

Filling in the Blanks: Subtle Cues of Coherence, Belongingness
and Meaning in Life

by

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A thesis submitted to the Faculty of Graduate and
Postdoctoral Affairs in partial fulfillment of the requirements
for the degree of

Master of Arts

in

Psychology

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Ottawa, Ontario

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Abstract

Heintzelman, Trent and King (2013) suggested that feelings of meaning in life (MiL) emerge when individuals perceive subtle cues of coherence. Study 1 and 2 sought to replicate and extend Heintzelman et al.'s (2013; Study 4) finding of increased self-reported MiL after being presented with coherent, in comparison to incoherent, linguistic triads. Both attempts, however, failed to replicate. Study 3 aimed to assess whether the effect of coherence on MiL is only realized when a threat to a fundamental need (belongingness) is apparent. Using an online ball-tossing game, Cyberball, to create feelings of exclusion, participants were subsequently randomly assigned to view either coherent or incoherent word triads. They then completed measures of MiL and current mood. Coherent triads (vs. incoherent triads) had no significant effect on MiL in either the inclusion or exclusion condition. Possible explanations for these discrepant findings are discussed, and potential future directions are proposed.

Acknowledgements

First and foremost, I would like to thank my supervisor, Dr. Chris Davis, for his guidance throughout my thesis. His patience and commitment to seeing his students succeed was fundamental to the completion of my Master's degree. I am sincerely grateful to have worked with him.

I would like to thank my lab-mates and friends from joint lab for their encouragement. This supportive community of students were reassuring about the graduate school experience and were inspiring for research. I would like to extend my thanks to my research assistants for their assistance for my final study. I hope to see their passion for research grow, and for them to succeed in future endeavours. I am also grateful for the hardworking faculty members of the Psychology Department.

Lastly, my family and friends outside of school have provided me with love, laughter, and unwavering support through my graduate studies. They have kept me balanced in all aspects of my life, and I appreciate their support for my goals. I am grateful for this experience, and for all the lessons, personal and academic, I have learned throughout my M.A. program. Cheers!

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Filling in the Blanks: Subtle Cues of Coherence, Belongingness and Meaning in Life

When asked, most people (at least in North America) say that their life is quite meaningful (Heintzelman & King, 2014). People from a broad range of life circumstances tend to evaluate their lives as meaningful, and on average these ratings are significantly over the midpoint of the rating scale, according to a recent review of two common meaning-in-life scales (Heintzelman & King, 2014). Research suggests that perceiving that one's life is meaningful is linked with a range of positive features: self-reported meaning in life (MiL) is associated with higher life satisfaction (Steger & Kashdan, 2007; Steger, Oishi, & Kesibir, 2011), better self-reported health (Steger, Mann, Michels, & Cooper, 2009) and more adaptive coping (Park & Folkman, 1997). Those who indicate that their life is not meaningful tend to report greater likelihood of psychological distress (Debats, van der Lubbe, & Wezeman, 1993), and depression (Steger & Kashdan, 2009). As there are many positive associations between MiL and positive states and negative associations with negative states, there may be importance to understanding what makes life feel meaningful.

Although people seem able to evaluate the extent to which their life is meaningful, it is often more difficult for them to explain why their life is or is not meaningful. Frankl (1963) argued that people have an innate "will to meaning", or in more current terms, a fundamental need to imbue their experiences with an order, purpose, or coherence. Baumeister (1991; Crescioni & Baumeister, 2013) proposed that people satisfy their need for meaning through the construction of purpose (a reason for living), through living up to a moral standard, through perceptions of control or efficacy, and through feelings of self-worth. From Baumeister's perspective, life is meaningful to

the extent that one has an abiding purpose (e.g., to get rich, to raise one's children), that one's behaviour is justified, that one has some control over one's destiny or direction in life, and that one is a good and decent person. Steger (2009, 2012) tried to encompass multiple definitions by arguing that meaning is a web of connections that help make sense of and comprehend one's life and provides the perception of significance and purpose in life.

In general, definitions of MiL offered by researchers tend to incorporate three themes. First, MiL includes a sense of purpose. Purpose is thought to arise from the pursuit and attainment of valued goals that are meaningful to the individual (McKnight & Kashdan, 2009), and gives the individual an overarching aim or sense of direction in life. For example, one may feel a sense of purpose when pursuing a medical degree as a step towards becoming a doctor. Second, MiL includes a sense that one possesses significance. Significance is a personal feeling of value or importance that may include mattering to others, or forming a legacy (Steger, Fitch-Martin, Donnelly & Rickard, 2014). One may feel significance from making a difference in one's community, or creating a business that will be passed on to one's children. Purpose and significance are motivational constructs in the sense that people strive for these aspects to create a meaningful life. The third aspect is comprehensibility. MiL comes from perceiving that one's life 'makes sense'; that one can understand or comprehend some order in one's life (Heintzelman & King, 2014). For example, people tend to believe that things will happen as expected and there is predictability, such as waking up in the same place you went to sleep. Unlike the first two aspects, which are motivational, comprehensibility is something that tends to be perceived rather than pursued (Baumeister & Vohs, 2002).

Life makes sense when one is able to ‘connect the dots’ in one’s life. It is important to note that each of these aspects is subjective and hence somewhat malleable and responsive to one’s circumstances. For instance, one would expect that one’s perceived meaning in life will drop when one senses that one is not progressing toward (or lacks) important personal goals, that one does not matter to others, or when one feels that one is adrift in a chaotic world. Overall, meaning in life is the feeling that people have when their lives and experiences matter, make sense and are motivated.

Detecting reliable connections in the environment may function as a signal that life ‘makes sense’ (Heintzelman & King, 2014). Comprehensibility, also referred to as the feeling of coherence, is conceived as the recognition of an association between stimuli that form a meaningful concept without conscious reasoning (Horr, Braun, Zander, & Volz, 2015). When there is no relationship detected between stimuli, then the information is understood as incoherent. The feeling of coherence is thought to be detected intuitively, and coherence judgements decrease when individuals use rational thinking (Topolinski & Strack, 2008). According to Heintzelman and King (2013), these feelings of coherence and connection can come from observing patterns, regularities and overlearned associations. They are characteristics of the world and intuitive processing may track these patterns in our external reality. Intuitive information processing of patterns in the environment may help individuals have a “gut-feeling” or “intuitive hunch” that the world is ordered and makes sense. Individuals may indicate that the experience feels ‘right’ even though they may not be able to explain how or why they feel this way. Intuitive perceptions of coherence have previously been found using visual object recognition (Volz & Von Cramon, 2006), auditory judgements (Volz, Rubsamen

& von Cramon, 2008), and also semantic judgments (Topolinski & Strack, 2008).

Heintzelman, Trent and King (2013) proposed that subjective feelings of meaning in life emerge from these intuitive feelings about reliable patterns in the environment. Even subtle cues of coherence are thought to influence the experience of meaning in life.

Though patterns in the environment may seem to be something potentially trivial to meaning in life, Heintzelman et al. (2013) argued that this intuitive perception of coherence could unconsciously colour a person's perception that his or her life has meaning. In a series of experiments, Heintzelman and colleagues (2013) showed that people's perception of meaning in life tends to be lower after exposing them to seasonal images out of order or word triads lacking a common theme relative to those who were exposed to seasonal images in order or word triads that have a common theme. These effects do not appear to be due to affect that might be associated with viewing the images or triads.

It is surprising that one's perceived meaning in life could be significantly affected by such a subtle cue as word triads that have or do not have a common theme, or by seasonal images presented in order of seasons or out of order. In the everyday social world, people are exposed to millions of stimuli, many of which do not have a coherent order. We do not consciously detect patterns in the people that walk past us at a shopping centre, or the colour or shape of cars on the road or houses in a block. It seems unlikely that such randomness in the natural or man-made world that we find ourselves in each day would have a deleterious effect on how meaningful we perceive our life to be. Indeed, it might be argued that perceiving too much order or predictability in our life

makes life seem boring and mundane. With these doubts about the Heintzelman et al.'s (2013) results, I attempted to replicate one of their experiments.

Study 1

Heintzelman, Trent and King (2013) introduced a novel approach to investigating how patterns in our environment might affect meaning in life. In their Study 4, they randomly assigned MTurk participants to view a series of either ten word triads where each triad had a common theme or ten word triads where each triad did not have a common theme. After being exposed to one of these two conditions, their participants were asked to rate the extent to which their life was meaningful using questions drawn from various MiL questionnaires. Heintzelman and colleagues (2013) reported that those exposed to the triads with a common theme reported greater meaning in life than those exposed to triads without a common theme ($d = .44$). Using the same stimuli, I conducted a direct replication study of Heintzelman et al.'s (2013) Study 4.

Method

Participants. Participants were recruited from Amazon's Mechanical Turk (MTurk) system. Through MTurk, 175 participants (76 male and 99 female; mean age = 37.47) completed the online survey. This sample size was based on Heintzelman et al.'s (2013) sample size. Participants were paid \$1 for completing the study, like the original study.

Procedure and Measures. After completing an informed consent form that described the purpose of the study as an investigation of the cognitive aspects of reading comprehension, participants were randomly assigned to view a series of ten word triads. In the coherent condition, the triads were made up of words that had something in

common (e.g., Falling, Actor, Dust; common associative word is Star). In the incoherent condition, the words in the triads did not have something in common (e.g., Falling, Quick, Shade) (see Appendix A for the complete set of word triads). The same 30 words were used in the two conditions. Each triad was presented for four seconds before the screen automatically advanced to the next triad. Participants were instructed to read each triad carefully.

