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Teleological Reasoning in Adults: Believing in the Purpose of Events

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TELEOLOGICAL REASONING IN ADULTS: BELIEVING IN THE PURPOSE OF
EVENTS

A Thesis
Presented to
The Faculty of the Department of Psychology
Western Kentucky University
Department of Psychology


In Partial Fulfillment
Of the Requirements for the Degree
Master of Arts

By
Carrie Jeanette Guggenmos

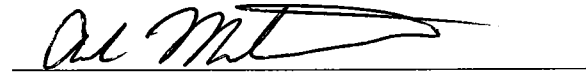
December 2012

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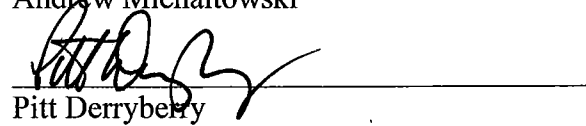
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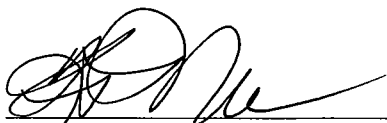
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CONTENTS

INTRODUCTION	1
METHOD	20
RESULTS	25
DISCUSSION.....	31
REFERENCES	61

LIST OF FIGURES

Figure 1. Mean purpose ratings by ACT group	56
Figure 2. Mean purpose ratings by vignette cause type.....	57
Figure 3. Mean purpose ratings by outcome type.....	58
Figure 4. Marginal mean purpose ratings for cause type X valence interaction.....	59
Figure 5. Mean purpose ratings for each religiosity group by condition.....	60

LIST OF TABLES

Table 1. Descriptive statistics for main variables	54
Table 2. Pearson correlation matrix among main variables.....	55

TELEOLOGICAL REASONING IN ADULTS: BELIEVING IN THE PURPOSE OF EVENTS

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Directed by: Kelly Madole, Andrew Mienaltowski, Pitt Derryberry

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Teleological reasoning reflects the general tendency to view objects, behaviors and events in terms of their “purpose.” Although healthy educated adults tend to refrain from committing errors in teleological reasoning about objects, our knowledge regarding how adults reason about events is limited. It has been suggested that teleological reasoning biases our interpretations of emotionally significant and unexpected life events of which a physical or social cause is absent or unsatisfactory. The current investigation seeks to better understand the types of events that evoke a teleological perspective and the conditions and individual difference factors that facilitate it. The results revealed that participants high in religiosity and low in ACT science reasoning are more likely to commit teleological errors (i.e., imbuing purpose upon events with non-intentional causal forces). Additionally, participants of low religiosity were more likely to commit teleological errors when placed under cognitive load. It appears that two routes to teleological reasoning exist: one that represents an explicit belief system such as religion, and one that reflects implicit intuitions about how the world works. These findings shed light on how, when confronted with certain life events, both our belief systems and situational pressures lead us to rely on intuitive assumptions rather than engage in careful consideration of more scientifically sound alternatives.

Keywords: teleology, reasoning, purpose of events, dual-process model

Teleological Reasoning in College-age Adults: Believing in the Purpose of Events

The ability to appreciate the “purpose” behind objects and behaviors is fundamental to successful cognitive functioning. Such ability is reflected in what is referred to as teleological reasoning. Specifically, teleological explanations have been described as assumptions that “objects, behaviors, or events occur for a purpose” (Kelemen, 1999b, p. 1440). We engage in this type of reasoning when we assume that an individual behaves in a way to achieve particular goals or speculate about the function of an object. For example, we may assume that a person opens a door with the purpose of going into a building or that a phone exists for the purpose of communication with others. Such reasonable assumptions allow us to make predictions about the intended nature or function of what we might encounter in everyday life.

It would be illogical to presume a purpose-based explanation for all categories, however. For example, a teleological error is reflected in unwarranted explanations of why birds exist or why the recent earthquake in Japan occurred. Simply, these two examples were not intended for a purpose. Although a reasonable adult would agree that the former example does not warrant a teleological explanation, the latter example may not inspire the same agreement. It has been suggested that the tendency to perceive meaningful life events as occurring for a purpose is due to a strong bias to detect agency and intentionality in general, and this bias is hard to suppress (Bering, 2002). That is, our need to detect the purpose behind someone else’s behavior drives our need to detect the purpose behind events, especially those that are unexpected and trigger “significant affect-related change” (Bering, 2002, p. 18). Empirical support for this suggestion

however, needs bolstering. The goal of the present study is to investigate the prevalence of teleological errors in reasoning about events in adults, the conditions under which they are activated or suppressed, and individual difference factors that predict their expression.

Although much is known about the impact of development on teleological reasoning about object categories, the research in regard to events has been limited to investigations of superstitious thinking. Therefore, the present review will be dedicated to these areas of research.

Developmental Literature Regarding Teleological Reasoning about Objects

Investigations into the development of teleological reasoning have revealed that children, unlike adults, have a general tendency to explain all object categories in terms of their purpose. Kelemen (1999a, p. 244) has labeled children's general inclination to endorse unwarranted teleological explanations "promiscuous teleology." Moreover, she suggests children's broad application of a teleological stance results from a burgeoning understanding of intentionality and agency. With exposure to alternative explanations, scientific reasoning and perhaps schooling, teleological explanation becomes restricted to appropriate categories (e.g., man-made artifacts and biological parts). In her landmark study, preschool children and adults were asked to explain what objects and their respective parts (living things, artifacts and non-living natural entities) were "for", with the opportunity to state that they were not for anything. The results of the study indicated that children offered teleological explanations far more broadly than adults did. Specifically, adults limited their explanations that an object was "for" something to artifacts (e.g., clocks) and biological parts (e.g., ear). By contrast children offered function-based explanations for objects from all categories (e.g., cloud is "for the sun to

go on”). In the second study, both groups were specifically asked if the object was “made for something” to be sure the children were not confusing what the object in question was *for* with what it could *do* (e.g., “clouds are for raining”). Once again, children offered teleological explanations far more broadly than did adults. These results support the existence of promiscuous teleology in children and demonstrate that teleological reasoning may become constrained throughout development.

Additional evidence suggests that teleological reasoning may change with development. Kelemen (1999b) conducted a study that compared the explanations given by children of different ages (first-, second- and fourth-grade students) with those of adults. Participants were presented with photos of novel prehistoric animals and non-living natural objects and asked to choose between a teleological or physical explanation for a particular object property. The nature of the teleological alternative varied by whether the type of purpose was other-serving or self-serving. For example, the prompt “Why do you think the rocks are so pointy?” was followed by a physical alternative “because little bits of stuff piled up over a long period of time” and a self-serving teleological alternative “so that animals would not sit on them and smash them” or an other-serving teleological alternative “so that animals like *Cryptoclidus* could scratch on them when they got itchy” (p. 1443). Children were again found to endorse unwarranted teleological explanations significantly more than adults even when instructed to think “like a scientist.” However, in contrast to the younger children, fourth-grade children showed lower levels of teleological bias for nonliving natural objects and limited their preference to social-serving explanations for biological properties. Kelemen suggested that this effect might be due a maturing understanding of science and perhaps the belief

that nature seeks homeostasis. Therefore it seems that initially, children's growing ability to detect agency and manipulate objects to achieve goals might provide the basis for which a teleological bias develops but progressively becomes constrained over the course of development. However, teleological errors may nevertheless remain a default style of reasoning (Kelemen, 1999b).

The results of the two previously mentioned studies (Kelemen, 1999a, 1999b) seem to indicate that with age and experience the tendency to make teleological errors is reduced. However, findings from more recent studies suggest that conditions exist in which adults default to unwarranted teleological reasoning about object categories. Casler and Kelemen (2008) conducted a cross-cultural study comparing two groups of Romanian Roma who differed in years of schooling and number of science courses with data from previously obtained American samples. The groups made for an ideal comparison to ascertain the degree to which factors of development, scientific literacy or sociocultural context influence teleological reasoning in adults. Unlike their more highly educated counterparts and American adults, the low school exposure group responded much like children have in past studies. Specifically, the undereducated individuals made significantly more teleological errors than did the adults with higher education levels. The findings from this study suggest that a promiscuously teleological bias may not be unique to children. Rather, it may instead persevere as a default response throughout development only to be constrained by formal exposure to scientific knowledge.

Further evidence for a persistent teleological stance throughout development comes from an investigation into the teleological beliefs of Alzheimer's disease patients, a group known for deficits in categorical reasoning (Zannino, Perri, Carelismo,

Pasqualetti, & Caltagirone, 2002). Lombrozo, Kelemen and Zaitchik (2007) conducted a study comparing the endorsements of teleological or physical explanations of individuals with Alzheimer's disease (AD), healthy elderly adults and healthy younger adults. Specifically, Lombrozo et al. suspected that if this form of dementia affects causal reasoning about objects detrimentally, the AD patients ought to respond in a manner similar to children. The results revealed that, although no differences were found in the responding of the healthy elderly individuals and the young adults, AD patients more broadly endorsed and preferred the teleological explanation. Interestingly, when asked about the causal origin of the object in question, the healthy individuals invoked "God" as an explanation significantly more than the AD patients. The results from the study provide further evidence of a teleological stance that adults may fail to suppress due to a compromised causal belief system. Also, it seems teleological intuition may exist independent of an explicit superstitious or religious beliefs. Rather, such reasoning may reflect a more fundamental type of processing that is fostered by culture.

Beyond investigations involving populations with low exposure to scientific knowledge and those with causal reasoning deficits, evidence indicates that a teleological bias exists in educated, healthy adults as well. Suspecting that teleological reasoning may have a motivational component, Davis, Juhl and Routledge (2010) conducted a study investigating the effects of mortality salience on endorsements of unwarranted teleological explanations in undergraduate students. The researchers found that when teleological beliefs were bolstered (i.e., told the unwarranted explanations were in fact "correct") participants demonstrated lower levels of death thought accessibility compared to those in the control condition. Also, those who were exposed to a mortality salience

condition provided higher ratings on a scale measuring purposeful-world beliefs (e.g., “everything happens for a reason”). These findings suggest that healthy adults are not completely immune to a teleological bias, especially when motivated to reduce the uncomfortable emotions activated by thoughts of death in favor of maintaining a belief that life has a purpose. Moreover, purposeful beliefs likely reinforce a false sense of predictability, justice and personal control in the world.

Although teleological beliefs appear to have a motivational function, such beliefs may become activated in situations under which our ability to invoke effortful control and analytical reasoning are compromised. Kelemen and Rosset (2009) asked undergraduate participants to indicate whether or not a particular explanation was a “good” or “bad” way of explaining why things happen. The task was completed under speeded, moderately speeded and unspeeded conditions. The results of the study revealed that the number of unwarranted endorsements of teleological explanations increased with speed. Also, when controlling for speed, scientific knowledge and inhibitory control predicted endorsements of unwarranted teleological statements. However, beliefs in God showed no significant relationship with the teleological bias. Kelemen and Rosset conjectured that, even in formally schooled individuals, a teleological stance might remain accessible in adulthood when processing resources are limited. These results may reflect a deeper bias for purpose-based explanations that are tapped into when conditions prevent educated adults from explicitly rejecting them. Furthermore, the preference for a “purpose” is related to one’s ability to invoke analytic reasoning and not beliefs in a creator. Lomrozo et al. (2007) similarly found that unwarranted teleological beliefs about objects exist independent of beliefs about supernatural deities. Therefore, it seems that

that although we intuitively see the *purpose* of an object, we do not as easily infer the designer who gave the object its supposed purpose.

