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The Role of Imagery in the Priming of a Mental Construct

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THE ROLE OF IMAGERY IN THE PRIMING OF A MENTAL CONSTRUCT

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Abstract

Priming is a term in psychology that refers to the unconscious activation of internal mental knowledge structures, such as trait concepts and stereotypes or mental representations of a stored idea, by specific details in the surrounding external environment (Bargh, Chen, & Burrows, 1996). This thesis conceptually replicated a priming experiment that used “old age” themed words in a sentence task to slow the walking speed of participants leaving the experimental room (Bargh, Chen, & Burrows, 1996). In the replication attempt University of Northern Iowa alumni themed posters were placed along a walking path near Rod Library on the UNI campus. The experimental condition featured three “old age” themed posters with “old age” related words and images of alumni with an average graduating year of 1959. The control condition featured three “medium age” themed posters with “young, fast” related words and images of alumni with an average graduating year of 1991. Those who viewed the “old age” posters walked significantly slower than those who viewed the “medium age” posters and those who did not view the “medium age” posters. The average walking speed of the “old age” group (6.62 seconds) was also closer to the preferred minimal cost walking speed (Browning, Baker, Herron & Kram, 2006) in humans (1.40m/s or 6.53 seconds across 30 ft) compared to the “medium age” posters (6.22 seconds).

Introduction

Humans slow behavior in response to “old age” related stimuli because the pattern of the “old age” stimuli causes an evolutionarily ingrained response to prepare for interaction with the elderly (Cesario, Plaks, & Higgins, 2006). This ingrained response is largely unconscious and causes the efficient allocation of mental and physical energy

resources towards minimal cost energy expenditure as indicated by the “old age” group walking significantly closer to the preferred minimal cost walking speed in humans. This preferred and efficient speed of behavior occurs through a balance between coherence across the cells of the body through the electromagnetic field of the physical heart (McCraty, Atkinson, Tomasino, & Bradley, 2009) and coherence in cognition through the utilization of ego-less, automatic, and implicit processing (Dietrich, 2004). This optimal balance results in relaxed, optimal cognitive processing in non-physical consciousness through the physiological coherence of the heart and brain (McCraty, Atkinson, Tomasino, & Bradley, 2009) and is similar to the optimal psychological state of flow (Ullén, Manzano, Theorell, & Harmat, 2010). Flow research has shown that positive emotions reduce self-consciousness and cause a person to be completely immersed with the external environment (Ullén, Manzano, Theorell, & Harmat, 2010). This internal coherence between the cells of the body and cognition through the physical heart allows external coherence with the environment and is a possible explanation for both the psychological state of flow and the efficiency of certain priming effects in altering unconscious behavior.

In the thesis replication the posters in the “medium age” condition with “young, fast” related words were not able to increase the walking speed of the participants. The participants in these conditions walked statistically similar and revealed a population average for people walking across the path on campus. The posters with “old age” images and “old age” words were able to slow the behavior of people who visibly acknowledged at least two of the three posters and indicates that both words and images can cause unconscious priming effects on walking speed. The findings also indicate that internal

imagery plays an important role in the semantic priming of the “old age” mental construct. A possibility for this automatic effect on walking speed by the internal imagery experienced by participants in the 1996 study is that the underlying theme of the elderly in the “old age” related words (“Florida”, “bingo”, “wrinkles”, “knits”) activates evolutionarily ingrained automatic and implicit processing through the “old age” mental construct. This would allow internal coherence in the body and external coherence with the environment through properly configuring the mental processing of the individual through an ingrained evolutionary mode of processing that allows resonance and harmony with a hierarchical social group. The findings also indicate that the optimal configuration of a social group places elderly individuals in a position of importance and authority to possibly relay information to younger individuals and also maintain an optimal level of energy expenditure for a collective social unit.

This thesis also applies a theoretical framework for consciousness, based on the book *My Big TOE*, to reexamine the findings from the 1996 study while also attempting to further understand two problems in priming research at large. The book proposes that consciousness, non-physical information calculation, is the underlying source of reality and all physical particles operate through a fundamental process that supports consciousness evolution (Campbell 2003). The TOE, an acronym meaning “theory of everything”, posits that consciousness evolution operates on all levels of individuated consciousness through a fundamental process in which individuated systems expand into potential states of information while simultaneously advancing with evolutionarily beneficial results. The evolutionary benefit is determined by the ability of the change to increase the order and efficiency of the system through moving physical particles towards

states of low entropy configuration with minimal energy expenditure while also progressing non-physical evolving consciousness towards low entropy states of high potential energy. Entropy is a measure of disorder and low entropy configuration indicates ordered and harmonious functioning for an individuated system of consciousness. It is argued that the automatic processing of the neurological heart operates in the body to find low entropy configurations of high potential energy for consciousness while the mind and executive control continues this process through relating the self to the complex randomness of the external environment.

The theoretical idea of evolving consciousness will first be applied to a 1996 finding in priming research that has been complicated recently by findings indicating that experimenter expectations significantly affect priming results (Doyen, Klein, Pichon, & Cleeremans, 2012). Through applying the idea of evolving consciousness to these findings as well as investigating alternative mechanisms of information transfer between humans, the original findings will be defended while also developing a theoretical understanding incorporating the recent replication attempt.

The generation problem in priming research refers to the ability of a single priming source to have multiple effects across several aspects of a psychological system. The second-generation problem refers to multiple priming sources in the environment causing a single significant effect in the body. To better understand the complexity of priming and human interaction in relation with the environment, the idea of evolving consciousness and a fundamental process of consciousness evolution will be applied to several examples of priming research. According to Bargh addressing these two problems

in priming research will result in a more comprehensive theoretical framework than what is currently in the literature (Bargh, 2006).