Immediately after completing the triad task, participants completed a five-item measure of Meaning in Life. The five items were selected by Heintzelman, Trent and King (2013) to focus on items including the words meaning and purpose. The five items were selected from established MiL measures: “My life has a clear sense of purpose” from the Presence of Meaning subscale of the Meaning in Life Questionnaire (MLQ; Steger, Frazier, Oishi, & Kaler, 2006); “I have found a really significant meaning in my life” and “I have a sense of direction and purpose in my life” from Krause (2004); and “My existence is very purposeful and meaningful” and “As I view the world in relation to my life, the world fits meaningfully with my life” from Crumbaugh and Maholick (1964). Items were rated on a scale from 1 (not at all) to 7 (extremely much). Cronbach’s alpha for the MiL scale was 0.962.

Participants then completed a measure of positive and negative affect. The positive affect subscale consisted of three positive affect descriptors (happy, cheerful, and pleased), each rated on a 7-point scale (1 = ‘not at all’ to 7 = ‘extremely much’) ($\alpha = 0.966$). The negative affect subscale included two negative affect descriptors (anxious and worried), each rated on the same 7-point scale ($\alpha = 0.902$).

Results

Participants in the coherent condition did not rate their lives as more meaningful ($M = 5.08$, $SD = 1.50$) than those in the incoherent condition ($M = 4.99$, $SD = 1.52$), $t(173) = .41$, $p = 0.69$, $d = .06$. Positive affect did not differ significantly between coherent ($M = 5.13$, $SD = 1.45$) and incoherent ($M = 4.83$, $SD = 1.46$) condition, $t(173) = 1.39$, $p = .17$, $d = 0.21$. Likewise, there was no difference in negative affect for the coherent ($M = 2.52$, $SD = 1.64$) and incoherent ($M = 2.82$, $SD = 1.64$) conditions, $t(173) = -1.20$, $p = .23$, $d = -0.18$.

Discussion

My attempt to replicate one of Heintzelman et al.'s (2013) key studies was not successful. Unlike their participants, those in my study who viewed patterned words did not have an increase in perceived meaning in life relative to those who viewed the random word triads (see Figure 1 for comparison). All methods and measures were a direct replication of their study. Although one failure to replicate may not cast much doubt on the reliability of Heintzelman et al.'s experiment, or on the validity of their theory, the findings do take on greater significance when considered in light of Hatfield's (2016) failure to replicate Heintzelman et al.'s (2013) Study 1. In Hatfield's (2016) study (also conducted in our lab), participants viewed 16 images of the four seasons that were either in the natural progression of the seasons or in randomized order (same stimuli as used by Heintzelman et al., 2013, Study 1). Counter to Heintzelman et al.'s findings, MiL scores for participants exposed to the seasonal order were not significantly different from those exposed to the trees in random order ($d = .16$ vs. $d = .49$ reported in Heintzelman et

al., 2013). Indeed, Hatfield (2016) reported a non-significant trend suggesting that meaning in life was rated higher among those who viewed seasons *out of order*.

Study 2

An extension to Study 1 was added in order to assess whether people intuitively discriminate between the coherent and incoherent triads. Bolte and Goschke (2005) found that participants in their studies were reliably able to judge intuitively the coherence of a triad, even if they did not have enough time to retrieve the solution. As well, Topolinski and Strack (2008) showed that asking participants to read the word triads yielded better results in comparison to asking them to explicitly search for solution words. Therefore, I repeated the experiment but included a coherence detection check in the procedure. The manipulation check was predicted to show that participants would have higher intuitive detection in the coherent condition in comparison to the incoherent condition. Consistent with Heintzelman et al. (2013), the manipulation of coherent versus incoherent triads was not expected to influence mood.

Method

Participants. For Study 2, 340 participants (195 male and 145 female; mean age = 22.77) completed the online survey. Participants were recruited from both MTurk (N = 73) and SONA (N = 267). Mechanical Turk participants received \$1 on their account for participation. SONA participants were given the choice to receive .25% credit towards their final mark or to receive \$5.

Procedure and Measures. Participants were asked to complete an online consent form that described the purpose of the study as an investigation of word play and personality. Participants were assigned randomly to either the coherent or the incoherent

condition as in Study 1. They were instructed to read the word triads carefully, and then to judge whether or not the words in each triad had something in common as fast as possible. If the words had a common meaning, participants were instructed to choose the ‘coherent’ option. If the words had no association, they were instructed to choose the ‘incoherent’ option. They were then given an example of a coherent triad (“Broken, Clear and Eye, these words are ‘coherent’ because they have Glass in common”). Each triad appeared on the screen for 4 seconds, and then they had 4 seconds to select whether the word was coherent or incoherent. Immediately after completing the triad task, participants completed the same measures that were used in Study 1. For the meaning in life questionnaire, Cronbach’s alpha for the items was 0.947. The positive affect items were at a Cronbach’s alpha of 0.922 and the negative affect items were at 0.891.

Results

In order to determine whether individuals were intuitively able to judge the coherence of the triad, I initially assessed the manipulation check. Participants in the coherence condition detected slightly more triads as coherent ($M = 5.64$, $SD = 1.69$) than those in the incoherent condition ($M = 4.58$, $SD = 1.83$), $t(338) = 5.55$, $p < 0.001$, $d = .60$.

Participants from SONA and MTurk were analyzed together, as results showed these groups did not differ significantly in meaning in life, $t(338) = 0.214$, $p = 0.83$. As in Study 1, there were no significant differences in meaning in life for those in the coherent condition ($M = 4.86$, $SD = 1.41$) and those in the incoherent condition ($M = 4.72$, $SD = 1.55$), $t(338) = 0.86$, $p = 0.39$, $d = .09$ (see Figure 1). Positive affect did not significantly differ in the two conditions, but participants in the coherent condition

reported slightly lower negative affect ($M = 3.72$, $SD = 1.85$) than those in the incoherent condition ($M = 4.10$, $SD = 1.74$), $t(338) = -1.98$, $p = 0.05$.

As not all participants in the coherent condition recognized the commonality in each triad, and some in the incoherent condition thought they recognized a commonality among words in some of the incoherent triads, I repeated the analysis including only those in the coherent condition who recognized commonality in at least 7 of 10 triads and those in the incoherent condition who recognized commonality in 3 or fewer of the 10 word triads. Even though participants who viewed coherent triads may have recognized significantly more patterns, they did not rate their lives as more meaningful ($M = 4.75$, $SD = 1.48$) than those who viewed the incoherent patterns ($M = 4.63$, $SD = 1.81$), $t(96) = .383$, $p = .70$, $d = 0.07$. Participants in the coherent condition ($M = 4.72$, $SD = 1.48$) indicate no difference in positive affect in comparison those in the incoherent condition ($M = 4.31$, $SD = 1.69$), $t(96) = 1.272$, $p = .21$. The difference in negative affect disappeared, as the coherent condition ($M = 3.37$, $SD = 1.90$) was not significantly different than the incoherent condition ($M = 3.89$, $SD = 1.66$), $t(96) = -1.44$, $p = .15$.

Discussion

On average, the proportion of triads that were evaluated as coherent was higher for those who were in the coherent condition in comparison to those in the incoherent condition. Although it seems that those in the coherent condition were detecting more coherence, they did not perceive their life to be more meaningful than those presented with triads that did not have something in common. Even for the participants who recognized a larger proportion of the coherent triads in the coherent condition, they did not indicate that their meaning in life was more meaningful than the participants who

recognized a larger proportion of incoherence in the incoherent conditions. The findings were inconsistent with Heintzeman and colleagues' (2013) original study, as we did not find the same effect.

Our scepticism that these subtle patterns increase meaning in life grows with the results found in Study 1 and 2. Since many researchers have suggested that coherence is only one essential component in meaning in life, it may be beneficial to see how different components of meaning in life come together. Indeed, assessing how the other components, such as the motivational aspects of meaning in life, interact with coherence may help us assess a more comprehensive understanding of meaning in life. There is a chance that perceptual processing may be biased in order to increase the feeling of coherence to the individual when it is needed, such as when there is a larger threat to meaning.

The notion that our sense of meaning in life rises when we see coherence in the physical environment is questionable. There are countless parts of daily life that are stable and reliable, such as breathing air and the sun rising every morning. If regularities in our environment are sufficient to suggest coherence and hence promote MiL, then almost everyone should show increases in meaning in life (as long as the sun rises every morning, we still have a roof over our heads, and our loved one's still recognize us). Rather than perceptions of coherence promoting a sense of meaning in life, it seems more plausible that an apparent lack of coherence threatens one's sense that life is meaningful. That is, if an individual intuitively or explicitly detects that his or her environment is unstable or chaotic (the sun has not risen in the morning, I have no idea where I am when I wake up, or my loved ones don't seem to recognize me – at least in my present

condition), MiL may be undermined. In a world that is generally stable, predictable and coherent, something that appears incoherent or nonsensical is likely to elicit attention and sense-making effort (and hence a perception that life is a bit less meaningful than hitherto thought), whereas in a world that is generally unstable, unpredictable and chaotic (such as a war zone), something that appears to be coherent is likely to elicit attention and, perhaps, a sense that one's life does have more meaning than previously thought. Relative judgements about meaning may be influenced by contrasting the current situation with the norm (in a sense, one's expectations for the current situation). Therefore, it may not be that participants in these experiments who encountered coherent stimuli are gaining meaning as much as it is that participants encountering incoherent stimuli (when they expect coherent stimuli) are temporarily experiencing less meaning in life.