The question is, what makes function-based explanations so easily accessible when more scientifically sound alternatives exist? A dual-process model of reasoning may help shed light on this issue. Specifically, it has been suggested by many that two distinct cognitive systems exist that influence our reasoning, judgment and social cognition (see Evans, 2008 for review). System 1 has been generally described as automatic, intuitive, low effort, pragmatic, evolutionarily old, and operating independent of working memory. By contrast system 2 reflects processing that is deliberate, analytical, high effort, logical, evolutionarily recent and constrained by working memory. System 2 processing does not simply replace system 1 processing, rather the two systems coexist throughout development and will be differentially activated given the demands of the situation in which reasoning occurs. Perhaps our teleological beliefs reflect our early intuitions about how the world works and more scientifically sound alternatives require greater effortful control to invoke. Such a perspective helps explain the differences that situational effects can have on adults' endorsements of unwarranted teleological explanations. Nevertheless, educated adults tend to constrain teleological beliefs about objects to appropriate categories (i.e., biological parts and artifacts) given that system 2 processing has not been constrained by situational factors.

In summary, it has been shown that children invoke teleological explanations in regard to object categories far more broadly than do adults (Kelemen, 1999a, 1999b). However, these developmental differences cannot be explained by mere maturity. Specifically, the sweeping tendency to view object categories from a teleological

standpoint is not merely replaced by a more advanced, analytical understanding of the world. It is instead constrained by an intact causal reasoning system, education, and cognitive availability. One could argue however that, unlike objects, emotionally significant events may be specially processed for determining their “purpose” as such events help us to make meaning out of our life narratives.

The Existential Theory of Mind

Bering (2002; 2003) has proposed that our tendency to see purpose behind events is driven by ordinary processes involved in social cognition that are responsible for detecting agency and intentionality behind social behavior. Specifically, humans tend to process events for their meaning, or teleological purpose, similar to the way we reason about the behavior of others. Bering suggests that along with theory of mind, an evolutionarily advantageous ability that allows us to interpret and predict the behavior of others, humans have also evolved an “existential theory of mind” (EToM), which responds exclusively to events. Specifically, this system becomes activated when unexpected, emotionally significant events occur absent a clear or psychologically satisfactory reason for happening. In such instances, we search for the purpose behind the occurrence of the event so that we might infer some sort of meaning.

Empirical evidence suggests that humans may even be biased for intentional explanations. Namely, one classic study found that adults attribute intentionality behind the supposed behavior of geometrical shapes (i.e., items that are incapable of purposeful action) moving on a screen in an apparently aggressive or cooperative way (Heider & Simmel, 1944). A more recent study found that, when placed under speeded conditions, participants were more likely to say that ambiguous acts (e.g., “he set the house on fire”,

“she woke up the baby”) were done intentionally rather than accidentally (Rosset, 2008). It seems that participants, when placed under processing demands, favored intentional explanations over the plausible accidental explanation. These results once again support the notion that purpose-based (i.e., teleological) explanations arrive at us with more ease than explanations that imply the event had no meaning.

Bering (2003) explains although the social domain of attribution provides targets (i.e., other individuals) to which we direct our intentionality bias, such targets are not always clearly responsible or psychologically satisfactory to the person evaluating the event. Such events include those that are unexpected and result in a strong emotional impact. To compensate, we often derive some sort of intended meaning or purpose from these events (e.g., “I was in a bad car accident when I was a teenager *because* I needed to learn that life is fragile”, Bering, 2002, p. 4). Bering is not specific about the nature of the emotional impact (i.e., positive or negative) and the literature is also inconsistent regarding this issue.

However, research suggests that people do in fact engage in the process of making meaning after experiencing an unexpected negative life event. Skaggs and Baron (2006) conducted a concept analysis including 86 references involving adults engaging in a search for meaning following a negative life event. From their analysis, the researchers suggested a model for understanding meaning making which explains that people seek congruency between one’s global meaning (i.e., general beliefs about one’s values, goals and purpose in life) and situational meaning (i.e., appraisals specific to individual events). Life events that are unexpected and negative often threaten our global meaning and lead us to engage compensatory processes to bring our interpretations of such events back into

congruency with our pre-existing global meanings. Such processes include changing the meaning of the event (e.g., reattribution of the cause, creating illusions) or changing our global meaning (e.g., reappraise event in a positive light, revalue mundane events to offset impact of negative event). These strategies, if successful, lead us to achieve what the authors refer to as “meaning congruence” or the positive outcome that results from the search for meaning. This process impacts psychological well-being as it allows individuals to emerge from negative situations with a more positive and appreciative outlook on life. The authors suggest that, if not for this process, individuals may experience the negative effects of meaning incongruence (e.g., depression, hopelessness, and discouragement).

Beyond a mere coping strategy however, the tenets underlying the proposed existential theory of mind suggest that meaning making reflects a deeper bias for intentionality and that this bias has evolutionary roots in systems responsible for social cognition. In fact, evidence suggests that the existential theory of mind may develop in a trajectory similar to ordinary theory of mind. Bering and Parker (2006) conducted a study with children ages 3-9 who, in the experimental condition, were told of a woman named “Princess Alice” with the magical ability to make herself invisible and who may possibly help them on a decision task. Children were asked to indicate which box contained a hidden ball. For some of the trials an unexpected event occurred (e.g., a picture falling, the light of a lamp flickering). The oldest children (7-9 years) were more likely to alter their choice and explained that the invisible agent was trying to help them correct the mistake than the younger children. The majority of the youngest children (3-4 years) did not change their behavioral response or did not offer an explanation at all. The middle

age group (5-6 years) also tended to not alter their response but told the researchers that they believed Princess Alice was responsible for the unexpected event. The developmental differences revealed in this study seem to match the developmental course seen with ordinary theory of mind—as the eldest children in this study demonstrated second-order, self-referential theory of mind capabilities (e.g., mentalizing an others' thoughts about your thoughts), the middle age group demonstrating the ability to simply mentalize an other, and the youngest age group making no inferences about the unknown intentions of an other.

A related study recently found that, people with Asperger's syndrome, a form of autism causing deficits in social reasoning and theory of mind, were less likely than neurotypical individuals to explain life events (e.g., contracting an illness, meeting a significant other) teleologically (Heywood & Bering, 2010). It seems that as our social reasoning becomes more sophisticated throughout development, so does our inclination that certain events were somehow intentionally caused. However, if our social reasoning abilities have been compromised at the neurological level, teleological reasoning does not manifest as it would in normal populations. The results from these two studies provide further evidence that believing in the purpose of events may be a consequence of a bias for processing information for their social content that is typical for normally developing individuals.

Discussing beliefs in the purpose of events would be inadequate without a mention of beliefs in God or other supernatural agents that may be invoked as the arbiter of events. In their review of the literature regarding attributions made to God as the causal agents of events, Gray and Wegner (2010) echo the sentiment of Bering (2002)

that believing in God reflects the activation of ordinary processes involved in social cognition such as perceiving the minds of others and appreciating their agentic ability. The authors state that in cases of “unjust suffering and undeserved salvation” (i.e., surprisingly positive or negative) absent a human cause, people are prone to seek out an agentic source, such as God, to blame or praise for willing the event to transpire. Thus, an overactive need to perceive agency helps us to fill in the gaps when unexpected events occur. Although this idea is consistent with ideas presented by Bering, Bering also points out that one’s existential theory of mind need not be culturally elaborated by supernatural agents such as God. In fact, one may actively deny the existence of God yet still seek out the purpose behind an unexpected event. One study found that although highly religious participants were most likely to invoke God as a causal agent behind an ambiguous event, participants moderate to low in religiosity frequently invoked other superstitious causes (e.g., “fate”) (Weeks & Lupfer, 2000). Thus, it seems that our social brain, specialized for agency and intentionality detection, provides the capacity for perceiving supernatural deities or forces as causal agents and culture defines them (Bering, 2002).

Teleological Reasoning Specific to Events

In contrast to the studies of teleological beliefs about objects, which have found mostly situational effects on adults’ preferences for purpose-based explanations, the few investigations involving beliefs about the purpose of events have focused on individual differences. An understanding of how adults reason about events is important for determining how broadly teleological beliefs are invoked beyond object categories. Lindeman and Aarnio (2007) reasoned that superstitious, paranormal, and magical beliefs are similar to the category mistakes made by children (Kelemen 1999a, 1999b) in that

they reflect our early intuitions and are not replaced by analytic reasoning, but rather both types of reasoning coexist in adulthood. Participants from a previous study whose scores on a measure of superstitious beliefs were in the lower or upper 10% were recruited. The study, conducted using an online questionnaire, measured participants' core knowledge confusions (e.g., material entities having mental attributes), the purpose of events, paranormal beliefs, emotional stability and analytical and intuitive thinking. Beliefs about the purpose of events were measured by ratings of the "purpose" of the event for short vignettes; for example, "The brakes of your car fail and you smash up with a stranger whom you will later marry. Did the brakes fail for a purpose?" (p. 736). In comparison to skeptics, superstitious individuals assigned more "purpose" to random, natural or artificial events. Also, when looking to distinguish superstitious individuals from skeptics, core knowledge confusion served as the best predictor followed by intuitive thinking. The results of this study indicate individual differences (i.e., core knowledge and intuitive thinking) have a strong influence on expressed superstitious beliefs.

Svedholm, Lindemen and Lipsanen (2010) conducted a more recent study investigating the individual variables affecting superstitious beliefs. The authors posited that believing in the purpose of events and superstitious beliefs are a part of the same phenomenon—general core knowledge confusion. Participants were Finnish volunteers directed to an online study with measures of core knowledge confusions, paranormal beliefs and the beliefs in the purpose of events. Of interest is the method used in the study 2, which explicitly defines "purpose" as involving "intentional planning by a supernatural agent or force" (p. 261). The results of the study indicate that both paranormal beliefs and beliefs in the purpose of events are strongly related and are best predicted by the latent

factor of a general core knowledge confusion. Moreover, confusions of intuitive psychology (e.g., “old furniture knows things about the past”, p. 225) served as a strong predictor of both types of beliefs. The results of the study suggest that beliefs in the purpose of events ought to be viewed as a form of superstitious belief based on core knowledge confusions.

Although these propositions are compelling and inherently pose implications for our understanding of superstitious beliefs, empirical investigations into our beliefs in the purpose of events needs bolstering. The researchers also made note that Finnish students are typically low in paranormal beliefs, which may be a potential limitation to the generalizability of these results of the study. Also, the restrictive sampling leaves one to wonder how people in general may respond to this measure. The results from this study warrant an investigation into teleological reasoning about events in a less restrictive sample. Perhaps teleological beliefs of events are invoked in populations that are not necessarily highly superstitious because of the intuitive nature of teleological beliefs. Although the experimental literature regarding the purpose of events is sparse, it appears that such beliefs are differentially endorsed as a function of individual differences. However, a direct study of beliefs about the purpose of events with a more general sample is needed. Therefore, a preliminary study was conducted to address this issue.

Guggenmos (2011) conducted a study in an effort to assess beliefs in the purpose of events in a less restrictive sample and also directly compare teleological beliefs about object categories to those regarding events. Beliefs in the purpose of events were measured using Lindeman and Aarnio’s (2007) Confusion Between Intentional and Non-Intentional Events scale (modified slightly for an English speaking sample) which

requires participants to rate the likelihood that random, natural, artificial and intentional events happened for a purpose, with “purpose” defined as in the previously mentioned study by Svedholm, et al. (2010). Beliefs about objects were measured using the teleology task developed by Lombrozo et al. (2007) in which participants indicate which alternative explanation (teleological or mechanistic) they believe to be appropriate and also which they prefer in regards to objects from categories of biological organisms (e.g., dogs), biological parts (e.g., eyes), nonliving natural objects (e.g., trees), natural phenomena (e.g., rain) and artifacts (e.g., tables). The study also included a brief religiosity measure (Plante & Boccaccini, 1997) as religiosity was expected to operate as an individual difference variable in beliefs about events. Participants were undergraduates at Western Kentucky University who completed the study via online questionnaire.