In this thesis it will be argued that human consciousness contains both the automatic internal processing of the neurological heart and selective external processing relating the individual to the environment through the mind. This thesis will present the idea that optimal cognition is largely automatic, implicit, and internally derived and occurs through coherence of the non-physical individuated self with the randomness of the physical environment through reliance on the neurological heart. The present study introduces the possibility that humans slow behavior when encountering stimuli referring to the elderly because it allows more preferable minimal cost energy expenditure and activates the automatic internal system of information processing. It is argued that the slow and controlled speed of behavior found in aspects of human behavior such as the minimal energy preferred walking speed (1.40m/s or 6.53 seconds across 30 ft) is evolutionarily adaptive at an individual and social level and allows for more optimal cognitive processing.

Literature Review

In 1996 John Bargh and colleagues published a research article titled, “Automaticity of Social Behavior: Direct Effects of Trait Construct and Stereotype Activation on Action,” that presented three experiments where the priming of participants with selected details concerning specific ideas (such as “old age” words inserted into a sentence completion task) unconsciously caused influences to behavior relating to those details (Bargh, Chen, & Burrows, 1996). The findings had a significant impact on priming research in social psychology, and his experiment has been cited over 2000

times. Recently, though, two attempts to replicate Bargh's experiment found non-significant results after adjusting the design of the original experiment in areas concerning experimenter expectations and timing methods. (Doyen, Klein, Pichon, & Cleeremans, 2012).

In the original experiment, Bargh showed that the semantic priming of participants with words commonly associated with old age (i.e. "Florida", "bingo", "wrinkles", "knits") resulted in reduced walking speed across a measured distance in the lone hallway exiting the experimental room. Participants completed a thirty-set task in which four-word sentences were generated from five-word lists. The participants were told the purpose of the study was to examine language proficiency, and post-test evaluation supports the claim that participants were not aware of any underlying connection to the theme of "old age" while taking the test or walking through the hallway (Bargh, Chen, & Burrows, 1996). As expected, the speed of the participants' walking was significantly slower among the experimental "old age" priming group compared to the control group, which was given a list of neutral words with no underlying theme.

Recently the role of semantic priming in causing slower walking speeds has been complicated by two experiments, which showed that experimenter expectations have a significant effect on participant behavior (Doyen, Klein, Pichon, & Cleeremans, 2012). The study used the sentence task with "old age" related words from Bargh and colleagues experiment and measured the walking speed of participants leaving the experimental room. In the first part of the study, the experimenter who administered the task was not told the purpose of the study. This stands in contrast to Bargh's original experiment, in which experimenters were aware of the purpose. The walking speed of the participants

was then measured using handheld and automatic timing devices. There was no significant difference between the experimental and control groups with handheld and automatic timing procedures. In the second part of the study the participants in the experimental group were administered the task by experimenters who were led to think the priming condition would slow walking speed while the control were led to think it would increase walking speeds. Both groups showed significant results in the direction of the expectation with at least one form of measurement.

These findings do not necessarily negate Bargh et al.'s original finding on priming's ability to produce direct, unconscious effects on participant behavior. These findings indicate that both experimenter expectations and the priming task itself can significantly affect the behavior of participants. The findings also show that results are consistently affected by the administration of the experiment in using stimuli to prime a single concept such as "old age."

The explanation presented by Doyen et al., 2012 is that participants unconsciously adapt their behavior according to the behavior and expectations of the experimenter. Doyen et al.'s findings point to a significant influence from experimenter expectation that can both amplify the priming effect and possibly reverse the priming effect. The reverse effect is likely caused by errors in subjective timing as indicated by analysis from Doyen et al. Experimenter expectations, however, still seem to have a significant influence in slowing participant walking speed through amplifying the priming effect. One possibility for this amplification is that increased coherence between the experimenter and participant results in the automatic adjustment of unconscious processing and the neurological heart towards more preferable minimal cost energy expenditure in the

physical body alongside high potential energy in non-physical thought to prepare for potential interaction with the elderly (Cesario, Plaks, & Higgins, 2006).

This replication process between experimenter and participant is supported by research investigating the established phenomenon that people automatically and implicitly mimic the facial expressions of others (Oberman, Winkielman, & Ramachandran, 2007). In the experiment this subtle imitation was manipulated by having the participants chew gum. The researchers found that when the participants were unable to mimic the experimenter, resulting in a disconnection between the two, the participants' memory for faces was significantly impaired. These findings show that experimenter behavior affects the ability of the participant to recognize and efficiently interact with patterns in the environment that are evolutionarily advantageous. The ability to recognize faces is an automatic and ingrained capacity in humans (Samal & Yengar, 1992) and this ability seems to be affected by the level of coherence a participant maintains with the external environment. This decreased coherence of the participant with the external environment causes a disconnection between automatic, implicit capabilities and the ability of explicit, executive control and evidences the importance of mental imagery in experiencing optimal cognition.

Other research has also found significant results in priming a social category by using a single photo to increase productivity in a brainstorming task and the performance of employees in a call center (Shantz & Latham, 2009). A single picture of a woman winning a race caused subjects to generate a significantly greater amount of ideas during a brainstorming task than those not primed with the picture. In a follow up study participants were divided up into three groups at a call center. The fact sheet given to

each group either had a photo of a woman winning a race, a photo of employees at a call center, or no photo. Most participants claimed that they did not notice the photo, indicating that the effects were largely unconscious. The call center condition raised the most money followed by the woman winning the race and the no photo condition.

In a similar experiment, researchers told one group of participants to imagine a professor's life and then list the traits that arose in consciousness (Dijksterhuis & Knippenberg, 1998). Another group was told to imagine a soccer hooligan's life and then list those traits. The control group was not primed with an idea. The groups were then asked questions from the board game Trivial Pursuit. The participants who imagined a professor's life scored significantly higher than the control group. The participants who imagined a soccer hooligan's life scored significantly lower than both the control and professor condition. These findings indicate that mental imagery serves an important function in determining the quality of cognitive processing. The imagery associated with a soccer hooligan would consist of quicker, random, and more spontaneous mental pictures while imagery for a professor would be more controlled, structured, and developed. This experiment in particular shows that a controlled speed of mental imagery is important in resonating explicit thought with automatic processing.