Although perceiving a lack of coherence may have an influence on one's sense of MiL, the purpose aspects of meaning should not be ignored. It is likely that purpose and coherence work together synergistically (Martela & Steger, 2016). Finding a clear purpose may be easier when the world makes sense; likewise, the world may seem more coherent when we are pursuing meaningful goals. Both need satisfying goals and a stable perception of the environment are thought to be critical for well-being especially during times of change (Wrosch, Scheier, Miller, & Carver, 2012). According to self-determination theory (SDT), the pursuit and attainment of intrinsic goals imbues life with meaning when purposeful action supports an individual's basic needs for autonomy, competence, and relatedness (Ryan & Deci, 2008). That is, SDT suggests that one will feel a sense of purpose (and hence meaning) to the extent that one is making progress

towards goals that give one a sense of autonomy (the goal is freely chosen), competence (one experiences efficacy or control in the pursuit of the goal), or relatedness (the goals contributes to a feeling of belongingness) (Deci & Ryan, 2000). When these needs are fulfilled, individuals develop a capacity to explore and master their environment, as well as internalize values and practices to feel meaning and connection (Ryan, 1995). Previous studies have demonstrated that the satisfaction of each of these needs relate to feelings of meaning in life. For instance, with respect to relatedness needs, Hicks and King (2009) found that relatedness need satisfaction was related to self-reported meaning in life, and Lambert et al. (2013) showed that experimentally increasing a feeling of belongingness in people increased the perception that their life was meaningful. Research also has indicated that perceptions of meaning in life are reduced after being excluded or ignored (Stillman et al., 2009; Zadro, Williams, & Richardson, 2004). With respect to autonomy need satisfaction, Trent and King (2010) found that in addition to relatedness, perceived autonomy was associated with greater meaning in life, especially when participants were asked to make a fast judgment about MiL, in comparison to a slow and thoughtful judgement. They believe this is because these needs are the most central sources of information for MiL. Finally, research has also indicated that competence need satisfaction is also associated with greater meaning in life (Trent & King, 2010). In sum, there exists a great deal of correlational data indicating links between satisfaction of fundamental needs and perceptions that one's life is meaningful.

If maintaining a sense that life is meaningful is important to well-being, then people should be motivated to restore meaning when one source of meaning is compromised. For instance, if one should experience something that does not 'make

sense' or a loss of self-esteem, then one should be highly motivated to fill the meaning vacuum. In general, any form of threat to important resources or goals should produce anxiety. This anxiety then motivates the individual to alleviate the aversive arousal (Jonas et al., 2014; Harmon-Jones, Harmon-Jones, & Price, 2013). Heine, Proulx and Vohs (2006) suggest that people can restore a sense of meaning by promoting a different source of meaning than the one that was initially threatened (a process that they refer to as 'fluid compensation' or the reaffirmation of meaning structures). Tullet, Teper, and Inzlicht (2011) refer to this approach as an indirect strategy to compensation, which contrasts with direct strategies that promote the same source as that which was threatened.

According to the Meaning Maintenance Model (MMM), people seek coherent relations within the external world, within themselves, and between themselves and the external world. In particular, MMM states that violations to meaning, certainty or control increase motivation for identifying patterns in the environment (Proulx & Heine, 2009).

Consistent with this idea, Proulx and Heine (2009) found that motivation to perceive patterns in the environment and ability to accurately detect patterns were enhanced after a meaning threat relative to when no meaning threat was present. According to MMM, people seek a predictable environment in order to act effectively. Identifying order or patterns in the environment after a threat can help individuals restore a sense of coherence in order to avoid cognitively taxing searches for meaning (Heine, Proulx, & Vohs, 2006). This may help individuals realize the coherence between themselves and the environment, how they fit in these patterns and relate to the grand scheme of things (Heine et al., 2006).

Ostracism (social exclusion) has been previously identified as a highly effective way to decrease meaning in life (Stillman et al., 2009; Williams, 2009; Zadro, Williams, & Richardson, 2004). A young boy who is rejected by the girl he loves, the elderly man who is rarely visited by his family, and the student who is picked last for a team all may feel a loss of meaning in life due to social exclusion. This drop in meaning may be due to the fact that social exclusion impedes future goal attainment and threatens basic psychological needs, especially the need for belongingness. Although it has been rarely approached from a self-determination perspective, there are indications that the basic psychological needs of competence, belongingness, and autonomy may play a distinct role in how social exclusion decreases meaning in life. Ricard (2011) revealed that social exclusion (manipulated using the future life alone paradigm; Baumeister, Twenge, & Nuss, 2002; Twenge, Baumeister, Tice, & Stucke, 2001) decreases satisfaction of all three basic psychological needs, whereas social inclusion increases satisfaction of these needs when compared to the control condition. Similarly, Williams (2001; Williams & Zardo, 2005) indicates that ostracism threatens at least four fundamental needs that roughly align with the self-determination perspective: the need to belong, self-esteem, need for control of one's environment, and a meaningful existence.

Since ostracism is assumed to be a threat to meaning in life, the MMM posits that the motivation to maintain one's sense of meaning would be activated after an experience of social exclusion. In essence, detecting coherence in the environment should restore meaning back to the individual through the process of fluid compensation (Heine et al., 2006). We should consider meaning in life as a product of shifting sources of information in order to affirm that life is meaningful. If individuals struggle to satisfy basic

psychological needs, a sense of coherence may be the signal that there is still stability and meaning. These cues of coherence may also be checks in order to see if one's perception of a threat matches reality (Swann & Brooks, 2012).

Study 3

Situations that create uncertainty for our goals, such as social exclusion, may prompt efforts to detect comprehensibility in our environment. Although many researchers note the different facets of MiL (purpose, significance and comprehensibility), there is little empirical research assessing the interplay between them (Heintzelman & King, 2014; Martela & Steger, 2016). As such, incorporating both motivational and perceptual components may indicate how these interact to make life feel meaningful. Therefore, I hypothesized that people will rate their lives as more meaningful when belongingness needs are met and when the environment is perceived as coherent. On the other hand, when belongingness is threatened, and environmental coherence is lacking, life should feel less meaningful. In accordance with fluid compensation, it was predicted that when belongingness needs are threatened, meaning would be compensated by the perception of coherence in the environment. Lastly, from Heintzelman et al.'s (2013) experiments, one would expect that life should feel less meaningful if belongingness needs are met but there is a lack of perceived coherence. Yet, as the previous experiments (Study 1 and 2) failed to replicate, it might be more realistic to anticipate that there would be no effect on meaning in life.

In order to threaten one's sense of belongingness in Study 3, I used the Cyberball paradigm. The paradigm has been used several times to create feelings of social exclusion (Hartgerink, van Beest, Wicherts, & Williams, 2015), which in turn threatens perceived

meaning in life (Stillman et al., 2009). This threat was crossed with the same coherence manipulation used in Studies 1 and 2, resulting in a 2 x 2 experimental design.

Method

Participants. Sixty-four participants (30 male, 33 females and 1 other; mean age = 20.72) were recruited from Carleton's SONA system to participate in the lab-based experiment. Two participants were excluded from analysis as they were familiar with the Cyberball paradigm and thus not deceived by that manipulation. Participants received partial credit (.5%) towards their final mark in exchange for their participation.

Procedures and Measures. Participants arrived at the laboratory under the cover story that they would be taking part in a study on the effect of cooperative play on cognitive problem solving. A confederate was on hand in the event that only two participants showed for the experiment, as the Cyberball manipulation requires that the participant believes that he or she is one of three or four participating simultaneously. Participants were seated in front of separate computer monitors. After explaining to the participants the purpose of the experiment (i.e., the cover story), they were asked to complete the consent form. In the initial task, participants were instructed to play an online ball-tossing game called Cyberball (Williams & Jarvis, 2006). They were asked to visualize playing ball toss with the other participants in the session. Participants were informed that they could throw the ball to whomever they wish, and were told that the other players can do so as well. If they were thrown the ball, they were to click on the player to whom they choose to throw it next. Participants were randomly assigned to one of two conditions: inclusion or ostracism. For the inclusion condition, the two other "players" toss the ball to each other and to the participant with about the same frequency.

In the ostracism condition, none of the players throw the ball to the participant after doing so briefly at the beginning of the exercise. A total of 30 tosses were made during the play time.

Participants then completed the word triad task as in Study 1. Participants were assigned randomly to either the coherent or incoherent condition. They were instructed to read the word triads carefully, and that the screen would automatically advance. Each triad was presented for four seconds.

After the participants completed the tasks, they were presented with the same scales used in Study 1 & 2 to measure meaning in life and current mood. For the meaning in life questionnaire, Cronbach's alpha for the items was .922. The positive affect items were at a Cronbach's alpha of .836 and the negative affect items were at .893.

As a manipulation check on whether participants were able to detect coherent word patterns, after assessing mood and meaning in life, participants were again presented with the same set of word triads in the same order. This time, they were asked to indicate whether each set of word triads were coherent or not (comparable to what was administered in Study 2). As with Study 2, participants were exposed to the word triad for four seconds before a decision on coherence was required.

When the tasks were complete, the students were debriefed about the true purpose of the experiment, and asked to consent to the use of their data now that they were fully informed about the purpose of the research. They were given a debriefing form.

Results

To determine whether individuals were able to detect whether the triads were coherent or incoherent, I initially assessed the manipulation check. The main effect of

coherence was significant such that those in coherent condition detected more triads were coherent than those in the incoherent condition, $F(1, 60) = 7.787, p = .007, \eta_{\text{partial}}^2 = .115$. There was no significant effect of ostracism on coherence detection, $F(1, 60) = .047, p = .829, \eta_{\text{partial}}^2 = .001$, but there was a significant interaction between ostracism and coherence on coherence detection, $F(1, 60) = 5.354, p = .024, \eta_{\text{partial}}^2 = .082$. For those assigned to the cooperative play condition, coherent triads led to higher coherence detection ($M = 5.40, SE = .358$) than incoherent triads ($M = 3.615, SE = .384$), $F(1, 60) = 11.555, p = .001, \eta_{\text{partial}}^2 = .161$. However, for those assigned to the ostracism condition, coherence had no effect, $F(1, 60) = .130, p = .719, \eta_{\text{partial}}^2 = .002$. Interestingly, among those who were excluded from play, those in the coherent condition ($M = 4.667, SE = .327$) had similar proportions of coherence detection in comparison to those in the incoherent condition ($M = 4.500, SE = .327$).