The results of the study revealed several important considerations concerning the current study. First, consistent with the findings of Lombrozo et al. (2007), participants on average made few endorsements of unwarranted teleological explanations for object categories. The study also revealed that errors made for object categories do in fact correlate positively with errors made about the intentional nature of events. Therefore, it seems that both types of beliefs may reflect an underlying bias for teleological explanations in general. Religiosity scores correlated positively with errors made for the “appropriate” judgments but not correlated with “preference” judgments in regards to object categories. This finding suggests that those higher in religiosity are more likely to endorse the unwarranted teleological explanation of an object *appropriate*. However, those who *preferred* this explanation were not necessarily religious. After coming upon a

similar finding in their study, Lombrozo et al. suggested that although some adults rejected the appropriateness of the teleological explanation, “healthy adults are surprisingly willing to entertain scientifically questionable teleological explanations” (p. 1004). These results are consistent with the previous research on beliefs about objects, which have found that healthy educated adults tend to be more restrictive with their endorsements of teleological explanations. Given errors regarding objects were correlated with errors regarding events, the present investigation is further justified in focusing on the under researched topic of beliefs about the purpose of events.

Consistent with previous studies regarding beliefs in the intentionality of events, Guggenmos (2011) also documented individual differences in the likelihood of rating an event as “purposeful.” As expected, those high in religiosity were significantly more likely than those low and high in religiosity to rate events as purposeful for both warranted and unwarranted vignettes. One’s level of religiosity may be indicative of how much they see life events as the workings of a higher plan constructed by a deity. Interestingly however, events leading to a positive outcome were allotted higher purpose ratings than those with neutral or negative outcomes. This effect did not interact with religiosity, meaning in general, participants allotted more purpose to the events leading to favorable outcomes (as if an intentional event can somehow be *more* intentional because it led a positive result).

Although Bering’s theory suggests that emotionally salient events are most likely to activate EToM processes, he does not predict that positive outcomes of events will be imbued with more purpose than negative outcomes. Given that this finding was not expected, some speculations as to why participants were responding this way were made.

Perhaps the hypothetical nature of the vignettes were tapping into what Weinstein (1980) had labeled “unrealistic optimism”, or the commonly held illusion that we are somehow more likely to experience good outcomes than bad outcomes and that bad outcomes are far more likely to happen to our peers than ourselves. Unrealistic optimism seems to serve as a motivational mechanism as we benefit from the self-enhancement made from comparing our odds to others’ and fortunate events make the possibility of achieving our goals all the more likely. If the positivity effect can be replicated in the main study of the present investigation, a new light might be shed on a previously unelaborated facet of teleological research: the importance of emotion and the motivation to believe that we are deserving of positive outcomes.

Current Study

The literature discussed thus far describes two types of teleological beliefs, those about objects and those about events. Both areas of research suggest that adults are not simply immune to a teleological bias, However, the suspected causes proposed for unwarranted teleological beliefs differ. Adults’ preferences for purpose-based explanations are typically limited to the categories of artifacts and biological parts, except in situations of limited processing resources, mortality salience, deficits in causal reasoning and low exposure to scientific knowledge. The literature specific to the beliefs in the purpose of events suggests that teleological expression is due to individual differences related to superstitious beliefs. However, it has been suggested that believing in the purpose of events is a universal tendency and some individuals may simply attempt to suppress this bias (Bering, 2002). The current study was conducted with the goal of shedding light on the prevalence of teleological errors about events in college students

and the potential conditions in which a teleological stance may be activated and how religious beliefs factor into these errors. Doing so may help us to better understand why rational people construe the events in favor of a purposeful world when more analytically sound alternative explanations exist. Moreover, the current investigation also explored a disagreement in the literature: whether or not teleological errors reflect a default style of reasoning or the expression of individual differences (i.e., religious belief).

Specifically, I investigated how limitations on processing resources (e.g., cognitive load) will affect participants' judgments about the purpose of events compared to those who are not placed under such demands. If participants low in religiosity are in fact suppressing a teleological bias for events, it can be hypothesized that demands on executive functioning will reduce participants' ability to inhibit a teleological response successfully. As suggested by Bering (2002), although individuals may use conscious effort to suppress the expression of EToM, teleological processing of events nevertheless remains active. This line of reasoning is consistent with findings in the object literature showing that participants placed under processing demands are prone to committing more teleological errors (Kelemen & Rosset, 2009).

A dual-process model perspective might suggest that alternatives to teleological explanations require a higher level of conscious effort to evoke that is dependent on working memory (Evans, 2008). Therefore, any additional demand on working memory will compromise one's ability to fully rationalize the information. In fact, cognitive load has been found to impair one's ability to appreciate situational factors and correctly infer dispositional differences when asked to make attributions about another individual (Gilbert, Pelham & Krull, 1988). A more recent study found that participants in a

cognitive load condition were less likely to make utilitarian judgments (i.e., a decision in which the ends justify the means) than those who were not loaded (Greene, Morelli, Lowenberg, Nystrom & Cohen, 2008). These authors suggest that utilitarian judgments require the controlled cognitive processing described as system 2 operations in dual-process theories. In light of these findings, the present study provides the opportunity to determine whether or not similar experimentally induced hindrances on executive processing will result in higher levels of teleological reasoning about events.

In addition to assessing beliefs about specific events, the present investigation will also include items used in the study conducted by Davis et al. (2011) that measured participants' beliefs in a purposeful world. In one of the three studies reported, the researchers found that participants placed under a mortality salience condition demonstrated higher scores on a purposeful world beliefs questionnaire compared to those in the control condition. They claim that participants might be motivated to see the world as purposeful to ease existential anxiety. It would be interesting to determine if a tendency to believe in the purpose of events is positively associated with beliefs in a purposeful world in general in participants. It is expected that cognitive load induction will facilitate beliefs in a purposeful world. Comparatively, participants in the control condition should generally demonstrate lower scores on this measure.

It is expected that religiosity will be a significant factor. That is, highly religious individuals will commit more teleological errors (i.e., a lot higher purpose ratings to non-intentional events) than those low in religiosity. It is also hypothesized that the positivity effect will be more pronounced for all groups in the cognitive load condition, as the ability to reason more realistically about one's chances to experience positive outcomes

will be hindered by processing demands. If Weinstein's (1980) notion of unrealistic optimism serves to explain the positivity effect found in the preliminary data, then it can be expected that participants will be especially unrealistic about their odds of experiencing a good outcome.

In addition to religiosity, the present study will examine participants' scientific reasoning ability (measured by ACT score). Although scientific reasoning has been a particularly important factor for predicting one's likelihood to commit a teleological error in regard to objects (Lombrozo et al., 2007; Kelemen & Rosset, 2009), it has not been specifically addressed in the literature involving beliefs about the purpose events. Kelemen and Rosset reported that, when controlling for speed, scientific reasoning predicted the number of teleological errors made by participants. One can posit that a strong appreciation of general scientific principles will be associated with a lower likelihood to commit a teleological error. This can be further assumed given that previous studies found one's level of core knowledge confusions are predictive of a tendency to imbue non-intentional events with purpose (Lindeman & Aarnio, 2007; Svedholm et al., 2010).

Method

Participants

One hundred and sixteen young adults (61 men and 55 women) ranging in age from 18 to 25 years ($M = 19.73$ years, $SD = 1.49$ years) were recruited from Western Kentucky University to participate in this study. An additional 12 individuals participated in the study but were excluded from the analysis for the following reasons: no ACT science reasoning score reported (10 cases), irregular responding (1 case), or failure to

perform the auditory task (1 case). Participants were randomly assigned to either the cognitive load condition ($n = 64$) or the control condition ($n = 52$).

Measures

Beliefs in the purpose of events. Individuals were presented with 24 vignettes depicting a hypothetical event and were encouraged to imagine the situation happening to them. Participants then indicated the extent to which they believed the event happened for a purpose on a five point rating scale ranging from: 1 = *The event definitely did not have a purpose* to 5 = *The event clearly had a purpose*. The vignettes used in this study have been adapted from those used by Lindeman and Aarnio (2007). Minor alterations to the scale include word changes so that the vignettes are written in a vocabulary familiar to our English speaking participant pool. Also, two additional items were added so equal numbers of stories are represented by each cause and outcome combination. Also, Guggenmos (2011) revealed that one item the Lindeman and Aarnio designed to be read as “intentional” received quite low purpose ratings from participants (i.e., “You and your friends race for fun and the tallest girl wins. Did the race have a purpose?”). A manipulation check was also conducted that asked participants to rate the outcomes of the events on a seven-point scale ranging from 1 = *absolutely negative* to 7 = *absolutely positive*. For some of the items, average ratings of valence given by the participants were not consistent their intended valence (e.g., for the item “You unexpectedly meet an old acquaintance and you go for a coffee together” an average response of *rather positive* was given when the item was intended to be neutral). New items were constructed to replace these items (see Appendix A for a copy of the scenarios used). An analysis of variance revealed valence ratings for each outcome type (i.e., positive, negative and

neutral) differed significantly from each other $F(2, 41) = 285.12, p < 0.001$. Mean valence ratings are reported separately for each vignette.

Purposeful world beliefs questionnaire. Beliefs in a purposeful world were measured using a three-item scale developed by Davis et al. (2011). Participants rated the statements “Everything happens for a reason,” “The world has a grand purpose,” and “There’s a purpose for everything, even if we don’t realize it” on a seven-point scale ranging from: 1 = *absolutely untrue* to 7 = *absolutely true*. Thus, higher average scores on this measure should indicate a higher belief that the world is purposeful in general. This questionnaire has a strong internal validity (Chronbach Alpha = .87).

Religiosity. Participants’ religiosity levels were assessed using the Santa Clara Strength of Religious Faith Questionnaire (SCSORFQ) developed by Plante and Boccaccini (1997). The measure includes 10 items designed to gauge an individual’s strength of faith on a four-point scale with high scores indicating higher levels of religiosity and low scores indicating lower levels of religiosity. The items in the SCSORFQ do not contain denominational content and therefore can assess faith in individuals regardless of an individual’s religious affiliation (or lack thereof). The SCSORFQ has a high internal reliability (Chronbach Alpha = .95) and high split-half reliability ($r = .92$). See Appendix B for a full version of the SCSORFQ.

Science reasoning. Science reasoning abilities were inferred from participants’ score on the ACT science test, which includes 40 items that measure one’s “interpretation, analysis, evaluation, and problem-solving skills required in the natural sciences.” Performance on this measure is totaled into one score. The content areas from which the items are drawn include biology, earth/space science, physics and chemistry.

Based on 2005-2006 data the ACT science test has a reliability of .80 with a mean score of 21.10 (ACT, 2007). The most recent score reported for the student was obtained. The goal is to determine participants' scientific reasoning ability prior to completing the study.

Cognitive Load Manipulation

Auditory detection task. The cognitive load induction was created by first obtaining a randomized list of numbers that coincided with letters of the English alphabet from Randomizer.org (a randomization service provided by the Social Psychology Network). Utilizing the "speech" service provided by a Macintosh operating system (version 10.5.8) and audio recording software, a recording was obtained of each letter read aloud at a rate of approximately one letter per second. Participants were instructed to keep track of every presentation of the letter "x" that they hear. In the sequence, the letter "x" is said 15 times.