Another mediating factor in eliciting these evolutionarily advantageous priming effects through "old age" stimuli is the attitude of the participant towards the elderly (Cesario, Plaks, & Higgins, 2006). Attitude towards the elderly was calculated for each participant by measuring the response latencies in evaluating positive and negative target adjectives following a category prime. Faster response latencies with positive target adjectives indicated positive attitudes towards the category prime while faster response

latencies with negative target adjectives indicated negative attitudes towards the category prime. Participants who indicated a positive attitude toward the elderly had significantly slower walking speeds compared to those participants who indicated a negative attitude toward the elderly.

The ability of both words in Bargh et al.'s experiment and images in subsequent experiments to produce these unconscious effects on behavior indicates that internal imagery is activated in priming the mental construct, "old age," and relates external and internal information as part of a larger process of information processing. One possibility presented in this thesis is that human consciousness contains both externally focused information processing and internally focused information processing and the quality of cognitive processing is determined by the level of coherence between these two domains of information. These two streams of processing would operate simultaneously and could be considered the bottom up (foundational) and top down (directed) processing of information. The externally focused processing system is argued to be executive control and the ability of humans to plan and solve problems in the environment. The internally focused system is more complex, automatic, and implicit in comparison to the focused processing of executive control, which exists to enact directed change to the environment, and could be considered the processing of the neurological heart.

Bargh et al.'s sentence task required the mental representation of a sentence structure based on the logical possibilities of the words and presumably activated mental imagery among the participants with specific words from the task. In the professor prime study participants performed better in Trivial Pursuit after activating professor-related mental imagery (Dijksterhuis & Knippenberg, 1998). In a replication of Bargh et al.'s

“old age” experiment participants who indicated a positive attitude of the elderly had significantly slower walking speeds compared to those participants who indicated a negative attitude.

These findings point to the possibility that the level of internal imagery that one is able to integrate with cognitive processing is determined by the productivity of that imagery in the environment. Negative attitudes and emotions would decrease the level of integration and potential productivity of imagery in conscious awareness and positive attitudes and emotions would increase the integration and productivity.

This possibility is supported by findings in flow research that have found the optimal psychological experience of flow to occur with positive emotions and reduced self-consciousness (Ullén, Manzano, Theorell, & Harmat, 2010). In the experience of flow a person is completely immersed in the external environment and is actively engaged with that environment (Ullén, Manzano, Theorell, & Harmat 2010). This limit on information calculation through the necessity of engaging with external details could also be advantageous for a social group at a collective level. If the human brain is hard-wired to naturally find resonance with the random and complex behavior of others through emotions (Bargh, Gray, Nocera, & Williams, 2009) then an advantageous defense mechanism for the collective balance and harmony of the social group would be to require individual optimal computation to closely fit the details of the collective external reality.

Dualistic Processing

Priming research over the past twenty-five years has produced a number of different findings that evidence how priming a single social concept can have several

resulting effects across psychological systems (Bargh, 2006). Research has linked the priming of a social norm concept with the guidance or channeling of behavior in social situations (Aarts & Dijksterhuis, 2005), goal achievement (Hertel & Kerr, 2001), fair mindedness, and emotions that shape our reactions and responses (Lerner, Small, & Loewenstein, 2004). This is only a fraction of the research in social norms, which is only a subset of the research in priming. Rather than dissect the original experiment in terms of the priming research on social norms, the information in this thesis will address a problem in priming research at large. Priming research overlaps in two general areas of pursuit in understanding unconscious influences on behavior. Most priming research overlaps in two areas of confusion: the generation problem and the second-generation problem (Bargh, 2006).

In terms of priming research in social psychology, the generation problem refers to multiple effects resulting from a single priming source. An example is the priming of the concept “aggressive”, resulting in multiple effects across several psychological systems including behavior, motivation, and perception (Bargh, 2006). The second-generation problem concerns multiple simultaneous priming influences in the environment being distilled into an individual’s nonconscious social action. Priming, it seems, is balanced by both individual priming influences, i.e. stimuli associated with “old age”, and collective input, the patterned randomness of the external environment.

One line of research in social psychology concerned with priming applies the standard “dual process” model of conscious processing to conceptualize the interaction between unconscious and conscious processing producing our experience with the world. Research applying this “dual process” has investigated stereotyping and prejudice

(Conrey, Sherman, Gawronski, Hugenberg, & Groom 2005), explicit and implicit attitudes (Nosek, 2005), and a dual process model of moral reasoning (Haidt, 2001). In terms of Bargh et al.'s experiment, the unconscious processing of the pattern of the underlying theme, "old age" in the external environment interacts with the conscious processing in the contents of awareness to result in the experience of slowed behavior as measured by walking speed. This "dual process" model helpfully outlines the basic elements of Bargh et al.'s experiment and the experiment in the thesis.

Bargh also points to models of language and speech production to understand nonconscious goal pursuit in priming (Bargh, 2006). Bargh contends that the process involved with language production in conversation (Clark, 1996) is applicable to understanding the complex social interaction of priming. In both situations, a nonconscious goal operates in complex interaction with the unpredictability in the environment and manages to achieve its ends. Both, according to Bargh, start with an activated goal or intention and then produce and regulate behavior through automatic, nonconscious mechanisms.