To test our main hypotheses, a 2 (ostracism: excluded vs. included) x 2 (coherence: coherent vs. incoherent) analysis of variance (ANOVA) was conducted on meaning in life. There was not a significant main effect of ostracism on meaning in life, $F(1, 60) = 1.612, p = .21, \eta_{\text{partial}}^2 = .026$. As well, there was not a significant main effect of coherence on meaning in life, $F(1, 60) = .004, p = .95, \eta_{\text{partial}}^2 = .000$. There was, however, a marginally significant interaction, $F(1, 60) = 2.94, p = .09, \eta_{\text{partial}}^2 = .047$. I followed up this marginally significant interaction with simple effects on ostracism. Among participants assigned to the cooperative play version of Cyberball, coherence had no effect, $F(1,60) = 1.401, p = .241, \eta_{\text{partial}}^2 = .023$. Though there is no significant effect for those who were included, coherent triads showed slightly higher meaning in life scores ($M = 5.03, SE = .32$) than incoherent triads ($M = 4.48, SE = .34$).

As well, among those assigned to the ostracism condition of Cyberball, the effect of coherence was non-significant, $F(1, 60) = 1.565, p = .216, \eta_{\text{partial}}^2 = .025$. Contrary to my hypotheses, among those who were excluded from Cyberball, those in the coherent condition ($M = 4.89, SE = .29$) rated their meaning in life slightly lower than those in the incoherent condition, ($M = 5.40, SE = .29$) (See Figure 2).

To test whether there were any effects of the manipulation of ostracism or coherence on mood, I conducted 2 (ostracism: included/excluded) by 2 (coherence: coherent/incoherent) ANOVAs on positive affect and negative affect. There was no significant main effect of ostracism on positive affect, $F(1, 60) = .038, p = .846, \eta_{\text{partial}}^2 = .001$. As well, there was no significant main effect of coherence on positive affect, $F(1, 60) = .067, p = .797, \eta_{\text{partial}}^2 = .001$. There was no significant interaction, $F(1, 60) = .979, p = .326, \eta_{\text{partial}}^2 = .016$. Similarly, there was no main effect of ostracism on negative affect, $F(1, 60) = 2.104, p = .152, \eta_{\text{partial}}^2 = .034$, and no main effect of coherence on negative affect, $F(1, 60) = .196, p = .660, \eta_{\text{partial}}^2 = .003$. The interaction was not significant, $F(1, 60) = .476, p = .493, \eta_{\text{partial}}^2 = .008$.

As not all participants in the coherent condition recognized the commonality in each triad, and some in the incoherent condition thought they recognized a commonality among some of the incoherent triads, I repeated the analysis including only those in the coherent condition who recognized commonality in at least 7 of 10 triads and those in the incoherent condition who recognized commonality in 3 or fewer of the word triads. The main effect of Cyberball on MiL was not significant, $F(1, 13) = 1.174, p = .298, \eta_{\text{partial}}^2 = .083$. There was no main effect of coherence on MiL, $F(1, 13) = .213, p = .652, \eta_{\text{partial}}^2 = .016$. There was no interaction, $F(1, 13) = .953, p = .347, \eta_{\text{partial}}^2 =$

.068. There were similar trends, as for those that participated in cooperative play, coherence showed slightly higher meaning in life scores ($M = 5.133$, $SE = .724$) than incoherence ($M = 4.240$, $SE = .561$). For those that were excluded from play, coherence showed slightly lower meaning in life ($M = 5.200$, $SE = .627$) than incoherence ($M = 5.52$, $SE = .561$).

Discussion

The hypothesis that the effect of perceived coherence on meaning in life would be moderated by threatened belongingness needs was not confirmed. Although a marginally significant interaction of inclusion/exclusion by coherence/incoherence was observed, neither the inclusion (control) or exclusion condition revealed any clear evidence that perceived coherence had any effect on meaning in life. If anything, those in the exclusion condition perceived slightly, but not significantly, more meaning in life when they were presented with incoherent triads than those who were presented with coherent triads.

Although those assigned to the coherent condition were more likely to detect coherence among the triads than those assigned to the incoherent condition, the mean difference was not large, and appeared only to apply to those in the inclusion condition; those who were excluded in the Cyberball game were evidently unaware whether the triads that followed were coherent or incoherent.

The results indicated that contrary to the Meaning Maintenance Model, after a threat, coherence in the environment did not reinstate meaning in life and incoherence did not leave one with a lack of meaning. Yet, as meaning in life did not differ significantly between the inclusion and exclusion conditions, it leaves me to speculate that individuals were still able to affirm feelings of meaning elsewhere after the threat to belongingness.

Participants may have been able to bolster their meaning in life through the self-report measure for meaning in life.

A limitation of Study 3 was the relatively small sample size. Due to the late start of running this study, I was only able to recruit 64 of the intended 200 participants. Nevertheless, given the patterns of means, it is doubtful whether the larger sample size would have produced results much different from those found in the current sample.

General Discussion

Typically people draw meaning from multiple sources in their life, and these different components of MiL are believed to help protect the individual from negative feelings associated with meaninglessness (Baumeister & Vohs, 2002). One component of MiL, comprehension, is usually conceptualized as involving reliable patterns or coherence. Heintzelman, Trent and King (2013) posited that simple coherent patterns in our world, such as the seasons being in order or finding associations between words, have an effect on meaning in life. Through four studies, they showed that subtle cues of coherence, in comparison to incoherence, increased feelings of meaning in life. With intrigue and suspicion as to whether these subtle patterns truly play a role in meaning in life, I conducted a direct replication of Heintzelman, Trent and King's (2013) Study 4. Despite using the materials and methods from the corresponding authors of the original paper, I failed to replicate their findings; in my first study, MiL did not appear to differ significantly between those who viewed coherent word triads and those who viewed incoherent word triads.

With this discrepancy in results, the second study sought to determine whether individuals were detecting the coherence or incoherence in the word triads, and whether

coherence needed to be perceived in order to have an effect on MiL. Participants in the coherent triad condition were able to detect a larger proportion of triads as coherent in the coherent condition relative to those in the incoherent condition, but greater coherence was not associated with higher MiL scores. Again, the inconsistencies between my studies and Heintzelman et al. (2013) raised further suspicion towards the underlying effect of their original studies.

The final experiment called into question whether the effect of coherence on meaning in life is only apparent when a threat is present. Coherence and patterns in our environment are assumed to be palliative -- increasing meaning in life when other sources of meaning (e.g., feelings of belongingness) are threatened. Yet again, there was no evidence of an effect of coherence on MiL regardless of whether participants were included or excluded from a game of Cyberball. Moreover, participants who were excluded from the Cyberball game seemed to be unaware whether the triads were coherent or incoherent.

Though it is unwise to judge a study through a single replication, there are now multiple studies showing that Heintzelman et al.'s (2013; Study 2 and 4) results fail to replicate. As previously mentioned, Hatfield (2016) conducted a conceptual replication that was unsuccessful. Ratner, Burrow, and Thoemmes (2016) conducted two direct replications, with large sample sizes, using identical methods and materials as Heintzelman et al. (2013; Study 2 and 4). Similar to our studies, Ratner and colleagues (2016) were unable to produce the same results as the original paper. In their paper, Ratner and colleagues noted that in addition to those failed replications described in Ratner et al. (2016), they had completed three more unpublished studies to replicate

Heintzelman et al. without any success. These studies (Hatfield, 2016; Ratner et al., 2016) lend support to the argument that these subtle cues of coherence have no effect on meaning in life, as a total of nine studies have failed to reproduce similar results to the original study. As well, these replications raise speculation that Heintzelman and colleagues may be selectively reporting findings. In the future, a meta-analysis should be conducted in order to obtain a cumulative confidence interval, instead of interpreting each replication separately (Maxwell, Lau, & Howard, 2015). The meta-analytic effect size will help determine whether we can truly reject the null hypothesis that there is no effect of coherence on perceived meaning in life.

Although comprehension and understanding connections in our world are assumed to imbue life with meaning, it may take more than detection of subtle symbols and patterns in one's environment to increase one's perceived meaning in life, and likewise, it may take more than subtle cues of disconnection or randomness to significantly decrease one's perceived meaning in life. Fairly explicit signs that all is right with the world (e.g., a beautiful sunset, a pleasant evening with friends or family) may be needed to increase the sense that one's life is meaningful. Reducing perceived meaning in life may similarly require fairly significant and personally relevant cues of disconnection or randomness (e.g., suddenly losing one's job or a friend). Lack of comprehensibility may need to feel as if there is something truly missing, rather than a brief confusion.

Limitations and Future Directions

If comprehensibility is a cognitive component of meaning in life, it may be important to assess how mood and individual differences affect coherence detection, and

in turn meaning in life. Previously, Hicks and colleagues (2010) found that intuitive individuals, who were induced with positive mood, were more likely to accurately recognize the coherence of linguistic triads. For some, meaning may be intuitively easier to detect and readily connect to a pattern or belief; however, for others meaning may need to be constructed by engaging in a more effortful process to close the gap between experience and expectation (King & Hicks, 2009). Future research should incorporate as potential moderator variables the extent to which individuals rely on mood and intuitive or rational information processing for coherence detection, as it may help us assess how these differences can affect meaning in life.