Materials

The items for the beliefs in the purpose of events questionnaire, the purposeful world beliefs questionnaire and the SCSORFQ were presented on a PowerPoint presentation. Each item contained in the beliefs in the purpose of events questionnaire was presented for 7 seconds and presented again immediately for an additional 7 seconds with the event in question underlined. This was done to ensure the participants first read the vignette in its entirety before considering the purpose of the event. There were four different orders of these items, which were determined through randomization. The purposeful world beliefs questionnaire was presented for only for 7 seconds. Items for both questionnaires were separated by a slide featuring an asterisk in the center to allow

for a pause lasting for 4 seconds. The religiosity items were displayed on a single, untimed slide. All items were formatted to display at the center of the screen in Arial 36-point font.

Participants were given a packet containing a response sheet for the measures mentioned previously. On each page of the packet, an empty column ran alongside the items. Participants in the experimental condition were told that the space is provided for them to keep a tally for each time they detect the letter “x” auditorially. Participants in the control condition were not given any information about this space.

Procedure

Sessions for this study took place in classrooms located in Gary Ransdell Hall on Western Kentucky University’s campus. Initially, participants read informed consent documents explaining the nature of the task. Once informed consent was obtained, participants were told to read the instructions (see Appendix A) for the first portion of the study (i.e., Beliefs in the Purpose of Events and Purposeful World Beliefs measures). Participants in the cognitive load condition were given additional instructions to complete the auditory task. Specifically, these participants were asked to make a tally for every time they heard the letter “x” in the margin of the survey packet. The experimenter encouraged the participants to be as accurate as possible on both tasks. With inspiration from the study by Gilbert et al. (1988), participants in the experimental condition were told that the researcher is interested in how well people can complete two dissimilar tasks at the same time.

Prior to the presentation, the researchers dimmed the classroom lights and setup the PowerPoint presentation. Before the main task, the participants completed a practice

trial, which included 4 of items written to mimic those by Lindeman and Aarnio (2007). Individuals assigned to the cognitive load condition completed a version of the practice trial that was coupled with a practice auditory task. Following the practice trial, participants began the main task, which included the Beliefs in the Purpose of Events and the Purposeful World Beliefs questionnaires along with the auditory task for those in the cognitive load condition. Once the main task was completed, participants in both groups were given a 1-minute break. Participants then filled out the religiosity questionnaire and a brief demographic measure. Additionally, participants provided their WKU 800 number, a unique identification code assigned to each student at the university, which allowed the researcher to access each participant's ACT science reasoning score through TopNet. Finally, participants were debriefed on the true nature of the study, thanked for their participation and excused. The study took about 20 minutes to complete.

Results

Relationships Among Measures

Preliminary analysis of the data looked at the relationship among measures used in the study. Descriptive statistics for all measures are shown in Table 1. Correlational analyses (Pearson's r for all correlations) were conducted among ACT science reasoning scores, average teleological errors for events, average purposeful world ratings, and average religiosity scores. As shown in Table 2, all correlations among these variables were found to be significant. A subsequent correlational analysis was done to determine if there was a relationship between ACT science reasoning and auditory tally. This correlation was found to not be significant ($r = .01, p = .916$). Therefore, it can be ruled

out that those with higher ACT science reasoning scores had higher accuracy on the auditory task.

Beliefs in the Purpose of Events Analysis

A 4 (order: 1, 2, 3, 4,) x 4 (cause type: intentional, artificial, random, natural) x 3 (valence: positive, neutral, negative) repeated-measures ANOVA was conducted on scores for beliefs in the purpose of events with order as a between-subjects variable to ensure the order of items did not impact ratings. As expected, scores did not differ between the four orders of presentation, $F(3, 112) = 1.19, p = .317$. A 2 (condition: cognitive load, no cognitive load) x 3 (intentional outcome type: positive, neutral, negative) repeated-measures ANOVA revealed that performance on the intentional items ($M = 3.70, SD = .78$) did not differ between the conditions, $F(1, 124) = .19, p = .732$. Intentional items were therefore dropped from further analyses.

Participants were designated to one of three groups based on their ACT science reasoning score. Grouping was determined by calculating percentile values (~33% and ~66%) to produce 3 equal groups. Those with scores less than or equal to 19 were assigned to the “low” ACT group ($n = 34$), those with scores between 20 and 22 were assigned to the “medium” ACT group ($n = 42$), and those with scores 23 and above were assigned to “high” ACT group ($n = 40$). The percentiles generated for this dataset match well onto national norms, with a score of 19 representing the 38th percentile, a score of 20 representing the 47th percentile, and a score of 23 representing the 71st percentile (ACT, 2012). In order to assess the effects of cognitive load on beliefs in the purpose of events scores, a 2 (condition: cognitive load, no cognitive load) x 3 (ACT science: high, medium, low) x 3 (vignette cause type: artificial, random, natural) x 3 (valence: positive,

neutral, negative) mixed-model repeated-measures ANOVA was conducted. Mauchly's test indicated that the assumption of sphericity had been violated; therefore degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity for within-subjects effects.

This analysis revealed a main effect of condition. As predicted, participants in the cognitive load condition allotted significantly higher purpose ratings to non-intentional events ($M = 2.96, SE = .01$) than those in the control condition ($M = 2.66, SE = .11$), $F(1, 110) = 4.16, p < .05$, partial $\eta^2 = .04$, indicating that cognitive load produces more errors in teleological reasoning. The ANOVA also revealed a significant main effect of ACT group, $F(2, 110) = 3.70, p < .05$, partial $\eta^2 = .06$. Post-hoc analyses (Fisher's Least Significant Difference for all post-hoc tests) revealed that participants in the high ACT group gave significantly lower purpose ratings to non-intentional events ($M = 2.55, SE = 1.30$) than those in the low ACT group ($M = 3.04, SE = .14$), $p < .01$. No significant differences were found between the high and medium ACT group and between the low and medium ACT group ($M = 2.85, SE = .122$) (see Figure 1).

A main effect of cause type was found, $F(1.89, 208.20) = 14.12, p < .01$, partial $\eta^2 = .114$. Post-hoc tests revealed teleological errors were made significantly more for items with an artificial cause type ($M = 2.96, SE = .09$) than for those with a random cause type ($M = 2.60, SE = .08$), $p < .01$. Also, teleological errors were made significantly more for items with a natural cause type ($M = 2.88, SE = .09$) than for those with a random cause type, $p < .01$. Errors for items with artificial and natural cause types did not significantly differ from one another (see Figure 2).

There was also a main effect of outcome valence, $F(1.79, 196.77) = 35.66, p < .01$, partial $\eta^2 = .245$. Post-hoc tests revealed that teleological errors were made significantly more for items with positive outcomes ($M = 3.22, SE = .11$) than for neutral outcomes ($M = 2.46, SE = .08$) and negative outcomes ($M = 2.75, SE = .08$), p 's $< .001$. Also, errors for negative outcomes were significantly higher than those for neutral outcomes, $p < .001$ (see Figure 3). These main effects were subsumed by a significant Cause type X Valence interaction, $F(3.96, 435.61) = 3.14, p < .05$, partial $\eta^2 = .028$. Repeated-measures ANOVAs were conducted to inspect purpose ratings for each level of valence at each level of cause type, which revealed that the pattern of ratings for valence demonstrated by the main effect held up except for items with random cause types. Specifically, errors for neutral and negative outcomes did not significantly differ from one another for items with a random cause type, $p = .73$ (see Figure 4) but they did for those with an artificial or natural cause type. This pattern was only found in the control condition, thus contributing to a 3-way interaction between cause type, valence and condition, $F(3.96, 435,61) = 2.61, p < .05$, partial $\eta^2 = .023$.

In order to determine if the effect of cognitive load and/or ACT group would remain significant when considering the influence of religiosity on teleological errors, a 2 (condition: cognitive load, no cognitive load) x 3 (ACT science: high, medium, low) x 3 (vignette cause type: artificial, random, natural) x 3 (valence: positive, neutral, negative) mixed-model repeated-measures ANCOVA with religiosity scores as a covariate was conducted. The ANCOVA revealed that, with religiosity held constant, the differences between conditions were no longer significant, $F(1, 109) = 2.78, p = .10$ and the differences between ACT groups were no longer significant, $F(2, 109) = .74, p = .48$.

Religiosity, however, proved to be a highly significant factor contributing to the variance, $F(1, 109) = 37.86, p < .01$, partial $\eta^2 = .26$. With religiosity held constant, the main effects of cause type, $F(1.88, 205.48) = .69, p = .50$, and valence, $F(1.80, 196.37) = 1.74, p = .84$, were no longer observed.

Outcome valence significantly interacted with religiosity as a covariate, $F(1.80, 296.31) = 3.50, p < .05$, partial $\eta^2 = .03$. To investigate this interaction, repeated-measures ANCOVAs were completed for each cause type. There was a significant Religiosity X Outcome Valence interaction for items with a random cause type, $F(1.85, 201.30) = 6.43, p < .01$, partial $\eta^2 = .06$, for items with a natural cause type, $F(1.89, 206.41) = 3.11, p < .05$, partial $\eta^2 = .03$, but not for items with an artificial cause type. Also, a significant interaction was observed between ACT group and cause type, $F(3.77, 205.40) = 2.55, p < .05$, partial $\eta^2 = .05$. Inspection of this interaction revealed that scores did not differ by ACT group for items with artificial or natural cause types. However, for items with a random cause type, the medium ACT group made significantly more errors ($M = 2.77, SE = .12$) than the high ACT group ($M = 2.35, SE = .13$), $p < .05$. No significant differences were found between high and low ACT groups ($M = 2.67, SE = .14$) or the low and medium ACT groups. This interaction was not predicted and is not readily interpretable.

Analyses at Each Level of Religiosity

The main research question was to ascertain whether or not the individuals low in religiosity merely suppress the teleological bias. Therefore, participants were designated to one of three groups based on their average religiosity score. To determine grouping, percentiles were generated to produce three equal groups (cut offs at ~33% and ~66%)

based on religiosity scores. Religiosity was high in this sample ($M = 2.88$, $SD = .88$) and the grouping reflects this finding. Individuals with a religiosity score 2.50 or lower were designated as the “low” religiosity group ($n = 39$), individuals with a religiosity score between 2.60 and 3.50 were designated to the “moderately high” religiosity group ($n = 37$), and those with a religiosity score 3.50 and higher were designated to the “very high” religiosity group ($n = 40$). A 2 (condition: cognitive load, no cognitive load) x 3 (religiosity group: low, moderately high, very high) x 3 (vignette cause type: artificial, random, neutral) x 3 (outcome type: positive, negative, neutral) repeated-measures ANOVAs done to compare purpose ratings between the religiosity groups and conditions. There was a main effect of religiosity group, $F(2, 443.95) = 24.30$, $p < .01$, partial $\eta^2 = .31$. Those in the low religiosity group allotted significantly less purpose ratings ($M = 2.24$, $SE = .11$) than both the moderately high ($M = 2.88$, $SE = .11$) and the very high religiosity groups ($M = 3.30$, $SE = .11$). The very high group allotted significantly higher purpose ratings than both the moderately high and low groups. Religiosity group and condition did not significantly interact, but the interaction approached significance $F(2, 443.95) = 2.74$, $p = .07$, partial $\eta^2 = .05$.

Despite the lack of an interaction between religiosity group and condition, a more thorough inspection of the effects of condition on low religiosity individuals required a priori comparisons to be completed. To determine the extent to which cognitive load impacted teleological reasoning in individuals low in religiosity, 2 (condition: cognitive load, no cognitive load) x 3 (vignette cause type: artificial, random, neutral) x 3 (outcome type: positive, negative, neutral) repeated-measures ANOVAs done separately for three levels of religiosity. No main effect of condition was found for those in the moderately

high and very high religiosity groups. However, as predicted, a main effect of condition was found for individuals low in religiosity, $F(1, 37) = 4.82, p < .05$, partial $\eta^2 = .12$. Specifically, scores were higher for low religiosity individuals in the cognitive load condition ($M = 2.50, SE = .18$) than for those in the control condition ($M = 1.97, SE = .18$) (see Figure 5).