Bargh elaborates that "cascade models" of language production can then be applied to understand priming through parallel-distributed models in which multiple levels of processing or representation are operating at the same time. Bargh contends that this conceptualization suggests that, "the semantic activation arising from perceiving an object automatically leads to the activation of various action plans with which the object is associated" (p.163). In the case of the elderly, action plans could include preparation for communication, preparation for aid, and preparation for interaction--all influencing conscious experience simultaneously. The evolutionary relevance of these action plans

would further strengthen their significance in unconscious processing and presumably is an important factor in the ability of “old age” stimuli to prime slowed behavior.

In terms of Bargh’s original experiment in question, this architecture for priming suggests that the act of reading words associated with “old age” automatically leads to action plans through the mental representation “old age” in our cognitive processing. This “old age” mental representation generally consists of slower moving, elderly citizens, and it causes significantly influential action plans. Furthermore, grandparents are a common influence across society and shape this mental representation towards wise and positive conceptualizations of elderly people. Past experiments have also found significant results after priming participants with positive words associated with the elderly, indicating that generally the “old age” mental representation is a positive one and serves an evolutionary purpose (Cesario, Plaks, & Higgins, 2006).

Scientists are still unable to explain, though, the efficiency of the exceedingly random process of social interaction, or how “nonconscious goal pursuit occur in the real social world where many of our goals can only be carried out in conjunction and collaboration with others” (Bargh, 2006, p.149). Specifically, in conceptualizing the concept, Bargh questions how humans are able to successfully relate and interrelate with others, largely unconsciously, who are not the same as themselves. In Bargh’s experiment the participant must interact with an experimenter who is both consciously and unconsciously processing the situation. Based on the findings from the replication attempt from Doyen et al, experimenter expectations, both consciously and unconsciously, can affect this collaboration resulting in slowed behavior that minimizes energy expenditure while finding ordered states of high potential energy.

One possibility for explaining this dual process in priming is a balance between a system of automatic internal information processing and a system of selective external information processing. The system of automatic processing would be considered the unconscious but is physically recognizable as the neurological processing of the heart, which begins and sustains the processing of internal information. The heart's response to changes in the body would be connected with internal imagery and through information sensors can be outside the limited awareness of selective processing. The system of selective processing would be executive control as the highest function of the mind, which exists to solve complex problems in the external world and enact change to that environment. The optimal state for humans, though, is a more relaxed and automatic state, which minimizes energy expenditure while maximizing internal experience.

Alternative Research

A line of research that investigates implicit processing comes from the Institute of HeartMath Research Center (McCraty, Atkinson, Tomasino, & Bradley, 2009). The center studies the physical heart and its relationship with the body. The center has found that physiological coherence of the heart is associated with a sine wave-like pattern that shifts the autonomic nervous system towards increased parasympathetic activity, and increases heart-brain synchronization and entrainment. Furthermore, there is efficient and harmonious functioning in the cardiovascular, nervous, hormonal, and immune systems. In this mode of functioning, natural regenerative processes are supported and the body operates with a high degree of efficiency and harmony. Furthermore, the Center has found that the heart has a measurable electromagnetic field that is the most powerful and rhythmic field produced by the body. The heart's electrical field is around 60 times

stronger in amplitude than that of the brain and its magnetic field is 5000 times greater in strength. The field envelops every cell of the body and extends in the external environment in all directions.

Research at the center found that the most consistent measure of synchronization is heart rate variability, which is a measure of the consistency or balance of autonomic heart rhythms (McCraty, Atkinson, Tomasino, & Bradley, 2009). Moment to moment heart activity is surprisingly irregular and the Center has found that generally, human functioning improves with increased regularity. Coherent heart activity has also been shown to increase heart-brain synchronization and cognitive performance. The Center has also found that positive emotions cause measurably greater degrees of coherence in oscillatory rhythms generated by the body's system. The findings from the Center all indicate that the heart is more involved in cognitive functioning than what is currently understood. The research from the Center indicates that the heart is a highly complex, self-organized information-processing center with its own functional, "brain," which is able to communicate and influence the brain through the nervous system, hormonal system, and other physiological systems. These findings point to the possibility that the coherence between automatic processing, the heart or the unconscious, and the full ability of top-down executive control, the mind, to influence a situation, is partly determined by the ability of conscious awareness to utilize imagery between these two extremes.

Visual and mental imagery would be considered a stream of information processing integrated with other senses and information filters. Visual and mental imagery serve a particularly important function as they are integrated to form internal imagery, which allows the imagination access to a near infinite configuration of potential

details. Past studies have found that mental imagery influences the quality of cognitive processing (Dijksterhuis & Knippenberg, 1998) and it is possible that this internal imagery allows access to true information not directly observable by the self (Bem & Honorton, 1994). This internal imagery is a potential connection between experimenter and participant not previously explored in priming research.

A fringe topic in psychology that sheds light on the interaction between expectations and measurement is psi research, which is involved with anomalous processes of information or energy transfer that are currently unexplained by known physical or biological mechanisms (Bem & Honorton, 1994). In a series of studies, researchers investigated the possibility of information transfer between physically separated participants through internal imagery. The Ganzfeld procedure involves the sensory deprivation of the participant in an attempt to stimulate the receptivity of telepathic communication through internally derived information. Past research with Ganzfeld stimulation had been done with statistically significant results but Honorton and his colleagues wanted to initiate a new series of tests that avoided past methodological problems.

The basic design of the studies was the same as past Ganzfeld studies. A sender and receiver were separated into two acoustically isolated chambers. After a fourteen-minute initial period of progressive relaxation, the receiver underwent Ganzfeld stimulation while describing his or her thoughts aloud for a 30 minute period. In Ganzfeld stimulation, the participant wears eye-cups to remove visual distraction and listens to headphones playing white noise to reduce auditory input. In the other isolated room the sender concentrated on a randomly selected target. At the end of the period the

receiver is shown four stimuli and then must select which stimulus had been the target of the sender's concentration. The target was randomly selected by a computer from the pool of possibilities and the four options presented to the receiver were also randomly generated by the computer. The results of the receivers' responses were then compared to the expected number of correct guesses, one in four, among the population to determine if statistically unlikely results had occurred.