Meaning in life is a difficult construct to measure. Some researchers have argued that instruments commonly used to measure meaning in life may not fully capture the experience of meaning in life (Brown & Wong, 2015; Hill, Burrow, Sumner, & Young, 2015). The instrument used in my studies, and also used by Heintzelman, Trent and King (2013) seems to tap into the motivational component of meaning in life, focusing mainly on purpose, leaving the cognitive component unaccounted for. As meaning is consistently referred to as having both cognitive and motivational components, it may be ideal to have separate subscales assessing the extent to which these different sources of meaning are being fulfilled. The comprehensibility aspect of meaning in life may be more of a ‘feeling’ or emotion – the sense that at one extreme all is right with the world and at the other extreme, that there is anxiety and discomfort, or what MMM refers to as ‘disanxiousuncertilibrium’ (Proulx & Inzlicht, 2012). Heintzelman and King (2014) indicated that self-reports “depend on an intuitive understanding of the words purposeful and meaningful”, yet this may be met by issues in semantic interpretations. Individuals

may not be able to automatically assess the ‘gut-feeling’ as such. Contrary to Heintzelman and colleagues (2013), I believe that that the sense of meaning in life may feel different depending on how it is derived, and that these scales might not capture these feelings. Focusing on meaning in life as a ‘feeling’ instead of a thought may improve measurement of MiL. Associations in the environment do not speak to the comprehensibility aspect of MiL in regards to our current findings, and therefore, it is hard to generalize coherence detection to overall feelings of meaning in life.

As the effect sizes obtained were smaller than previously documented, the question of power ultimately arises. A post hoc power analysis (G*Power; Faul, Erfelder, Lang, & Buchner, 2007) revealed that Study 1 only achieved 6.8% power, whereas Heintzelman, Trent and King (2013; Study 4) achieved 81.15% power. Therefore, if we based further assessments from the findings in Study 1, an n of approximately 8724 would be needed to obtain statistical power at the recommended 80% level (Cohen, 1988). For Study 2, power was approximately 13.14%, and in order to obtain the needed 80% power an n of 3878 would have been needed. Finally, Study 3 indicated that the effect of coherence, for those in the inclusion condition, had approximately 22.68% power. Similarly, there was 24.27% power for detecting the effect of coherence, for those in the exclusion condition. To have 80% power for these simple effects, I would have needed an n of 336. Though Study 3 may have been realistically achievable, Study 1 and 2 show that the effect of coherence alone may not be worth pursuing.

Conclusion

Judgments about meaning in life may need to be parsed further in order to assess how the motivational and comprehensibility components interact. For now though, these

results leave a gap with respect to how the feeling of meaning is maintained. Whereas Heintzelman, Trent and King (2013) indicated that subtle cues of coherence affect feelings of meaning in life, my studies suggest that there is no effect of coherence on meaning in life. Researchers may want to revisit the comprehensibility component of meaning in life, as there seems to be a missing connection.

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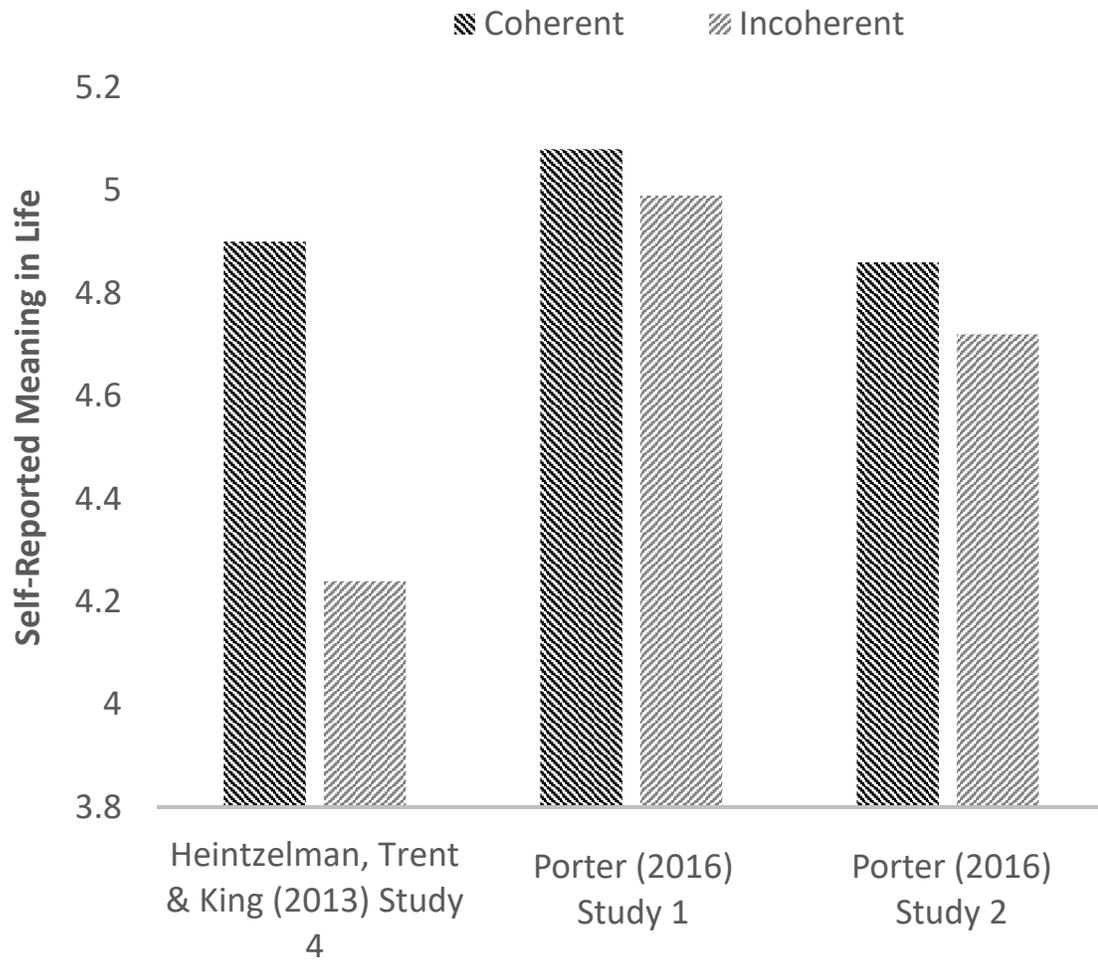


Figure 1. Heintzelman, Trent and King (2013) in comparison to Study 1 and Study 2, mean self-reported meaning in life for those who viewed coherent triads and those who viewed incoherent triads.

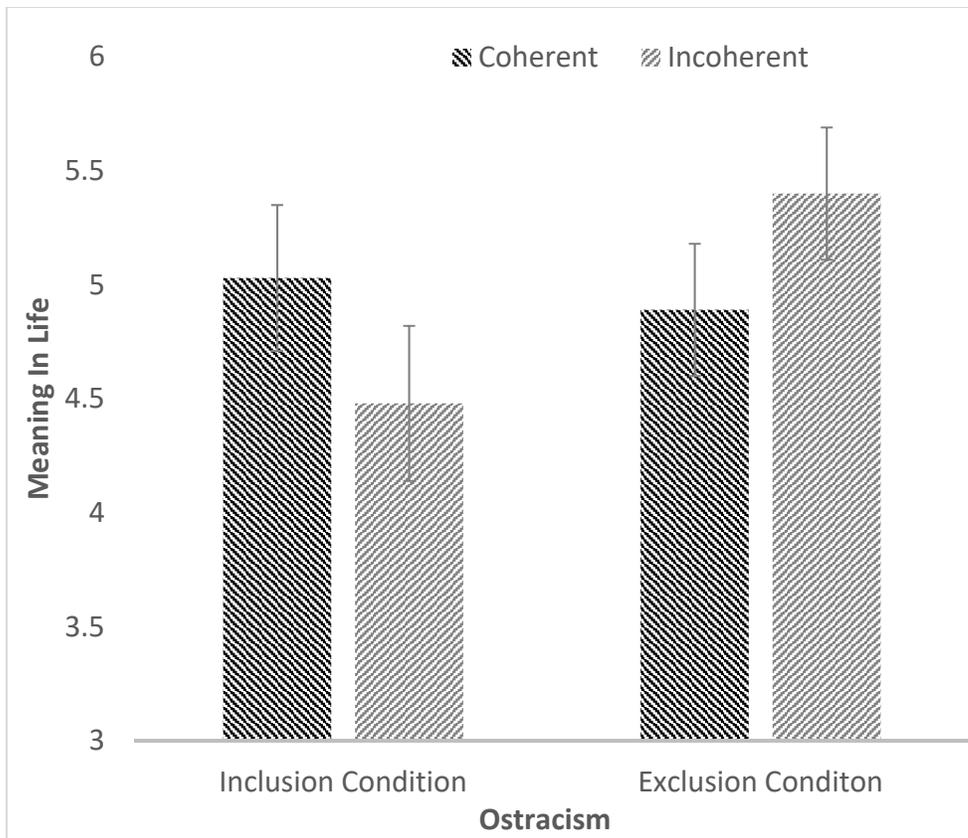


Figure 2. Graph showing means (and standard errors) for ostracism and coherence on meaning in life.

Appendix A: Study 1

MTurk Recruitment Notice for Study

Study Name: Reading Comprehension and Cognition

Description: We are interested on examining cognitive aspects of reading comprehension. You will be asked to complete a quick reading task. You will then we given a questionnaire online that consists of questions about personality and well-being.

Eligibility Requirements: Must be 18 years of age and a resident of the US.

Keywords: psychology, questionnaire

Duration and Locale: 10 minutes

Compensation: You will receive 1\$ on your MTurk account

Your HIT gets approved if you: 1) Finish the survey, 2) Have not completed this survey before, and 3) Submit the confirmation ID (provided at the end of the survey) here.

Researchers: Janessa Porter (Principal Investigator); Professor Chris Davis (Faculty Sponsor);

Phone: 613-520-2600 ext. 1448

Email: janessa.porter@carleton.ca

This study has received clearance by the Carleton University Psychology Research Ethics Board (Reference #15-115).

Informed Consent

The purpose of an informed consent is to insure that you understand the purpose of the study and the nature of your involvement. The informed consent must provide sufficient information such that you have the opportunity to determine whether you wish to participate in the study.