Beliefs in a Purposeful World Analysis

To determine how cognitive load, ACT science reasoning, and religiosity impact participants' perspective on a purposeful world, a 2 (condition: cognitive load, no cognitive load) x 3 (ACT science: high, medium, low) ANCOVA with religiosity scores as a covariate was conducted. Inconsistent with my predictions, purposeful world belief scores did not differ by condition, $F(1, 109) = .002, p = .96$. However, a main effect of ACT group was found, $F(2, 109) = 3.1, p = .05$, partial $\eta^2 = .05$. Post-hoc analysis revealed the high ACT group demonstrated significantly lower purposeful world belief scores ($M = 4.65, SE = .22$) compared to the low ACT group ($M = 5.41, SE = .24$), $p < .05$. The high ACT group did not significantly differ from the medium ACT group ($M = 5.45, SE = .21$) and the low and medium ACT groups did not significantly differ from one another. Religiosity was found to be a highly significant factor accounting for the variance in purposeful world belief scores, $F(1, 109) = 48.68, p < .01$, partial $\eta^2 = .31$.

Discussion

Summary of Findings

Consistent with my predictions, the results of this study indicate that when processing resources are limited, even college-attending adults are prone to making teleological errors in reasoning about events. Specifically, individuals placed under

cognitive load made significantly more errors than those who did not. Also as predicted, science reasoning was found to be an important factor, with those with the lowest ACT science reasoning scores committing significantly more errors than those with high ACT scores. Thus, although it appears that appreciation of scientific principles serves as a major contributor to one's likelihood to imbue purpose on non-intentional events, these errors are amplified by the demands of the situation. Inconsistent with prior predictions however were the types of situations that tend to provoke teleological errors. These results indicate that events with artificial or natural cause types inspired the higher levels of teleological reasoning compared to those with a random cause type. Moreover, events with positive and negative outcomes received higher purpose ratings than those with neutral outcomes. This finding is inconsistent with a prior study, which found errors to only be especially high for positive outcomes. Although positive outcomes were rated with significantly more purpose than negative outcomes, this present study suggests that outcomes at either extreme of valence inspire teleological reasoning.

Religiosity was found to be an extremely important factor; when analyzed as a covariate variable, cognitive load and scientific reasoning were no longer significant as between-subjects variables for beliefs in the purpose of events. That is, when the variance accounted for by religiosity is held constant, no significant differences are found among individuals on purpose ratings based on processing resources or scientific reasoning. Moreover, no differences based on the type of cause (i.e., artificial, random, natural) or valences of outcome (i.e., positive, neutral, negative) were found. Thus, it appears that, of all the variables included in this study, religiosity is the single most important contributor to teleological errors. However, when selectively examining the data, this does not appear

to be the full story. The results showed that, for low religiosity individuals in particular, cognitive load significantly increased teleological errors. No differences were found between conditions for those who scored higher in religiosity. Thus, it appears that individuals low in religiosity do in fact suppress the teleological bias and cognitively demanding situations weaken this ability. By contrast, those high in religiosity appear to be unaffected by cognitive load perhaps because such explicitly held beliefs in the purpose of events do not change as a function of situational demands.

Interestingly, my prediction that cognitive load would inflate beliefs in a purposeful world was not met. Scores on this measure were inflated in general ($M = 5.09$, $SD = 1.68$ on a 7-point scale) and did not change as a function of cognitive load with religiosity held constant. Religiosity and ACT however were found to be significant contributors to participants' beliefs in a purposeful world. Thus, it appears that one's explicit faith and appreciation of scientific knowledge contributes to whether or not they endorse statements suggesting that the world is purposeful in general (e.g., "Everything happens for a reason") rather than processing resources. These results suggest that these beliefs are, a) readily accessible, b) generally high and c) heavily tied to individual differences in religiosity and scientific reasoning.

Teleological Reasoning: The Type of Event Matters

Putting individual differences in religiosity and scientific reasoning aside, the current study found that certain characteristics of an event in part determine the likelihood that a teleological error will be made. Specifically, events that are caused by artificial (e.g., brake failure) and natural (e.g., fog) forces were seen as more purposeful than those with random causes (e.g., a coin toss). This finding was not anticipated and

Svedholm et al. (2010) did not report such a distinction between the types of force causing the event. It appears that, within this sample, individuals appreciated the non-intentional nature of random forces more than artificial or natural forces. Such a result appears to conflict with a recent study which showed that participants tend to resist the explanations of randomness in favor of explanations implying order and purpose (Rutjens, Pligt, & Harreveld, 2010). Although Bering (2011) discusses how natural events often provoke teleological processing (e.g., hurricanes, tsunamis) and Kelemen and Rosset (2009) found that adults made the most errors for items suggesting that nature is an intentional force, previous research does not reveal how other types of causal forces might inspire (or fail to inspire) teleological processing. Integral to Bering's (2002) ideas, however, is the notion of surprise entailed with an event. That is, unexpected events are predicted to invoke the most teleological processing. Upon inspecting the items, one can speculate that items with a random cause type (e.g., coin toss, dealt the 3 of clubs) were simply less surprising than those with artificial cause types (e.g., brakes fail, power outage) and natural cause types (e.g., thunderstorm, lightning strike). Therefore, the effect of cause type may be attributed to the types of items used in this study and any theoretical speculation should be made cautiously.

This study does further illuminate the importance of the emotional impact of an event's outcome on teleological reasoning. Specifically, events with valenced outcomes were rated as happening for a purpose more than events with neutral outcomes and this effect was especially pronounced for positive outcomes. This finding further refines the proposed effect of emotional salience that has been discussed in previous literature. Specifically, Skaggs and Baron (2006) discussed how a common theme in trauma

literature is the process of making meaning following a negative event. That is, people tend to seek out the purpose behind a negative event because their expectations have been violated. Bering (2002; 2003) has placed much emphasis on the importance of emotional impact the event has on the individual; arguing that those that are affect-laden will provoke far more searching for purpose than mundane events. This idea coincides with Gray and Wegner's (2010) suggestion that we seek out agency behind events of "unjust suffering and undeserved salvation" that lack a clear human cause. Such a proposal is intuitive; why would we waste cognitive resources considering the purpose behind mundane events? Rather, the events that evoke an emotional response inspire us to seek out the purpose behind the event, even if none exists. Once this purpose is discovered (or conjectured), it can be more neatly accommodated into our life narrative.

The present study found that, when considering hypothetical vignettes, individuals ascribed higher levels of purpose to events that were affect-laden at both positive and negative directions. However, this study also provides empirical evidence that people tend to find events with positive outcomes as more purposeful than both negative and neutral outcomes. Perhaps this effect is due to what Weinstein (1980) describes as "unrealistic optimism" or people's tendency to estimate the occurrence events with positive outcomes as far more likely than events with negative outcomes. It seems that people are not only biased in their predictions about positive outcomes, but they also tend imbue more intentionality behind their causes. That is, people seem to think that an intentional force is acting behind events with good outcomes, perhaps because of a belief that they deserve such outcomes. Particularly relevant to this motivational aspect of teleological reasoning about events is the widely studied belief in a

just world (Hafer & Begue, 2005). The general proposal behind just-world theory is that people are driven to believe the world operates in a way so that people get what they deserve: good things happen to good people and bad things happen to bad people (Lerner, 1980). Bering (2002) has suggested that EToM will be activated when an unexpected event “deviates from or conforms to culturally scripted just world expectations” (p. 18). That is, such events may be interpreted as enforcing a sort of justice upon the individuals affected because they are ultimately deserving of their fate. Thus, imbuing purpose upon non-intentional events may ease the anxiety associated with violations of our expectancies in a similar way that just-world beliefs do. Moreover, when it comes to considering scenarios relevant to the self, our tendency for unrealistic optimism biases us to believe that positive outcomes are the result of some intentional force.

Teleological Errors: Universal Tendency or Individual Differences?

Although our likelihood to commit teleological errors seems to depend on the type of event that has occurred, the present study also addresses two other important factors: the conditions that inspire teleological errors and the types of people who are likely to commit them. Similar to the results found by Kelemen and Rosset (2009), this study found that college-attending adults committed significantly more teleological errors when placed under processing demands and that this effect was most pronounced for individuals with low scientific reasoning ability. The present study extends upon these findings with a study in which participants made judgments about life events rather than object categories. Thus, it appears that teleological beliefs about both events and objects are vulnerable to factors such as cognitive resources and scientific knowledge. According to Kelemen and Rosset, teleological explanations become constrained by scientific

knowledge, rather than replaced, and therefore can be exposed by compromising one's ability to invoke cognitive control over their explanations. Thus, teleological reasoning perseverates throughout development as an explanatory default and extra cognitive resources are required to override this default. Such faulty reasoning becomes expressed not only when considering the teleo-function of object categories, but also our life events.

These ideas are consistent with Bering's (2002) assertion that looking for the purpose is much like a "knee-jerk" reaction that must be actively suppressed. However, Bering describes this tendency as being the result of an active Existential Theory of Mind (EToM), which, much like ordinary Theory of Mind, processes information for the potential intentionality. According to him, the EToM system evolved and develops with Theory of Mind, however responds specifically to events. Therefore, EToM is likely to have a biological basis and operates universally in all individuals. Combining the ideas of Kelemen and Rosset (2009) and Bering, the results of the present study can be interpreted as such: both cognitive control and scientific knowledge are needed to suppress the responding of the EToM. Thus, imbuing purpose upon events seems to be so intuitive, that only those with the means (i.e., cognitive resources) and the knowledge (e.g., appreciation of scientific principles) are able to sufficiently suppress it. This perspective helps explain why those under cognitive load and those with low science reasoning scores were so prone to teleological error.

Svedholm et al. (2010) oppose this perspective, however and have argued that beliefs in the purpose of events are a function of individual differences in superstitious beliefs, rather than a universal (yet mutable) tendency. In their study, highly superstitious individuals were significantly more likely than skeptics to endorse the beliefs in the

purpose of events. However, it can be argued that the participants in their study were responding in a way that is most consistent with their ideological beliefs (i.e., suppression of teleological reasoning for skeptics and facilitation of teleological reasoning for highly superstitious individuals) because they had the cognitive capacity to do so. The present study provided the opportunity to tap into beliefs that might be more implicitly held by reducing cognitive resources. Because cognitive load led to more errors, it seems teleological reasoning is not solely a function of individual differences. A major challenge to this conclusion however is that fact that when religiosity is controlled for, cognitive load was no longer a significant factor contributing to teleological errors. Thus, it might be argued that expressions of teleological errors are, to a higher degree, a function of differences in faith rather than situational influences. This conclusion however, is still too simplistic.

Given that the interaction between religiosity and condition was not significant, it appears initially that religiosity trumps the effect of condition. However, this was not the case at every level of religiosity. Specifically, those with the lowest religiosity scores were the only group to be affected by cognitive load. Such a finding supports Bering's (2002) assertion that even ideological atheists, who may reject the idea of an abstract external agent such as God, may nevertheless be compelled to question the purpose behind of events. The findings here coincide with those of Weeks and Lupfer (2000), which found participants of low religiosity frequently referred to supernatural forces (e.g., "fate") as arbiters behind events. That is, although ideological atheists may explicitly reject the existence of an agent such as God, the tendency to seek out intentionality behind events operates at a much more intuitive level and, if provoked, may

be expressed in alternative ways (e.g., believing in fate or merely asking “why did this happen to me”). Presumably then, low religiosity individuals in the present study may explicitly reject faith (i.e., as measured by the religiosity scale), yet are more likely to rate non-intentional events as happening for a purpose if cognitive resources have been compromised.