Overall the experimenters found a correct guess or "hit" rate of 32% among the population. Even though this does not seem to be significantly different than the expected hit rate of 25%, the probability of the entire population following this elevated hit rate is statistically very unlikely at .2%. Another interesting result was the high hit rate of 50% among the group of 20 Julliard artists. In past reports it had been hypothesized that there is a relationship between creativity or artistic ability and psi performance and these results seem to back that claim. The groups of experienced participants also tended to score higher, 43%, 30%, 54%, than the novice participants, who scored 29%, 24%, 36%, 30%, 33%, even though their hit rates did overlap.

Another psi experiment conducted by the PEAR (Princeton Engineering and Anomalies Research) lab investigated the possible linkage between a human operator and a target machine thousands of miles apart (Dunne & Jahn, 1992). The output distributions of the random binary events of the machine showed statistically significant mean shifts correlated with the distant human operator's pre-stated intention. The authors of the study contend that results such as this provide evidence for a psi mechanism of information transfer between human consciousness and random physical processes.

Another experiment conducted to test psi phenomenon concerned emotional expression and its effect on a random event generator (Blasband, 2000). Videotaping and coding of therapy sessions was synchronized with the operation of a nearby random event generator (REG) and comparisons were made during periods of neutral emotion and emotional expression. Statistical analysis revealed anomalous REG output during periods of emotional expression versus periods of neutral talking. The study also found the expression of anger to be significantly correlated with marked elevations of REG output and periods of crying and sadness to be correlated with the depression of REG output.

Another experiment tested the ability of human populations to affect the output of random number generators located around the world (Radin, 2002). The experiment found that the single greatest change in variance for the year occurred on September 11th, 2001. The study also found that the largest correlation among all the random number generators occurred on September 11, 2001. Furthermore, the study found that the 250 days that made headline news showed statistically significant greater correlation than the 115 days with non-eventful days.

Robert G Jahn at the Princeton Engineering Anomalies Research (PEAR) Laboratory summarizes the findings in psi research in the following way, “In the array of experiments on mind/matter or human/machine anomalies that have been regularly reported to this Society we find incontrovertible evidence that consciousness can play a proactive role in the behavior of simple or complex physical devices and processes” (Jahn, 2001, p.447). After reviewing the large body of empirical data collected on anomalous interactions on consciousness, Jahn also concluded that significant results are generally unaffected by separation between the consciousness and the system being

measured across both space and time. After reviewing research in psi phenomenon, Richard Shoup of the Boundary Institute in Los Altos California concluded, “Perhaps the most important message from Psi experimentation is that our traditional notion of unidirectional causality is inadequate, or perhaps just plain wrong, and a bi- or omni-directional relational approach is more likely to represent physical reality” (Shoup, 2002, p.4).

Possible explanations for psi mechanics have been explored in laboratories across the country for decades. The PEAR lab at Princeton was one of the leading research facilities in pursuit of this question and presented a series of papers researching psi. In 2001 Jahn and Dunne published an article entitled “A Modular Model of Mind/Matter Manifestations (M5),” which presented an M5 model and an updated M* model addressing the question of consciousness and its role in psi effects (Jahn & Dunne, 2001). The paper postulates that the anomalous effects observed do not emerge from direct intercourse between the conscious mind and the physical world. Rather, the direct intercourse is sustained at the depth of the unconscious mind and an intangible substrate of physical reality.

Important to the discussion of the theoretical framework underlying unconscious processing are the possible physical mechanisms connecting information in the universe across time and space. One possible explanation comes from the field of physics and is known as zero-point energy, which is the lowest possible energy for a system and an energy that exists even at absolute zero (Milonni, 2009). In his paper “Searching for the Universal Matrix in Metaphysics,” H. E. Puthoff, a physicist at the Institute for Advanced Studies at Austin, explains that contemporary physics posits an all-pervasive energy field

called quantum vacuum energy or zero-point energy (Puthoff, 2002). This energy is random, ambient fluctuating energy that even exists in empty space. Zero-point energy is the seat of continuous virtual particle-pair creation and annihilation processes and underlies matter and non-matter as a foundational field that is then subsequently transformed and shaped into the matter of the present moment. Puthoff explains it quite concisely as a, “Blank matrix upon which coherent patterns can be written, such information constituting at the bottom end of the scale coherent particle and field structures, and, to a zero-point-energy chauvinist like myself, an ascending ladder of possible other information structures” (Puthoff, 2002, p.3).

This zero point energy is a monad of energy of various densities according to Charles D Laughlin in the essay published in the *Journal of Scientific Exploration* titled, “Archetypes, Neurognosis, and the Quantum Sea.” This monad energy structure permeates the universe, even permeating the most complex vacuum (Laughlin, 1996). Laughlin uses the term, “quantum sea,” to explain the monad of energy. According to Laughlin neural networks may be prepared to operate as transducers of patterned activity in the quantum sea. This transformation of neural activity can also produce transformations in the sea. Laughlin presents the idea that if biochemical interaction among neural cells is influenced beyond local causation then a complete understanding of cognition includes the biophysical activity between the cells and the sea.

Coherence between systems is a central concept in quantum physics and refers to events that are correlated over time and space. (Laughlin, 1996). In a coherent system, the activity of one component affects the other, and vice versa. The two are directly connected even when separated by time and physical space. Laughlin posits that all

objects, from simple atomic particles to complex biological organisms are by definition, as sustained systems, made of coherent energies. The foundation for these coherent energies, the quantum sea or zero point field, connects across physical reality and interacts with the cellular level to produce coherence across the expanse of a neural network, involving controlling a connected system of thousands and potentially millions of cells. Recent findings in neuroscience also support the possibility that neural networks with billions of cells could be controlled. The neural network can influence this zero point field through influencing the random vacuum energies of that organism, which is determined in part by conscious awareness and executive control. Laughlin postulates a continuum of levels of structural organization connecting the underlying sea with cognition and executive control.