Present study: Reading Comprehension and Cognition

Research personnel. The following people are involved in this research project, and may be contacted at any time if you have questions or concerns: Janessa Porter (Primary investigator, e-mail: janessa.porter@carleton.ca, phone: 613-520-2600, ext. 1448), Dr. Chris Davis (Faculty Sponsor, email: chris_davis@carleton.ca, phone: 613-520-2600 ext. 2251).

Concerns. Should you have any ethical concerns about this research, please contact Dr. Shelley Brown, Chair - Carleton University Research Ethics Boards - B, at shelley_brown@carleton.ca (613-520-2600 ext. 1155).

Purpose. The purpose of this study is to investigating cognitive aspects of reading comprehension.

Task requirements. We are asking you to complete a reading task. You will then be asked to fill out a number of questionnaires regarding your background (e.g., demographics), personality and well-being. The session will take approximately 10 minutes.

Benefits. You will receive \$1 for your MTurk account.

Potential risk/discomfort. There are no known physical or psychological risks to participating in this study.

Confidentiality. The data collected in this experiment are strictly confidential. There will be no identifying information attached to your data. All data are coded such that your name is not associated with the responses you provide. The coded data are made available only to researchers associated with this project. Data will be destroyed 5 years post completion of publications associated with aggregated data. Please note that the online survey tool used in this study (Qualtrics) is hosted by a server located in the USA. The United States Patriot Act permits U.S. law enforcement officials, for the purpose of an anti-terrorism investigation, to seek a court order that allows access to the personal records of any person without that person's knowledge. In view of this we cannot absolutely guarantee the full confidentiality and anonymity of your data. Also, we will not collect IP addresses. With your consent to participate in this study you acknowledge this.

Right to withdraw. You may withdraw from the study at any time. You may also choose to skip (i.e., not answer) questions for any reason without penalty.

This study has received clearance by the Carleton University Research Ethics Board (Reference #15-115).

By checking this box you agree to the following terms:

- I have read the above form and understand the conditions of my participation. My participation in this study is voluntary, and if for any reason, at any time, I wish to leave the experiment I may do so without having to give an explanation and with no penalty whatsoever. Furthermore, I am also aware that my participation as well as the data gathered in this study is confidential. Checking the box below and clicking 'Next' indicates that I agree to participate in the study.

- I do not wish to participate in this study

Demographics

Age: _____

Gender: Female/Male

Word Triads

Three words, called Triads, will be presented on the screen at a time. Please read the following triads carefully. The screen will advance automatically.

Coherent Triads:

Magic, Plush, Floor (carpet)
Falling, Actor, Dust (star)
Coin, Quick, Spoon (silver)
Leaf, Big, Shade (tree)
Gold, Stool, Tender (bar)
Manners, Round, Tennis (table)
Playing, Credit, Report (card)
Salt, Deep, Foam (sea)
Surprise, Wrap, Care (gift)
Thread, Pine, Pain (needle)

Incoherent Triads:

Magic, Actor, Spoon
Falling, Quick, Shade
Coin, Big, Tennis
Leaf, Stool, Report
Gold, Round, Floor
Manners, Deep, Dust
Playing, Plush, Care
Salt, Wrap, Tender
Surprise, Pine, Foam
Thread, Credit, Pain

Meaning in Life (MIL) Questionnaire

Please take a moment to think about what makes your life feel important to you. Please respond to the following statements as truthfully and accurately as you can, and also please remember that these are very subjective questions and that there are no right or wrong answers. Please answer according to the scale below:

Not at All						Extremely Much
1	2	3	4	5	6	7

___ My life has a clear sense of purpose.

___ I have found a really significant meaning in my life.

___ I have a sense of direction and purpose in life.

___ My existence is very purposeful and meaningful.

___ As I view the world in relation to my life, the world fits meaningfully with my life.

Explicit Affect

Please indicate whether the descriptor characterizes how you are currently feeling:

Absolutely Untrue 1	Mostly Untrue 2	Somewhat Untrue 3	Can't Say True or False 4	Somewhat True 5	Mostly True 6	Absolutely True 7
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Happy _____

Cheerful _____

Pleased _____

Anxious _____

Worried _____

Debriefing

What are we trying to learn in this research?

The purpose of this study was to assess the extent to which being exposed to words that fit a pattern (as opposed to being exposed to words that do not fit a pattern) affects how meaningful you feel that your life is. People who report that their life is very meaningful also tend to be happier, and tend to report better quality of life. Chaos in our lives takes away from a sense of meaning in life. We are interested in learning if self-reports of meaning in life can be influenced subtly by experimental manipulations of coherence.

Why is this important to scientists or the general public?

Previous research has found that greater self-reported meaning in life is associated with higher quality of life, better self-reported health, and better adaptive coping. As there are many associations between meaning in life and positive outcomes, understanding the process behind what makes life meaningful is important. Recently, it was found that the feeling that life is meaningful is sensitive to the coherence of presented stimuli. The current study was to replicate these findings. The current study will help us to continue the research on coherence detection and self-reported meaning in life.

What are our hypotheses and predictions?

We predict that meaning in life would be higher following an encounter with coherent stimuli in comparison to incoherent stimuli. We do not expect the manipulations to influence mood.

Where can I learn more?

If you are interested in learning more, please refer to the following articles:

Heintzelman, S. J., Trent, J., & King, L. A. (2013). Encounters with objective coherence and the experience of meaning in life. *Psychological Science*, 24, 991-998.

Heintzelman, S.J. (2014). *Exploring the purpose of meaning in life*. Retrieved from <http://www.spsblog.org/exploring-the-purpose-of-meaning-in-life/>

What if I have questions later? If you have any remaining concerns, questions, or comments about the experiment, please feel free to contact Janessa Porter (Primary Investigator), at: janessa.porter@carleton.ca (1-613-520-2600, ext. 1448), Dr. Chris Davis (Faculty Sponsor), at: chris.davis@carleton.ca (1-613-520-2600, ext. 2251). Should you have any ethical concerns about this research, please contact Dr. Shelley Brown (Chair - Carleton University Research Ethics Boards - B, shelley_brown@carleton.ca, 1-613-520-2600, ext. 1505.

Thank you for participating in this research!

Appendix B: Study 2

SONA Recruitment Notice for Study

Study Name: Word Play and Personality

Description: We are interested in examining word play and personality. You will be asked to complete a quick word game. You will then be given a questionnaire online that consists of questions about personality and well-being.

Eligibility Requirements: Must be an undergraduate student.

Keywords: psychology, questionnaire

Duration and Locale: 10 minutes

Compensation: You will have the choice to receive a .25% course credit towards a psychology course (PSYC 1001, 1002, 2001, 2002, NEUR 2001, 2002), or \$5.00.

Researchers: Janessa Porter (Principal Investigator); Professor Chris Davis (Faculty Sponsor);

Phone: 613-520-2600 ext. 1448

Email: janessa.porter@carleton.ca

This study has received clearance by the Carleton University Psychology Research Ethics Board (Reference #15-115).

MTurk Recruitment Notice for Study

Study Name: Reading Comprehension and Cognition

Description: We are interested on examining cognitive aspects of reading comprehension. You will be asked to complete a quick reading task. You will then be given a questionnaire online that consists of questions about personality and well-being.

Eligibility Requirements: Must be 18 years of age and a resident of the US.

Keywords: psychology, questionnaire

Duration and Locale: 10 minutes

Compensation: You will receive 1\$ on your MTurk account

Your HIT gets approved if you: 1) Finish the survey, 2) Have not completed this survey before, and 3) Submit the confirmation ID (provided at the end of the survey) here.

Researchers: Janessa Porter (Principal Investigator); Professor Chris Davis (Faculty Sponsor);

Phone: 613-520-2600 ext. 1448

Email: janessa.porter@carleton.ca

This study has received clearance by the Carleton University Psychology Research Ethics Board (Reference #15-115).

SONA Informed Consent

The purpose of an informed consent is to insure that you understand the purpose of the study and the nature of your involvement. The informed consent must provide sufficient information such that you have the opportunity to determine whether you wish to participate in the study.

Present study: Word Play and Personality

Research personnel. The following people are involved in this research project, and may be contacted at any time if you have questions or concerns: Janessa Porter (Primary investigator, e-mail: janessa.porter@carleton.ca, phone: 613-520-2600, ext. 1448), Dr. Chris Davis (Faculty Sponsor, email: chris_davis@carleton.ca, phone: 613-520-2600 ext. 2251).

Concerns. Should you have any ethical concerns about this research, please contact Dr. Shelley Brown, Chair - Carleton University Research Ethics Boards - B, at shelley_brown@carleton.ca (613-520-2600 ext. 1155).

Purpose. The purpose of this study is to investigating word play and personality.

Task requirements. We are asking you to complete a word game. You will then be asked to fill out a number of questionnaires regarding your background (e.g., demographics), personality and well-being. The session will take approximately 10 minutes.

Benefits. You will receive a .25% increase in your final grade of PSYC 1001, PSYC 1002, PSYC 2001, PSYC 2002 or NEUR 2001, 2002 or \$5 compensation for participating in this study.

Potential risk/discomfort. There are no known physical or psychological risks to participating in this study.

Confidentiality. The data collected in this experiment are strictly confidential. All data are coded such that your name is not associated with the responses you provide. Any identifying information associated with your code will be confined to a single page that will be separated from your questionnaire, and kept in a separate, secured file by the research investigators, who will keep this information confidential. There will be no identifying information attached to your data. All data are coded such that your name is not associated with the responses you provide. The coded data are made available only to researchers associated with this project. Data will be destroyed 5 years post completion of publications associated with aggregated data. Please note that the online survey tool used in this study (Qualtrics) is hosted by a server located in the USA. The United States Patriot Act permits U.S. law enforcement officials, for the purpose of an anti-terrorism investigation, to seek a court order that allows access to the personal records of any person without that person's knowledge. In view of this we cannot absolutely guarantee

the full confidentiality and anonymity of your data. Also, we will not collect IP addresses. With your consent to participate in this study you acknowledge this.