Perhaps the best way to conceptualize this apparent disagreement is with a dual-process model perspective, an increasingly popular way to explain human reasoning (Evans, 2008). According to this model, human reasoning is guided by two systems that compete for expression. System 1 incorporates reasoning that is quick, intuitive, implicit, and operates independent of working memory. System 2 on the other hand is effortful, analytical, explicit, and is constrained by working memory. Although both systems may operate simultaneously, system 2 requires cognitive effort to override the responding of system 1. The results of the present study provide an eloquent example of how these two systems operate in teleological reasoning. For individuals with low religiosity, the ability to suppress system 1 (i.e., teleological reasoning) can be compromised, as evidenced by the higher number of errors under cognitive load. Those higher in religiosity are unaffected by cognitive load because they endorse teleological beliefs at *both* the implicit and explicit level. That is, religious individuals do not resist teleological errors because their faith encourages them to believe that every event happens for a purpose. Therefore, it seems that there are two paths to teleological beliefs: one at the explicit level (i.e., religious faith) and one at the implicit level (i.e., teleological reasoning). Religion then, appears to make our teleological intuitions concrete by offering dogma to elucidate the agent and meaning behind our life events. This same line of reasoning can be further

applied to explain the lack of effect cognitive load had on beliefs in a purposeful world. These beliefs were highly correlated with religiosity and perhaps tap the same construct of “promiscuous teleology” (Kelemen, 1999a), which is easily accessible and readily endorsed in these individuals.

The seemingly incongruent relationship between religiosity and analytics is perhaps most striking when looking at the strongly negative correlation between religiosity and ACT science reasoning scores. It seems that a tendency to reject religious intuitions is robustly associated with an appreciation of scientific principles. In fact, a recent study provided evidence that various experimental manipulations to induce analytic reasoning caused reductions in religiosity scores (Gervais & Norenzayan, 2012). Also drawing upon a dual-process model, these authors concluded that analytic processing inhibits system 1 processing which presumably underlies the intuitive nature religious cognition. The results of the present study complement their conclusions by providing an example of how weakening the ability to reason analytically promotes system 1 processing. Both studies illustrate how our beliefs are relatively subject to our ability to deploy effortful cognitive processing. This is not to say that religiosity is the result of poor analytical thinking, rather how intuition and analytics operate on two distinct systems of reasoning that are at odds with one another at times.

Implications of Findings

The present investigation sheds light on aspects of teleological reasoning that until now, had yet to be explored. Specifically, teleological beliefs were measured using a questionnaire aimed to target individuals’ beliefs about real life events and created conditions that resemble the demands we experience in everyday life. Much of the

previous research had concentrated on reasoning about object categories and the results of the present study suggest that even college attending adults err about events in a similar way. That is, for both objects and life events, we instinctively attribute purpose unless we have both the ability and knowledge to suppress it. Perhaps then, teleological errors of any kind reflect the activation of the same underlying mechanism. There has been theoretical disagreement, however, as to what mechanism underlies our propensity to make teleological errors.

Kelemen (1999b) has suggested that teleological beliefs grow out of children's early experiences with learning about intentionality and goal-directed behavior and are at first promiscuously applied to all object categories but are eventually constrained by later acquired knowledge. Bering (2002) employed an evolutionary approach and asserted that our tendency to seek purpose reflects the activation of a biological mechanism, EToM, which is specialized for seeking intentionality behind events. A third perspective, offered by Svedholm et al. (2010), argues that looking for the purpose behind events is a type of superstitious belief moderated by a failure to appreciate core knowledge distinctions. Although the present study is not able to precisely illuminate the underlying cause of teleological errors, it does clarify how they operate. From the present results, it appears that teleological beliefs operate at both the implicit and explicit level. That is, teleological beliefs are not solely the expression of individual differences (i.e., religiosity, science reasoning) or situational influences (i.e., cognitive demands), but rather both.

Although this study has only clarified the role of these factors in how teleological beliefs operate, a speculation can be made to address this theoretical disagreement. Perhaps evolution has predisposed the human species to filter information, be it object,

behavior, or events, for potential purpose. Such a tendency is evolutionarily beneficial—it would be adaptive to be acutely aware of the utility and intentionality behind the things we encounter in life because a) we appreciate the potential functionality of objects we encounter and b) appreciate agency in the environment, which is important for detecting predators and intentions of our conspecifics. This biologically based propensity might rapidly increase in expression around early childhood when object manipulation (Kelemen, 1999b) and mental state appreciation (Bering & Parker, 2006). As humans further develop, their environment either constrains or elaborates upon this tendency. That is, exposure to complex scientific principles (e.g., biology, physics) or ideological expression (e.g., agnosticism, atheism) leads one to suppress the teleological stance. By contrast, religiosity and superstitious beliefs outright sanction our teleological errors (e.g., God or Fate was responsible for this random event). Although these later influences affect how our explicit teleological beliefs are expressed, our teleological intuitions, both biologically inherent and developmentally critical, persist to guide our implicit beliefs. These implicit beliefs may not be obvious in religious and superstitious individuals, because they explicitly endorse teleological errors. However, their expression in individuals who score low on these constructs when cognitive resources are limited provide evidence that filtering information for potential purpose in some way reflects a default style of reasoning. It is up to future research however to determine if a specific module (e.g., EToM) can in fact be found at the biological level.

Regardless of the mechanism for teleological errors, a better understanding of how and why adults reason in unwarranted teleological ways poses a variety of implications for how people function in everyday life. A strong belief that one's life has a

purpose has been found to have a profound impact on well-being. Specifically, purpose in life beliefs mediate the relationship between religiosity and happiness (French & Joseph, 1999) and moderate the relationship between depression and suicide ideation (Heisel & Flett, 2004). Thus, it seems psychologically advantageous to have an answer to the philosophical quandary of *why am I here?* Therefore, what might be deemed as an error in reasoning literature might be considered a useful tool in promoting psychological health in clinical settings.

It has been suggested that human's teleo-functional beliefs are applied to the self in a fashion similar to our teleological reasoning about objects (Bering, 2010). This sort of reasoning is immediately apparent in people's beliefs about destiny and God's (or some similar entity's) use of natural events (e.g., an earthquake) to communicate some sort of message to us. As Bering points out, a belief in the purpose in one's life may be seemingly innocuous, but suicide missions inspired by a belief that the act had been ordained by a higher power provide disturbing examples of how extreme such beliefs can be (p. 292). This line of research suggests that humans are compelled to filter their experiences for their teleological purpose to give meaning to the autobiographical experiences that make up one's life and this compulsion may be rooted in more fundamental cognitive processes. Moreover, this study and others like it (Gervais & Norenzayan, 2012; Svedholm et al., 2010) have the potential to further our knowledge about religious or superstitious thinking. That is, these types of belief systems may not be solely a product of cultural indoctrination, but also the result of ordinary cognitive processing. In light of the present results, it appears that a teleological bias is one factor that underlies religious cognition at both an implicit and explicit level. This finding

further contributes to a body of work indicating that religiosity is a product of ordinary cognition rather than mere culture or psychological ailment (see Barret, 2011).

Limitations and Outstanding Questions

Although the present findings are intriguing, interpretations must be made with caution, as this study is not without limitations. Based on these limitations, outstanding questions and directions for future research can be put forth. First, limitations exist in how the experiment was conducted. As previously discussed, items with random cause types inspired significantly less teleological errors than expected. Any future use of this scale as a measure of beliefs in the purpose events ought to check and potentially correct for a lack of surprise with these items. Moreover, although participants were encouraged to consider the scenarios in the Beliefs in the Purpose of Events questionnaire as if they actually transpired, the study nevertheless suffers for some lack of ecological validity. Put simply, considering each hypothetical event for approximately 14 seconds does not equate to actually experiencing the event and therefore, the present results may reflect an underrepresentation of teleological beliefs. Based on the findings of Skaggs and Baron (2006), one could argue that our actual experiences receive the more teleological processing because they become incorporated into our life narrative, whereas considering hypothetical scenarios may not invoke the same level of teleological processing. Perhaps future research should adopt a more qualitative approach to inquire how people react to actual life events that vary by expectancy and valence to determine if a pattern of teleological processing similar to the present findings emerges. Similarly, it is difficult to assert that the cognitive load method chosen (i.e., an auditory task) sufficiently resembles the busyness and perhaps stress of real life events. Moreover, the method used here is one

of many styles of cognitive load induction (Paas, Tuovinen, Tabbers, & Van Gerven, 2003). Therefore, future research should also attempt to validate the present results utilizing other forms of cognitive load induction.

Although the SCSORFQ was chosen as a measure of religiosity for its high reliability and nondenominational quality (Plante & Boccacini, 1997), other measures of religiosity should be used to validate and further expand upon the present findings. For example, the Intrinsic-Extrinsic measure of Allport and Ross's (1967) Religious Orientation scale which differentiate different motivations for adherence to religion. Those who score high on the extrinsic dimension tend to view religiosity as a means to an end (e.g., go to church to maintain a social network). Those who score high on the intrinsic dimension truly believe the tenets of their religion and employ its teachings to drive their behavior. It would be interesting to replicate the present study but distinguish participants who are intrinsically vs. extrinsically motivated in their religiosity. Perhaps those with extrinsic beliefs would perform more variably under cognitive load, as their beliefs are only explicitly held and are therefore more vulnerable to distraction. Moreover, although the SCSORFQ is a good measure of religious faith and engagement, it by no means captures the totality of one's religiosity. That is, religiosity is likely to be more nuanced than what can be captured by this single measure, and interpretation of the present results should be made with this in mind.

Issues with interpreting the results should also be noted. Religiosity, which was found to be a rather important factor contributing to teleological errors, was quite high in this sample ($M = 2.88$, $SD = .88$, on a 4-point scale). This trend is not surprising, considering the high rates of religious adherence, as measured by reported affiliation and

regular attendance of service, in the state of Kentucky (51.6% across denominations and 33% of the Evangelical Protestant tradition Grammich, Hadaway, Houseal, Jones, & Krindatch, et al., 2010). Therefore, it may be difficult to generalize these results across to other geographical areas with different religious adherence rates and dominant religious traditions. However, this “limitation” actually sheds further light on teleological reasoning. Kelemen and Rosset (2009) did not find an effect of beliefs in God on teleological errors for object categories. The participants in their study however, were students attending the prestigious Boston University. The individuals who participated in the present study were recruited from a public university in the south, and therefore provide a unique perspective into how a different group of college-attending adults reason teleologically. Moreover, the individuals who participated in this study had an average ACT science reasoning score ($M = 21.48$, $SD = 4.06$) that closely represented the national average (i.e., a score of 21 represents the 56th percentile according to national norms, ACT 2012). ACT science reasoning scores were found to be positively associated with number of teleological errors for events and beliefs in a purposeful world. This finding poses larger implications for our education system, in that a poor appreciation of scientific principles is associated with hyper-attribution of purpose to non-intentional events and the world in general. Thus, this study provides some insight into how a population of students errs about non-intentional forces at a national level. However, the instructions (See Appendix A) were deliberately vague enough to encourage a subjective or objective interpretation of “purpose.” Perhaps then, the present study could be confounded by a difference in interpretation of “purpose”, one that implies literal intentionality or one that implies supernatural forces (e.g., karma, fate, God). It would be

interesting to replicate the present study to compare two explicit definitions of purpose to determine whether or not how “purpose” is defined is critical. Perhaps individuals high in religiosity will suppress their explicit belief system in favor of more analytic rationality if instructed to think about “purpose” in the most literal sense of the word.

