives: thoughts are assumed to be over-powerful, and the mind over-sovereign, for example. Thus, universal cognitive architecture may be responsible for the existence of paranormal beliefs whereas culture is responsible for the specific forms the beliefs might take.

At first sight, the fact that millions of people all over the world do not believe in the supernatural seems to challenge the above argument. And we have already seen that disbelievers do not endorse ontological confusions but take them metaphorically. However, most of the studies concerned were based on self-reports, and they leave open the possibility that implicit ontological confusions can also be endorsed implicitly.

We recall that skeptics may, in general, have stronger cognitive inhibition than believers. Inhibition can also be temporarily compromised by asking study participants to

respond very quickly. Speeded responding increases cognitive load and causes inhibitory failures, making judgements more reflective of intuitive processes. Preliminary evidence does indeed suggest that when forced to think intuitively, ontological confusions can be found not only among paranormal believers but among other people as well.

Kelemen and her colleagues (Kelemen & Rosset, 2009; Kelemen, Rottman, & Seston, 2013) have conducted several experimental studies on the role of inhibition in endorsing unwarranted intentional explanations. They showed that, if asked to respond quickly, university students and even physical scientists explain natural phenomena, such as sunlight, by reference to a purpose and design in nature. In our study, the number of ontological confusions increased across all participants when asked to respond quickly as well (Svedholm & Lindeman, 2013). Importantly, the confusions lost their relationship to paranormal beliefs under speeded responding, which possibly indicates that even individuals who do not believe in paranormal phenomena make similar confusions under demanding conditions. It may thus be the case that ontological confusions can be implicit, and that consequently they are most discernible when thinking is dominated by intuitive processing.

Why People Believe

As a summary, we can now delineate an overall, albeit tentative, view of intuition and reason in the formation and maintenance of paranormal beliefs.

Paranormal beliefs are best understood as culturally and historically variable beliefs that are based on ontological confusions of core knowledge about physical, psychological and biological phenomena. These confusions are typical of the early phases of children's cognitive development, and it is possible, although not yet rigorously proven, that the misconceptions do not disappear when growing up. In adulthood, the confusions can be unintentionally inhibited, or they can suddenly come to mind as intuitions that can either be trusted or intentionally rejected as irrelevant.

Particularly individuals with an intuitive thinking style tend to consider ontologically impossible phenomena to be feasible, making the adoption of culturally available supernatural ideas possible. Belief in ghosts and other spirits is possible only if one accepts, in one way or another, that a mind can live without a biological body. The intuitive thinking style also entails a broad spectrum of heuristics and biases which further make culturally prevailing paranormal conceptions easy to digest. Associative and experiential thought processes can predispose an individual to assume that the co-occurrence of a full moon and a strange experience reflects causation, or that one's personal experience of a flash of light, and the interpretation associated with it, proves the existence of angels.

Concurrently with ontological confusions and paranormal beliefs, intuitive thinkers may have rational and well-founded knowledge about the same things. Conflicting beliefs can be held in parallel because they are processed differently, one more analytically and the other more unconsciously. That intuition speaks in favor of the supernatural although reason can find no rational foundations for the beliefs is sometimes frankly admitted. As a Finnish vicar has said: "I allow myself a belief in the virgin birth and I understand that according to modern biology it is impossible."

Some people, in turn, try to explain the conflict away. However, it is easier to believe in astrology than to convincingly explain how it works, and it is easier to believe in God than to justify his existence. The conflict breeds foggy metaphors and ambiguous rationalizations: we try to explain verbally something which cannot be verbalized. This sits well with Epstein and Pacini's (1999), Stanovich's (2004) and Evans's view that confabulation is one of the functions of the reflective mind: "We make up stories to maintain the illusion that we are the chief executive who is really in control" (Evans, 2010, p.6).

Although intuitions are compelling as well as resistant to change, and deep-rooted culturally shared supernatural beliefs can be difficult to resist, they both can be abandoned

after critical evaluation. Cognitive abilities may be one underlying factor, but an analytical thinking style is more important. A critical attitude towards ontological confusions and the supernatural is particularly characteristic of individuals who prefer actively open-minded thinking, that is, who aim at flexible and objective reasoning and who avoid absolutism, dichotomies and dogmatism.

Analytical thinkers are also able to avoid general cognitive biases. Among other things, they are better at detecting conflicts, for example between reality and supernatural beliefs (Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2014). Furthermore, for analytical thinkers, the personal experience of a psychic's ability to accurately predict a specific event does not suffice: clairvoyance cannot be rationally explained, and psychics have so far not managed to demonstrate their abilities under objective conditions. Because reflective thinkers seek various points of view before making a conclusion, they have also noticed, for instance, what was wrong when astrologers claimed that the murder of Swedish politician Anna Lindh in 2003 could be forecasted from her astrological chart. All of the forecasts were given after the murder.

To conclude, I quote the philosopher Bertrand Russell (1921/1949, p. 231) who wrote that belief is the central problem in the analysis of mind: "Believing seems the most mental thing we do...The whole intellectual life consists of beliefs, and of the passages from one belief to another." By carefully scrutinizing what we believe and why, not only may critical thinking increase, but eternal questions such as "what is the purpose of life" might also be approached from a new point of view. That is, not as a difficult question to which the correct answer is hard to find, but as a question that is wrongly posed.

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