Right to withdraw. You may withdraw from the study at any time. You may also choose to skip (i.e., not answer) questions for any reason without penalty.

This study has received clearance by the Carleton University Research Ethics Board (Reference #15-115).

I have read the above form and understand the conditions of my participation. My participation in this study is voluntary, and I understand that if at any time I wish to leave the experiment, I may do so without having to give an explanation and with no penalty whatsoever. Furthermore, I am also aware that the data gathered in this study are confidential with respect to my personal identity. By completing my name, date, and clicking "I agree to participate in this study" you are providing consent to the use of your data.

I agree to participate in this study

I DO NOT agree to participate in this study

Please provide your name and student number in order to receive your course credit or \$5.00.

Name: _____

Student Number: _____

MTURK Informed Consent

The purpose of an informed consent is to insure that you understand the purpose of the study and the nature of your involvement. The informed consent must provide sufficient information such that you have the opportunity to determine whether you wish to participate in the study.

Present study: Reading Comprehension and Cognition

Research personnel. The following people are involved in this research project, and may be contacted at any time if you have questions or concerns: Janessa Porter (Primary investigator, e-mail: janessa.porter@carleton.ca, phone: 613-520-2600, ext. 1448), Dr. Chris Davis (Faculty Sponsor, email: chris_davis@carleton.ca, phone: 613-520-2600 ext. 2251).

Concerns. Should you have any ethical concerns about this research, please contact Dr. Shelley Brown, Chair - Carleton University Research Ethics Boards - B, at shelley_brown@carleton.ca (613-520-2600 ext. 1155).

Purpose. The purpose of this study is to investigating cognitive aspects of reading comprehension.

Task requirements. We are asking you to complete a reading task. You will then be asked to fill out a number of questionnaires regarding your background (e.g., demographics), personality and well-being. The session will take approximately 10 minutes.

Benefits. You will receive \$1 for your mTurk account.

Potential risk/discomfort. There are no known physical or psychological risks to participating in this study.

Confidentiality. The data collected in this experiment are strictly confidential. There will be no identifying information attached to your data. All data are coded such that your name is not associated with the responses you provide. The coded data are made available only to researchers associated with this project. Data will be destroyed 5 years post completion of publications associated with aggregated data. Please note that the online survey tool used in this study (Qualtrics) is hosted by a server located in the USA. The United States Patriot Act permits U.S. law enforcement officials, for the purpose of an anti-terrorism investigation, to seek a court order that allows access to the personal records of any person without that person's knowledge. In view of this we cannot absolutely guarantee the full confidentiality and anonymity of your data. Also, we will not collect IP addresses. With your consent to participate in this study you acknowledge this.

Right to withdraw. You may withdraw from the study at any time. You may also choose to skip (i.e., not answer) questions for any reason without penalty.

This study has received clearance by the Carleton University Research Ethics Board (Reference #15-115).

I have read the above form and understand the conditions of my participation. My participation in this study is voluntary, and I understand that if at any time I wish to leave the experiment, I may do so without having to give an explanation and with no penalty whatsoever. Furthermore, I am also aware that the data gathered in this study are confidential with respect to my personal identity. By completing my name, date, and clicking "I agree to participate in this study" you are providing consent to the use of your data.

I agree to participate in this study

I DO NOT agree to participate in this study

Demographics

Age: _____

Gender: Female/Male

Word Triads

Three words, called Triads, will be presented on the screen at a time. Please read the following triads carefully. The screen will advance automatically after a few seconds. You will then be asked to judge whether or not the words in each triad have something in common. If they have some meaning in common, please choose the 'coherent' option. If the words have no association, please choose 'incoherent'. Please respond as fast as possible, as the screen will automatically advance.

For example, consider:

Broken, Clear, Eye

These words are 'coherent' because they have Glass in common.

Press the <return> key to start.

Coherent Triads:

Magic, Plush, Floor (carpet)

- Coherent
- Incoherent

Falling, Actor, Dust (star)

- Coherent
- Incoherent

Coin, Quick, Spoon (silver)

- Coherent
- Incoherent

Leaf, Big, Shade (tree)

- Coherent
- Incoherent

Gold, Stool, Tender (bar)

- Coherent
- Incoherent

Manners, Round, Tennis (table)

- Coherent
- Incoherent

Playing, Credit, Report (card)

- Coherent
- Incoherent

Salt, Deep, Foam (sea)

- Coherent
- Incoherent

Surprise, Wrap, Care (gift)

- Coherent
- Incoherent

Thread, Pine, Pain (needle)

- Coherent
- Incoherent

Incoherent Triads:

Magic, Actor, Spoon

- Coherent
- Incoherent

Falling, Quick, Shade

- Coherent
- Incoherent

Coin, Big, Tennis

- Coherent
- Incoherent

Leaf, Stool, Report

- Coherent
- Incoherent

Gold, Round, Floor

- Coherent
- Incoherent

Manners, Deep, Dust

- Coherent
- Incoherent

Playing, Plush, Care

- Coherent
- Incoherent

Salt, Wrap, Tender

- Coherent
- Incoherent

Surprise, Pine, Foam

- Coherent
- Incoherent

Thread, Credit, Pain

- Coherent
- Incoherent

Debriefing

What are we trying to learn in this research?

The purpose of this study was to assess the extent to which being exposed to words that fit a pattern (as opposed to being exposed to words that do not fit a pattern) affects how meaningful you feel that your life is. People who report that their life is very meaningful also tend to be happier, and tend to report better quality of life. Chaos in our lives takes away from a sense of meaning in life. We are interested in learning if self-reports of meaning in life can be influenced subtly by experimental manipulations of coherence.

Why is this important to scientists or the general public?

Previous research has found that greater self-reported meaning in life is associated with higher quality of life, better self-reported health, and better adaptive coping. As there are many associations between meaning in life and positive outcomes, understanding the process behind what makes life meaningful is important. Recently, it was found that the feeling that life is meaningful is sensitive to the coherence of presented stimuli. The current study was to replicate these findings. The current study will help us to continue the research on coherence detection and self-reported meaning in life.

What are our hypotheses and predictions?

We predict that meaning in life would be higher following an encounter with coherent stimuli in comparison to incoherent stimuli. We do not expect the manipulations to influence mood.

Where can I learn more?

If you are interested in learning more, please refer to the following articles:

Heintzelman, S. J., Trent, J., & King, L. A. (2013). Encounters with objective coherence and the experience of meaning in life. *Psychological Science*, 24, 991-998.

Heintzelman, S.J. (2014). *Exploring the purpose of meaning in life*. Retrieved from <http://www.spsblog.org/exploring-the-purpose-of-meaning-in-life/>

What if I have questions later? If you have any remaining concerns, questions, or comments about the experiment, please feel free to contact Janessa Porter (Primary Investigator), at: janessa.porter@carleton.ca (1-613-520-2600, ext. 1448), Dr. Chris Davis (Faculty Sponsor), at: chris.davis@carleton.ca (1-613-520-2600, ext. 2251). Should you have any ethical concerns about this research, please contact Dr. Shelley Brown (Chair - Carleton University Research Ethics Boards - B, shelley_brown@carleton.ca, 1-613-520-2600, ext. 1505.)

Thank you for participating in this research!

Appendix C: Study 3

SONA Recruitment Notice for Study

Study Name: Cooperative Play and Problem Solving

Description: We are interested on examining the effect of cooperative play on cognitive problem solving. You will be asked to play a cooperative game and then asked to complete a quick reading task. You will then be given a questionnaire online that consists of questions about personality and well-being.

Eligibility Requirements: Must be an undergraduate student.

Keywords: psychology, questionnaire

Duration and Locale: 30 minutes in lab (Location to be determined by Central Scheduling)

Compensation: You will have the choice to receive a .5% course credit towards a psychology course (PSYC 1001, 1002, 2001, 2002, NEUR 2001, 2002).

Researchers: Janessa Porter (Principal Investigator); Professor Chris Davis (Faculty Sponsor);

Phone: 613-520-2600 ext. 1448

Email: janessa.porter@carleton.ca

This study has received clearance by the Carleton University Psychology Research Ethics Board – B (Clearance #106572).

SONA Informed Consent

The purpose of an informed consent is to ensure that you understand the purpose of the study and the nature of your involvement. The informed consent must provide sufficient information such that you have the opportunity to determine whether you wish to participate in the study.

Present study: Cooperative Play and Problem-Solving

Research personnel. The following people are involved in this research project, and may be contacted at any time if you have questions or concerns: Janessa Porter (Primary investigator, e-mail: janessa.porter@carleton.ca, phone: 613-520-2600, ext. 1448), Dr. Chris Davis (Faculty Sponsor, email: chris_davis@carleton.ca, phone: 613-520-2600 ext. 2251).

Concerns. Should you have any ethical concerns about this research, please contact Dr. Andy Adler, Chair - Carleton University Research Ethics Boards - B, (by phone: 613-520-2600 ext. 4085 or email: ethics@carleton.ca).

Purpose. The purpose of this study is to investigate the effect of cooperative play on cognitive problem solving.

Task requirements. We are asking you to play a short game with other participants and then be asked to individually complete a reading task. You will then be asked to fill out a number of questionnaires regarding your background (e.g., demographics), personality and well-being. The session will take approximately 30 minutes.

Benefits. You will receive a .5% increase in your final grade of PSYC 1001, PSYC 1002, PSYC 2001, PSYC 2002 or NEUR 2001, 2002.