Conclusions

In summary, it appears that college-attending adults remain prone to teleological errors when reasoning about events. The present findings highlight several factors that contribute to this tendency, including the emotional impact and cause type of the event, the cognitive resources available, and individual differences in religiosity and scientific appreciation. Moreover, the present study expands our understanding of promiscuous teleology beyond how humans think about object categories, but to scenarios designed to mimic real life situations. Teleological errors appear to reflect reasoning conducted at an intuitive and easily accessible level. By contrast, resisting such intuitive explanations requires explicit rejection in the purpose of events, which appears to depend on scientific appreciation, working memory capability, and lower levels of religious faith. These findings pose implications for both how human reasoning operates, but also the cognitive foundations for which we base our religious beliefs. Educators should be aware of how such faulty reasoning is fostered, and clinicians might have a better understanding of how their patients rationalize both tragedy and good fortune. It is up to future investigations to pinpoint the source of teleological beliefs and perhaps develop a more precise model of how teleological beliefs are founded and cultivated or constrained throughout development.

**Appendix A: Vignettes to Assess Beliefs in the Purpose of Events (Adapted from
Lindeman & Aarnio, 2007)**

Instructions:

When something happens, people sometimes think that the event happened for a “purpose” even though we don’t know what the purpose is. These phrases can mean many different things and sometimes they are simply used out of habit. In this study, the expressions are used in the following sense. An event happens for a purpose if you think it was intentionally caused by a visible or an invisible agent. Now imagine the following things happened to you. It is important that you try to picture the situations.

Each of the situations will be presented to you on the screen for approximately 7 seconds and then will be presented again for another 7 seconds with the event in question underlined. There will be a brief pause between each scenario. To what extent do you believe the underlined event happened for a purpose?

Scale:

1= *The event definitely did not have a purpose*

2= *The event probably did not have a purpose*

3= *Not sure/ No opinion*

4= *There was some kind of purpose*

5= *The event clearly had a purpose*

(Intentional, Positive)

1. A person that you are attracted to kisses you in the middle of the street and you start going out together. [5.91]

2. You do your upmost for an interview and receive the job. [6.72]

(Intentional, Neutral)

3. You lend your classmate a pencil during an exam and they return it to you afterwards.

[4.86]

4. You drive to your place of work and have a typical day on the job. [4.49]

(Intentional, Negative)

5. Your colleague teases you regularly and your job performance declines. [1.77]

6. Your neighbor spreads an undesirable rumor about you around the neighborhood and you are not invited to a block party. [2.49]

(Artificial, Positive)

7. A long electrical power outage occurs and to pass the time you and your partner make love. After nine months a much hoped-for baby is born. [6.00]

8. Your brakes fail and you get into a minor accident with an individual who you will eventually marry. [4.95]

(Artificial, Neutral)

9. A server fails and you cannot send or receive email for two days. [2.88]

Item changed to A server fails and you cannot send or receive email for an hour.

10. City traffic becomes seriously jammed and you decide to take the bus to work. [3.74]

(Artificial, Negative)

11. The brakes on your car fail and the resulting crash causes you serious injury. [1.51]

12. An electrical fault causes a fire and your home is destroyed. [1.40]

(Random, Positive)

13. A coin you toss lands on heads and you win a large amount of money. [6.35]

14. You unexpectedly run across a former heartthrob and you start going out together.

[5.63]

(Random, Neutral)

15. You are dealt the 3 of clubs and you break even in a poker game. [4.72]

16. You are randomly selected by a computer and asked to complete a customer satisfaction survey. [New]

(Random, Negative)

17. You only get clubs and spades in a game of cards and therefore run up large debts.

[1.70]

18. A stone falls from a scaffold unexpectedly and you get seriously injured. [1.35]

(Natural, Positive)

19. Fog delays the departure of your plane and you meet a person at the airport who you will become engaged to after a year. [5.58]

20. A power outage happens during a thunderstorm and you have to do a big job by hand.

Your boss praises your skills and you later get a raise. [6.05]

(Natural, Neutral)

21. A snow storm delays the departure of your train and you read a book. [4.60]

22. A lightning strike topples a big tree in your garden, but causes no other harm. [4.49]

(Natural, Negative)

23. Lightning strikes the house you are living in and you lose your home. [1.37]

24. You catch a bacterial infection while traveling abroad and fall ill for a long time.

[1.63]

*** Number shown in brackets represent average valence ratings on a scale from 1 = “absolutely negative” to 5 = “absolutely positive.”**

Appendix B: Strength of Religious Faith Questionnaire (Plante & Boccaccini, 1997)

Instructions:

Please answer the following questions about religious faith using the scale below.

Indicate the level of agreement (or disagreement) for each statement.

1 = strongly disagree 2 = disagree 3 = agree 4 = strongly agree

1. My religious faith is extremely important to me.
2. I pray daily.
3. I look to my faith as a source of inspiration.
4. I look to my faith as providing meaning and purpose in my life.
5. I consider myself active in my faith or church.
6. My faith is an important part of who I am as a person.
7. My relationship with God is extremely important to me.
8. I enjoy being around others who share my faith.
9. I look to my faith as a source of comfort.
10. My faith impacts many of my decisions.

Appendix C: Informed Consent Document

INFORMED CONSENT DOCUMENT

Project Title: Beliefs about the Purpose of Events

Investigator: Carrie Guggenmos, B.A. and Kelly Madole, Ph.D., Dept. of Psychology, 745-6475

You are being asked to participate in a project conducted through Western Kentucky University. The University requires that you give your signed agreement to participate in this project.

The investigator will explain to you in detail the purpose of the project, the procedures to be used, and the potential benefits and possible risks of participation. You may ask him/her any questions you have to help you understand the project. A basic explanation of the project is written below. Please read this explanation and discuss with the researcher any questions you may have.

If you then decide to participate in the project, please sign on the last page of this form in the presence of the person who explained the project to you. You should be given a copy of this form to keep.

1. **Nature and Purpose of the Project:** The goal of this study is to determine how people think about a variety of life events.
2. **Explanation of Procedures:** You will be asked to provide some general information about yourself in addition to responding to three different questionnaires. The first will ask you about why you believe some events occur. The second will ask you about your beliefs about how the world works. The third and final questionnaire will ask you about some basic demographic information. NOTE: In the demographic questionnaire you will be asked to provide your WKU 800 number so that we may get some information from you about your test scores. Once we obtain this information, this sheet will be destroyed so that no identifying information is associated with your responses to the questionnaires. In addition to the questionnaires, you may also be asked to complete an additional task that requires your ability to multitask.
3. **Discomfort and Risks:** This study has no risks beyond those you would incur in everyday life.
4. **Benefits:** Your instructor may provide you with course credit or extra credit for participating. This study may also help us to understand how people reason about objects and events.
5. **Confidentiality:** Your participation in this research is confidential. Your name will not appear on any answer sheet. In the event of publication of this research, only group data will be reported. No personally identifying information will be disclosed.

(consent form continued)

6. Refusal/Withdrawal: Refusal to participate in this study will have no effect on any future services you may be entitled to from the University. Anyone who agrees to participate in this study is free to withdraw from the study at any time with no penalty.

You understand also that it is not possible to identify all potential risks in an experimental procedure, and you believe that reasonable safeguards have been taken to minimize both the known and potential but unknown risks.

Signature of Participant

Date

Please sign here to indicate your willingness to share your ACT score with this study.

Signature of Participant

Date

Witness

Date

THE DATED APPROVAL ON THIS CONSENT FORM INDICATES THAT
THIS PROJECT HAS BEEN REVIEWED AND APPROVED BY
THE WESTERN KENTUCKY UNIVERSITY INSTITUTIONAL REVIEW BOARD
Paul Mooney, Human Protections Administrator
TELEPHONE: (270) 745-6733

Appendix D: Tables and Figures

Table 1

Descriptive Statistics for Main Variables (N = 116)

	Minimum	Maximum	Mean	SD
ACT Science Reasoning	14.00	35.00	21.48	4.06
Teleological Errors	1.00	4.61	2.82	.82
Purposeful World Beliefs	1.00	7.00	5.09	1.70
Religiosity Scores	1.00	4.00	2.88	.88

Table 2
Pearson Correlation Matrix among Main Variables

	Teleological Errors	Purposeful World Beliefs	Religiosity
ACT Science Reasoning	-.268**	-.360**	-.279**
Teleological Errors		.698**	.557**
Purposeful World Beliefs			.596**

Note. **p < 0.01

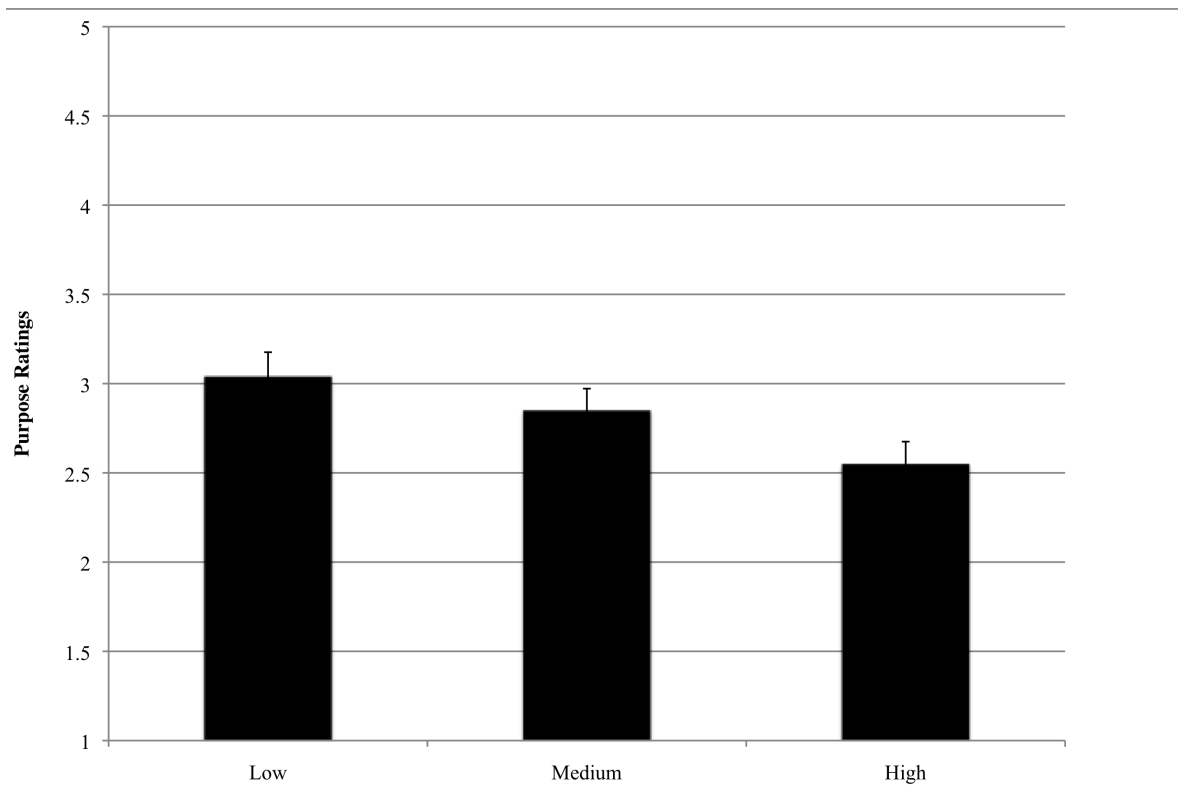


Figure 1. Mean purpose ratings by ACT group.