One of the most comprehensive published journal articles on consciousness, “Sensors, Filters, and the Source of Reality,” comes from research at the Princeton Engineering Anomalies Research Laboratory. Based on their findings in psi research, Jahn and Dunne present a theoretical framework based on the concept of “the source” and its interaction with consciousness filters specifying the information flow between the two-dynamic systems, source and consciousness (Jahn & Dunne, 2004). The model is based on more than 25 years of researching consciousness and deviates from causal physical logic. The authors explicitly state that “the source” is synonymous with “zero point vacuum.” In the dynamics, each serves the purpose of its singular existence while in symbiosis mutually sustaining a connection. The information from normal physiological sensory channels is routinely supplemented by various subjective modalities that inform a more extended, less physicalistic consciousness.

Perhaps the most thorough and comprehensive explanation of consciousness comes the book *My Big Toe*. In the TOE, an acronym meaning theory of everything, physicist Thomas Campbell presents a three-part explanation of consciousness based on life experience, empirical scientific evidence, and research in meditation and astral projection or “out of body” experiences. Campbell’s ideas work through scientific evidence and theory and connect across a minimum number of assumptions: primordial consciousnesses and a fundamental process of consciousness evolution. Primordial consciousness is defined as the initial conditions of information processing for consciousness that begins in our physical universe as dim, undifferentiated potential energy, and which shapes itself into improved configuration through generating information and progressing through evolutionarily beneficial results. All physical particles are considered conscious as the information calculation of their potential states is determined by evolving consciousness and becomes increasingly individuated with ascending complexity.

A human, individual consciousness, serves the purpose of evolving consciousness, the source. On every level, or sub-system, of this evolving consciousness, physical particles naturally devolve into high entropy configuration and low energy states, entropy being a measure of disorder and low entropy configuration indicating ordered system interworking. The degree of awareness or quality of consciousness within that subsystem subsequently determines the ability of that system to enact change towards low entropy configuration and high potential energy. No matter what level of size, complexity, awareness, or configuration that is pinpointed or named, as a subsystem of consciousness the sub-system will function through the process of evolving source

consciousness. This source consciousness, primordial consciousness as a single undifferentiated potential force developing into brightly aware consciousness, follows a relatively simply iterative, structured, momentous strategy of existence.

Based on past existence, a single optimal result is calculated for the present moment in a subspace of evolving consciousness and funneled to individual consciousness through information sensors and filters. As individual subsystems of evolving consciousness, humans process the details of the present moment based on the balance between this source consciousness information and the information of the self or ego. At every moment this processing results in an interaction with the universe that is compared by large-scale consciousness to the optimal result. This process is iteratively repeated from moment to moment. Humans find greater coherence with this calculation through life experience and the learning of more efficient and clearer processing and “the source” moves towards greater coherence through incrementally and iteratively repeating the process with a near infinite number of subsystems.

Both individuated consciousness and the source have two-way capabilities. The mind is a system in itself and can have direct resonant couplings with the environment (Jahn & Dunne, 2004). The mind can also produce indirect effects, which can transmit information to the source, back to the consciousness, or potentially to both. Individuated consciousness can connect to the source through our physical and mental senses and can be disconnected from the source through information filters. The information filters serve as limits and blockades for individuated consciousness and result in a consistently objective external reality in relation to an internal subjective world. Objective reality, (physical matter) exists in tandem with subjective reality (non-physical consciousness).

The environment, according to Jahn and Dunne is an emergent property of this much more complex intangible reservoir of potential information between source and consciousness. The environment could be considered the potential calculation states and space for evolving consciousness to lower the entropy of primordial consciousness while finding low energy configurations for humans through the processing of the physical heart.

A helpful mathematical concept in conceptualizing this iterative process is that of a fractal, in which every part contains the pattern of the whole and is formed by the distribution of a repeating pattern (Bieberich, 1999). In the paper, "Structure in Human Consciousness: A Fractal Approach to the Topology of the Self-Perceiving an Outer World in an Inner Space," Erhard Bieberich introduces a model in which the self is generated by a neural network that compresses spatial and temporal information into a fractal structure. Any amount of coherence between an inner observer and the parts of a fractal structure entails coherence to the whole structure, as every part contains the pattern of the whole. This compression of information into a fractal structure would allow updated information about the self from moment to moment while also maintaining a connection to evolving source consciousness as the compressed information is generated by the evolving source.

In terms of human perception, this duality of information about the self, consciousness, and information accessible to the self, the source, allows a cognitive experience of dualistic processing. Information can be effectively stored in relation to the singular self while also allowing updated information about the self in relation to the external environment. Herman Sno, a psychiatrist in the Netherlands, suggested that the

brain stores memories similar to a hologram (Miller & Miller, 2003). Each section of the hologram contains all the necessary information to reproduce the image of the entire picture. The clarity of this internal imagery is determined by the size of the fragment and the smaller the fragment, the fuzzier the image. According to Sno, when small elements of a situation closely match a memory fragment in a human, an image from that former experience is evoked. One possibility for explaining this occurrence is that the recognition of external patterns, small elements of a situation, increases coherence between automatic and selective processing through internal imagery. This enacted imagery could also result from a singular ingrained memory of evolving source consciousness from childhood, which is generated when there is less inhibition to the subjective modalities of perception. This internally ingrained memory of evolving consciousness could be applied to all patterns in the environment and could be a driving force in the recognition of evolutionarily advantageous patterns across a lifetime.