Potential risk/discomfort. Some participants may find the play and/or cognitive task somewhat stressful.

Confidentiality. The data collected in this experiment are strictly confidential. All data are coded such that your name is not associated with the responses you provide. Any identifying information associated with your code will be confined to a single page that will be separated from your questionnaire, and kept in a separate, secured file by the research investigators, who will keep this information confidential. The coded, anonymous data may be shared with trusted colleagues. As required by journals where the study might be published, data will be stored for five years post publication. Please note that the online survey tool used in this study (Qualtrics) is hosted by a server located in the USA. The United States Patriot Act permits U.S. law enforcement officials, for the purpose of an anti-terrorism investigation, to seek a court order that allows access to the personal records of any person without that person's knowledge. In view of this we cannot absolutely guarantee the full confidentiality and anonymity of your data. Also, we will not collect IP addresses. With your consent to participate in this study you acknowledge this.

Right to withdraw. You may withdraw from the study at any time. You may also choose to skip (i.e., not answer) questions for any reason without penalty.

This study has received clearance by the Carleton University Research Ethics Board - B (Clearance #106572).

I have read the above form and understand the conditions of my participation. My participation in this study is voluntary, and I understand that if at any time I wish to leave the experiment, I may do so without having to give an explanation and with no penalty whatsoever. Furthermore, I am also aware that the data gathered in this study are confidential with respect to my personal identity. By completing my name, date, and clicking "I agree to participate in this study" you are providing consent to the use of your data.

Name: _____

Student #: _____

Date: _____

I agree to participate in this study

I DO NOT agree to participate in this study

Demographics

Age: _____

Gender: Female/Male/Other

Cyberball

Cyberball



In a little bit you will play a game called Cyberball.

The rules of the game are simple: There are three players (including you), and you can toss a ball amongst three of you. When you receive the ball, you will have to return it to one of the other players. You can choose which one by clicking the image of that player. After that, the other player can play the ball to you again or the other player, and this way the ball keeps being tossed around.

When the timer below reaches zero the game will start!

Cyberball	
Including the Participant	Excluding the Participant

Debriefing

What are we trying to learn in this research?

The purpose of this study was to assess the extent to which being socially included (as opposed to being socially excluded) and being exposed to words that fit a pattern (as opposed to being exposed to words that do not fit a pattern) affects how meaningful you feel that your life is. People who report that their life is very meaningful also tend to be happier, and tend to report better quality of life. Chaos in our lives takes away from a sense of meaning in life. We are interested in learning if self-reports of meaning in life can be influenced by experimental manipulations of belongingness and subtle cues of coherence.

How did we use deception?

In order to conduct a fair test of our research question, it was important that we led you to believe that you were playing the ball toss game with the others in the lab. In reality, these opponents in the game were not real. The Cyberball game is a programmed computer game that randomly assigned you to be included or excluded from play. For some participants, the computer players were friendly and threw the ball back to you as often as they threw the ball to each other. For other participants, however, the computer players were programmed to give you the “cold shoulder” and stop throwing the ball to you. If you were in the excluded group, we understand that this can be mildly stressful or possibly feel a bit sad for being left out. But now that it’s over, remember that it wasn’t real players! It was just a computer game designed to act selfishly. Finally, the problem-solving task was our way to expose you to either words that fit a pattern (coherent triads) or words that did not fit a pattern (incoherent triads). You were either selected to view all coherent word triads or all incoherent triads.

Why is this important to scientists or the general public?

Previous research has found that greater self-reported meaning in life is associated with higher quality of life, better self-reported health, and better adaptive coping. As there are many associations between meaning in life and positive outcomes, understanding the process behind what makes life meaningful is important. Previously, it was found that sources of meaning shift in order to keep a stable feeling of meaning in life, and to possibly avoid feeling meaninglessness. When meaning is threatened in one domain of life, such as one’s belongingness, then it is thought that people become motivated to fill in the blanks with another domain, such as finding patterns in the environment. The current study will help us to continue the research on belongingness, coherence detection and self-reported meaning in life.

What are our hypotheses and predictions?

I expect that people will rate their lives as more meaningful when belongingness needs are met and when the environment is perceived as coherent. On the other hand, when belongingness is threatened, and environmental coherence is lacking, life should feel less meaningful. In accordance with fluid compensation, it is predicted that when belongingness needs are threatened, meaning will be compensated by the perception of coherence in the environment. Lastly, it would be expected that life there will be no

effect on meaning in life if belongingness needs are met but there is a lack of perceived coherence, based on two previous replications.

Where can I learn more?

If you are interested in learning more, please refer to the following articles:

Heintzelman, S. J., Trent, J., & King, L. A. (2013). Encounters with objective coherence and the experience of meaning in life. *Psychological Science, 24*, 991-998.

Stillman, T. F., Baumeister, R. F., Lambert, N. M., Crescioni, A. W., Nathan, C., & Fincham, F. D. (2009). Alone and without purpose: Life loses meaning following social exclusion. *Journal of Experimental Social Psychology, 45*(4), 686–694.

Heintzelman, S.J. (2014). *Exploring the purpose of meaning in life*. Retrieved from <http://www.spspblog.org/exploring-the-purpose-of-meaning-in-life/>

What if I have questions later? If you have any remaining concerns, questions, or comments about the experiment, please feel free to contact Janessa Porter (Primary Investigator), at: janessa.porter@carleton.ca (1-613-520-2600, ext. 1448), Dr. Chris Davis (Faculty Sponsor), at: chris.davis@carleton.ca (1-613-520-2600, ext. 2251). Should you have any ethical concerns about this research, please contact Dr. Andy Adler, Chair - Carleton University Research Ethics Boards - B, (by phone: 613-520-2600 ext. 4085 or email: ethics@carleton.ca).

Thank you for participating in this research!

Verbal Debriefing

Participants will be told:

1. The true nature of the study was withheld from them. The purpose of the study was to examine the effect of ostracism and coherence on meaning in life.
2. Withholding the true nature was done:
 - a. To ensure that participants would believe that they were playing ball-toss with other students.
 - b. To create a plausible scenario that would allow us to evoke a feeling of social exclusion or inclusion.
3. In order to establish this scenario, we require the use of deception.
4. The deception came in the following forms:
 - a. As mentioned, the initial pretense of the study. We could not state the true nature of the study in order for individuals to believe that they would be participating in cooperative play with other participants in the lab.
 - b. Making the participant believe they were being excluded from the game. This was done so participants would believe that they were being social excluded from the game by their peers, not by the computer, and therefore serve as a conflict to belongingness.
5. Since there was deception used in our experiment, the participant will be asked to complete another consent form. They will also be told of their option to include or withdrawal their data from the study. They will also be told of their option to include or withdrawal their data from the study.
6. Following the deception debriefing, a full explanation of our experiment will be given and the participants will be given an opportunity to ask questions and provide feedback.
7. Finally, participants will be given a debriefing form and given another opportunity to discuss the study. They will be asked to not discuss the study with other students from Carleton University.

Informed Consent Form – Post Experiment

The purpose of an informed consent is to ensure that you understand the purpose of the study and the nature of your involvement. The informed consent must provide sufficient information such that you have the opportunity to determine whether you wish to participate in the study.

Present study: Cooperative Play and Problem-Solving

Research personnel. The following people are involved in this research project, and may be contacted at any time if you have questions or concerns: Janessa Porter (Primary investigator, e-mail: janessa.porter@carleton.ca, phone: 613-520-2600, ext. 1448), Dr. Chris Davis (Faculty Sponsor, email: chris_davis@carleton.ca, phone: 613-520-2600 ext. 2251).

Concerns. Should you have any ethical concerns about this research, please contact Dr. Andy Adler, Chair - Carleton University Research Ethics Boards - B, (by phone: 613-520-2600 ext. 4085 or email: ethics@carleton.ca).

Purpose. The purpose of this study is to assess the effects of belongingness and coherence on self-reported meaning in life. In particular, we were interested whether (a) exclusion (versus inclusion) and (b) subtle cues of coherence (versus incoherence) will affect one's meaning in life.

Use of Deception: In order to conduct a fair test of our research question, it was important that we lead you to believe that you were playing the ball toss game with the others in the lab. If you knew that the cyberball game was programmed, then you would not have believed that you were being included or excluded by your peers. Since we could not fully disclose the true nature of the experiment prior to the study, we are obligated to request your consent now that you have been fully debriefed.

Benefits. You will receive a .5% increase in your final grade of PSYC 1001, PSYC 1002, PSYC 2001, PSYC 2002 or NEUR 2001, 2002.

Confidentiality. The data collected in this experiment are strictly confidential. All data are coded such that your name is not associated with the responses you provide. Any identifying information associated with your code will be confined to a single page that will be separated from your questionnaire, and kept in a separate, secured file by the research investigators, who will keep this information confidential. There will be no identifying information attached to your data. As required by journals where the study might be published, data will be stored for five years post publication. Anonymous data may be shared with trusted colleagues. Please note that the online survey tool used in this study (Qualtrics) is hosted by a server located in the USA. The United States Patriot Act permits U.S. law enforcement officials, for the purpose of an anti-terrorism investigation, to seek a court order that allows access to the personal records of any person without that person's knowledge. In view of this we cannot absolutely guarantee the full

confidentiality and anonymity of your data. Also, we will not collect IP addresses. With your consent to participate in this study you acknowledge this.

Right to withdraw. Similar to your right to withdraw during the experiment, you also have the right to have your results removed from the study without penalty or repercussion. Please indicate your decision by marking the appropriate line.

I have read the above form and understand the conditions of my participation. By completing my name, date, and clicking "I agree to participate in this study" you are providing consent to the use of your data.

Name: _____

Date: _____

____ I **AGREE** to have my results included in the study

____ I **DO NOT AGREE** to have my results in the study

This study has received clearance by the Carleton University Research Ethics Board - B