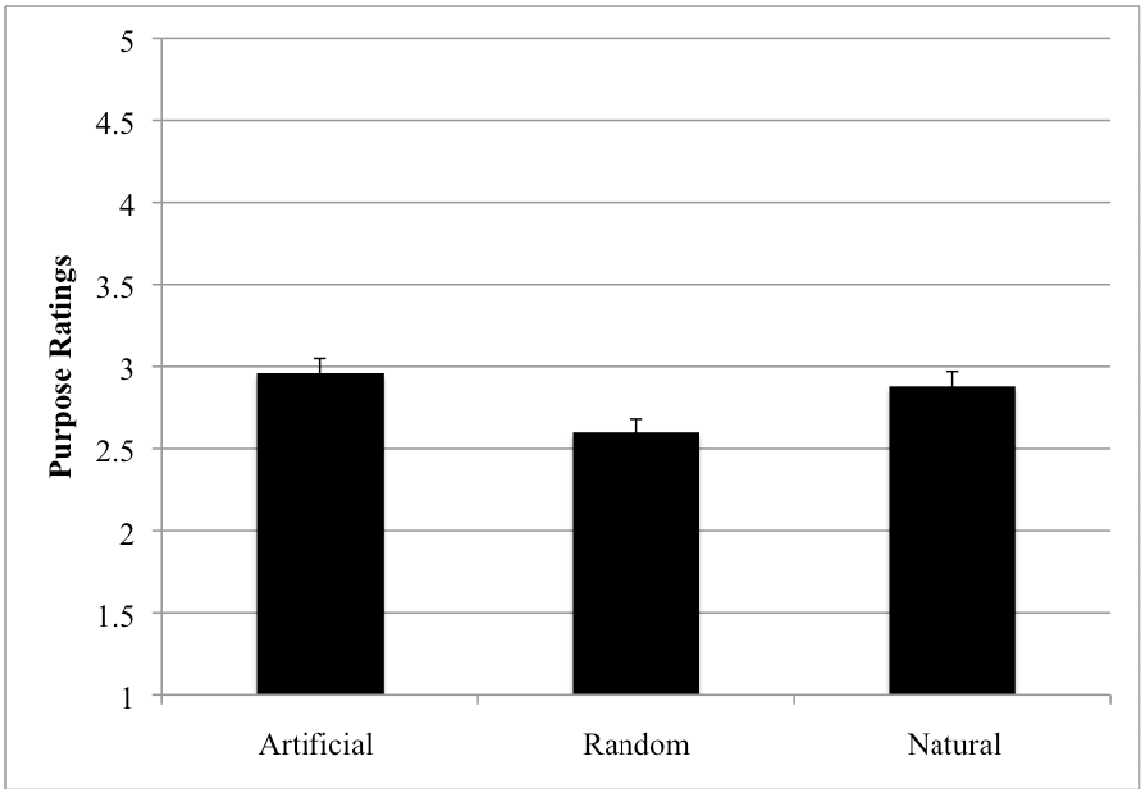


Figure 2. Mean purpose ratings by vignette cause type.

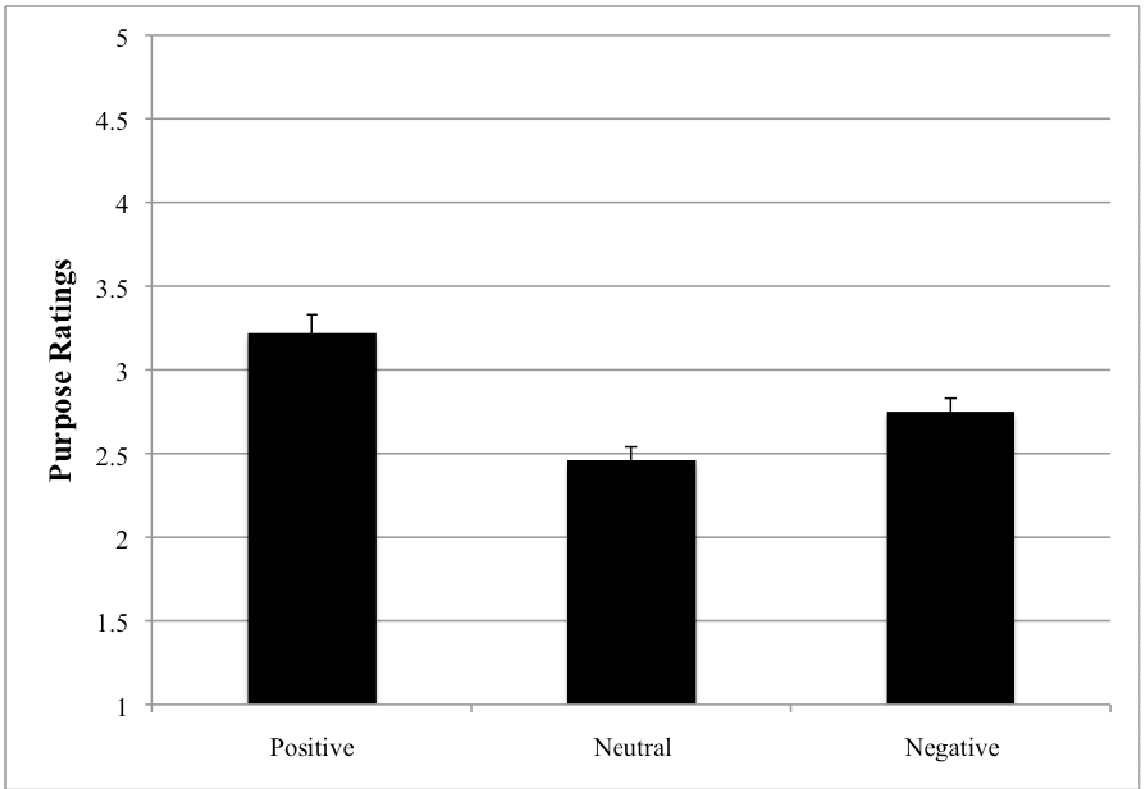


Figure 3. Mean purpose ratings by outcome type.

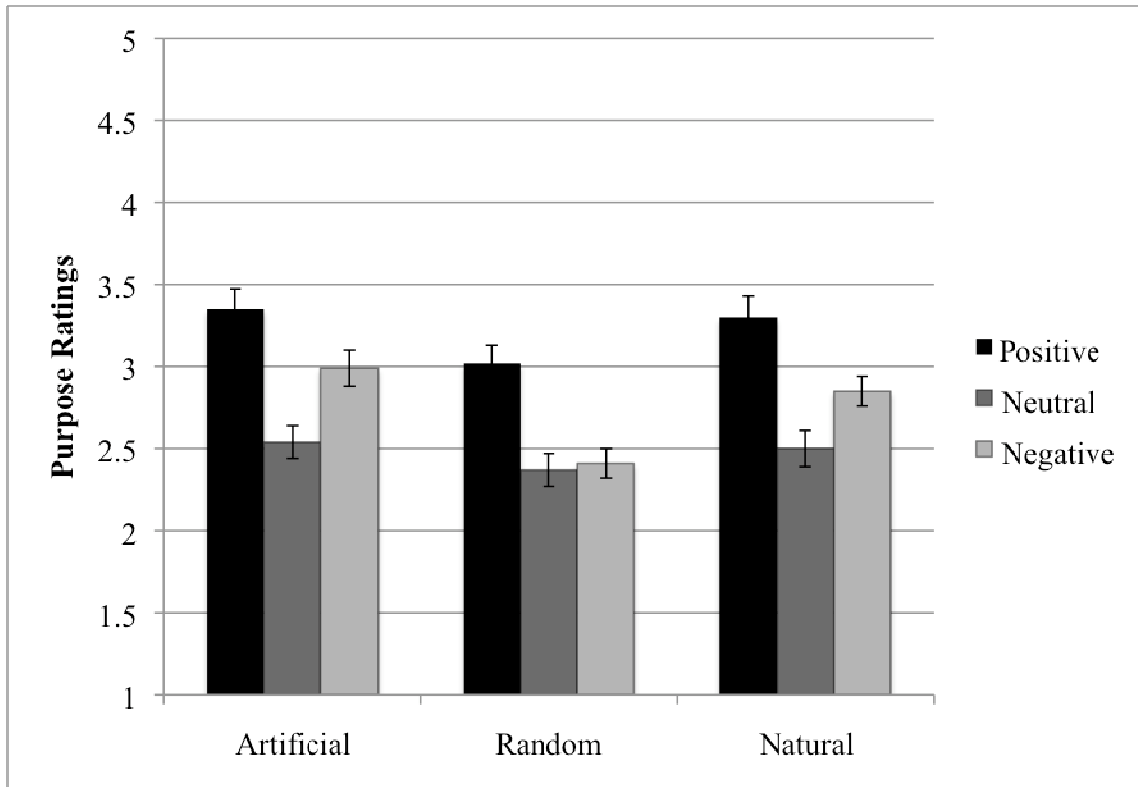


Figure 4. Marginal mean purpose ratings for vignette Cause type X Vignette outcome valence interaction.

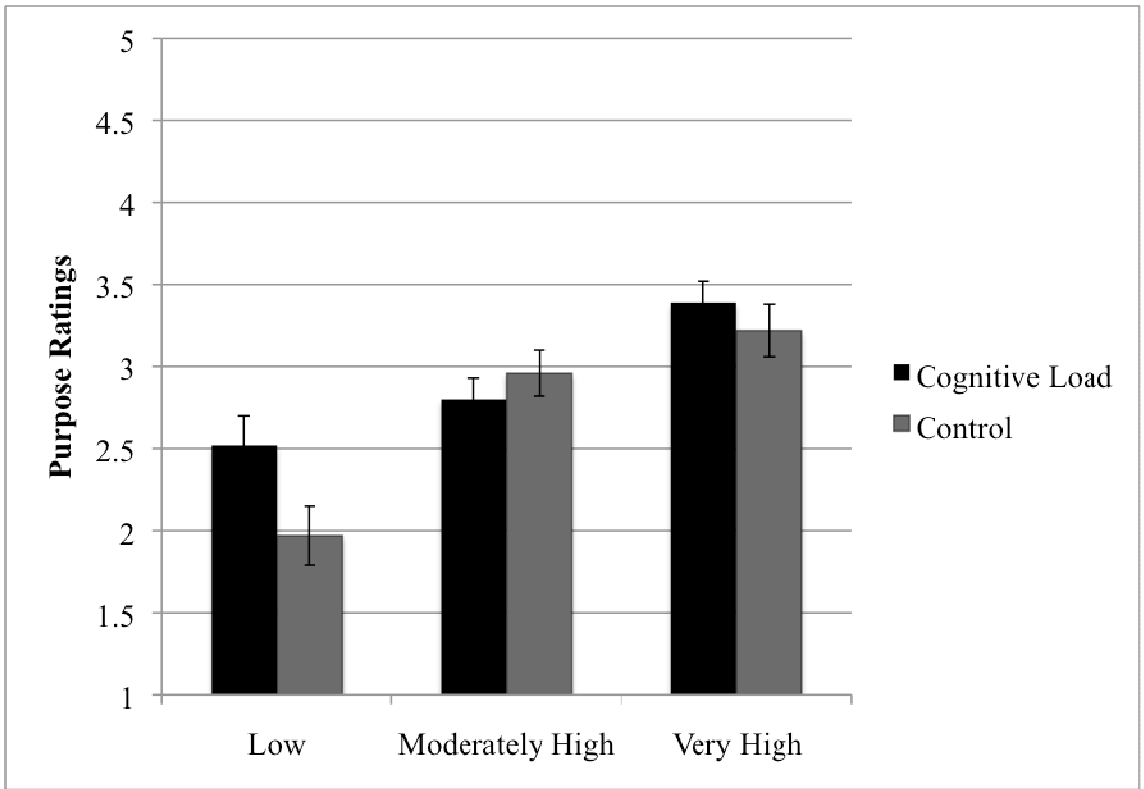


Figure 5. Mean purpose ratings for each religiosity group by condition

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