This holographic concept of reality also helpfully outlines possible mechanisms in the information transfer by consciousness across time and physical space (Miller & Miller, 2003). Accessing information through psi mechanisms is based on the quality and size of the internal imagery evoked. The meaning of the information comes through emotions along with visual, auditory, and kinesthetic stimulation. This human potential is accessible through focused attention and intent driven decisions. Humans have the potential to focus and relax attention, and intent is suggested as a variable in the transmission and reception of the information.

Implicit processing has been shown to be more complex, comprehensive, and useful than explicit processing in terms of experiencing the optimal psychological state of

flow (Dietrich, 2004). This presents the possibility of a universe with optimal processing at every level resulting from the optimal processing of evolving consciousness. In flow theory, optimal experience is more likely to occur with submission of the ego and submissiveness into the external environment, thus becoming the universe processing itself to a more significant degree through an egoless, low entropy configuration (Ullén, Manzano, Theorell, & Harmat, 2010).

In terms of the source as presented by Jahn and Dunne, an important aspect in the flow of information between the source and human consciousness is the reliance on unconscious implicit processing to build explicit resonance along moment to moment experience. Filters on physiological and mental facilities limit these objective and subjective sensory channels through physical, cultural, and emotional factors that restrict this flow. However, through goal-oriented or intent-driven decisions the effect of these filters can be reduced through reliance on the implicit system of processing, which has greater access to the information being filtered. Though both can sustain moment-to-moment experience and even systems in the environment, ultimately implicit large scale processing is more important in optimally constructed thought as it lays the foundational base from moment-to-moment for explicit information processing.

The generation problem, multiple effects from a single priming source, could be explained through coherence between source consciousness and individual consciousness causing the sustained activation of evolutionarily beneficial change towards states of low entropy configuration with high potential energy. This could be accomplished through mental constructs organizing conscious processing and neural networks and subsequently increasing the potential usefulness of internal thoughts. The mental construct would be

activated through internally-derived pattern recognition allowing increased coherence with the random dynamics of the external environment.

An example illustrating this occurrence is the subliminal priming of participants with African American faces resulting in increased hostility (Bargh, Chen, & Burrows, 1996). The activation of this mental construct automatically and unconsciously integrates information of the self in relation to the external environment. The participants' internal processing is better equipped to resonate with the environment based on the observed pattern, indicating potential interaction. This integrated information lowers the entropy of thoughts, despite the negative emotions involved, and aids in the expenditure of energy during the hostile behavior. This finding indicates that internal imagery also serves an important function in evolutionarily-ingrained responses concerned with survival or competition as well as responses for optimal, relaxed processing. A possibility is that automatic, foundational processing enacts evolutionarily ingrained responses for optimal, relaxed processing while the secondary supplementary processing of executive control enacts adapted behavior to deal with perceived threats and problems in the environment.

The internal world of the self and internal imagery would be the first extreme domain of information while the selective processing of the external physical world would be the second extreme domain. Priming influences are sustained in the automatic processing of internal pattern recognition and occur through any significant configuration of pattern in the external environment that activates evolutionarily beneficial automatic processing. The second generation problem, multiple simultaneous priming influences in the environment being distilled into an individual's nonconscious social action, could be explained through external processing recognizing a significant configuration of patterns

and subsequently causing changes to internal pattern recognition that are evolutionarily beneficial. This evolutionary benefit could be for survival, collecting food, social interaction, avoiding danger, or any other potential of individuated evolving consciousness in changing towards states of ordered system interworking.

When the participants read the words while forming sentences in Bargh et al.'s semantic priming task, the imagery associated with specific and possibly all words is activated in the mind. This imagery system is a direct link to a field of comprehensive source consciousness or a connected field of consciousness (Laughlin & Throop, 2001), and is successfully activated in semantic priming when the participant uses automatic mental capacities to retrieve learned associations (Neely, 1977). The participants will activate imagery associated with the words centered on the concept of "old age" and will initiate pattern recognition in cognitive processing. As post task surveys have shown that participants are not aware of any underlying theme or connection while completing the task, this cognitive processing of an underlying pattern is largely unconscious or at least preconscious (Bargh, Chen, & Burrows, 1996).

In the case of Bargh et al.'s experiment, this patterned imagery is rarely explicitly processed and remains in the unconscious until it no longer is applicable to the current situation, i.e. the participant has long forgotten about the incident. Until that point, though, the largely unconscious, implicit foundational processing relates that information to moment-to-moment cognition. If this unconscious pattern is further strengthened with slowed experimenter behavior, the effects will be more significant as a participant's cognitive processing is better able to resonate with this underlying pattern with additional

incoming information that confirms significance in the configuration of these ambiguous external details.

The activity of a person walking down the measured path is an unpredictable dynamic system largely determined by lower level neurological processing. An experimenter with a focused and clear intent could potentially resonate with a participant through consciousness and move the two systems towards coherence. This could be accomplished through strengthening the relevance of the underlying pattern of “old age” stimuli through mental activity and consciousness and subsequently influencing the entropy of the participant’s information processing. The participants’ automatic unconscious processing of relevant information concerning the mental construct “old age” could potentially integrate this information communicated through more subjective modalities of source consciousness.

This being the case, it is hypothesized that:

1. Participants will walk slower after viewing the “old age” themed posters compared to the “medium age” posters
2. Participants will walk slower when the experimenter is aware of the purpose of the “old age” stimuli
3. Participants will walk a similar speed when not viewing the “old age” posters

Method

Participants

The two hundred and seventy six participants observed in the experiment were people walking on campus along a path near Rod Library. No personal information was collected from the participants and there were no age or physical limitations. The

majority of the participants were college-age students walking on campus to and from class. All participants were blind to experimental conditions and no one was aware that they were being timed from a distance for a psychology experiment.

Materials

Six 11''x17'' UNI advertisement posters were created with images of alumni and three posters were placed near each other along a walking path near Rod Library (see Appendix A for examples of the posters). Three of the posters featured alumni with an average graduating year of 1959 while the other three-featured alumni with an average graduating year of 1991. The experimenter measured the walking speed of participants with a Timex wristwatch and data was recorded with a pencil and notebook. A Flip video camera was also used to film ten-minute segments of the poster conditions.

Procedure

People on campus who visibly acknowledged at least two of the three posters were timed walking across a thirty-foot distance following the third poster. The timing was done with a wrist watch from the third floor of Rod Library. The experimenter attempted to remain unbiased while taking the measurements and the variability of the times supports this attempt. In each condition three categories of people; those who viewed two of the three posters, those who did not view the posters, and those walking in the opposite direction were timed across the thirty-foot distance.

In the elderly condition, the posters also included elderly themed words based on past experiments that have successfully elicited slowed behavior through inserting elderly

words into a sentence creation task. Examples of words used in the present experiment included “wisdom, generosity, retiring, mature, senior, and experienced.” In the medium age condition the posters included young, fast themed words generated by the experimenter including, “intense, Speedway, speedy, persistence, NFL record, and United States Marine Band.”

The images of the alumni came from UNI magazines accessible through the Internet and the posters were designed with help from a graphic designer in University Relations. The poster conditions were altered across the time of day with “old age” measurements taken from 9:21am-10:11am and from 11:46am-12:39pm, and “medium age” measurements taken from 10:21am-11:31am and 12:48pm-1:42pm. The weather remained partly cloudy throughout the day and the temperature was also consistent across conditions at 34-36 degrees Fahrenheit. In collecting the measurements the person was required to be walking alone with no one else ahead within ten feet along the marked distance. The person was also required to visibly acknowledge at least two out of the three posters. No person stopped walking while viewing the posters in both conditions. The experimenter also videotaped ten-minute segments of the posters conditions, which was measured by a research assistant after the experiment. The research assistant, however, was not able to collect a sufficient amount of measurements for each condition to make any worthwhile statistical comparisons. The angle and quality of the video footage prevented the research assistant from confidently recognizing participants who visibly acknowledged at least two of the three posters.

Results

The experimenter measured the walking speed of three categories of people in each of the two conditions along the marked distance. The first were those who viewed two of the three posters while walking the appropriate direction, the second were those who did not view two of the three posters while walking the appropriate direction, and the third were people walking the opposite direction. For the 51 participants who were measured viewing the “medium age” posters, the average time across the distance was 6.22 seconds, SD= .617. The 54 participants who did not view the “medium age” posters had an average time of 6.25 seconds, SD = .619. The 55 measured walking in the opposite direction during the condition had an average of 6.08 seconds, SD= .635. For the 48 people who viewed the “old age” posters, the average time was 6.62 seconds, SD= .654. The 38 who did not view the posters had an average time of 6.36 seconds, SD= .688. The 30 people measured in the opposite direction during this condition had an average speed of 6.23 seconds, SD= .655. (See Table 1).

Table 1	View Medium	Not view Medium	Opposite Medium	View Old age	Not view Old age	Opposite Old age
Average	6.22	6.25	6.08	6.62	6.36	6.23
SD	.617	.619	.635	.654	.688	.655

A one way analysis of variance revealed that at least one of the measured categories was significantly different than the other categories [F (5, 270)= 4.054, p=.001]. Post hoc pair-wise comparisons using Tukey HSD found a significant difference

($p < .05$) between those who viewed the “old age” posters ($M=6.62$, 95% CI [6.43, 6.81]) and those who viewed the “medium age” posters ($M=6.22$, 95% CI [6.05, 6.39], $p = .026$) those who did not view the “medium age” posters ($M=6.25$, 95% CI [6.08, 6.42], $p = .044$), and those who walked in the opposite direction of the “medium age” posters ($M= 6.08$, 95% CI [5.91, 6.25], $p = .000$).

The findings from the “old age” condition indicate that the “old age” posters were associated with slower walking speeds in participants. Those who viewed the “old age” posters had significantly slower speeds than those who viewed the “medium age” posters and those who did not view the “medium age” posters. These findings suggest that the “old age” posters were able to significantly affect walking speed and support Bargh’s original findings. Furthermore, the average time for the “old age” condition was closer (6.62 seconds, difference = .09) to the preferred walking speed of humans (6.53 seconds) than all other measured conditions (did not view “old age”, difference = .21), (did not view “medium age”, difference = .27), (walked opposite direction “old age”, difference = .30), (viewed “medium age”, difference = .31), and (walked opposite direction “medium age”, difference = .45).

Discussion

People walked significantly slower across the three categories of measurement in the “old age” condition compared to those measured during the “medium age” condition ($df=1$, $F=10.435$, $p=.001$). This finding supports the first research hypothesis, which predicted that participants would walk slower after viewing the “old age” themed posters compared to the “medium age” posters. The results also support the third research hypothesis, which predicted that participants would walk a similar speed when not

viewing the “old age” posters. This response in people during the “old age” condition towards more preferable energy expenditure could be mediated by the electromagnetic field of the heart and access to internal information connected by source consciousness. It is also possible that individual optimal cognition for humans is affected by the collective resonance among the electromagnetic fields of individuals and potentially an earth wide collective electromagnetic field connecting source consciousness.

The individuated fundamentally evolving system of source consciousness through the body, heart, spinal cord, and brain would interact with secondary collective extended processing with potential access to new information in the environment through more subjective modalities of perception. This potential access to new information is supported by findings from Doyen et al., 2012, which showed that slower walking speeds occurred after exposure to “old age” stimuli only when the experimenter was informed of the purpose of the study and expected slower speeds. In the thesis replication attempt the research assistant was unable to collect a sufficient amount of measurements and therefore the second research hypothesis was not properly tested. Though, this prediction was not thoroughly tested because of video complications it is weakly supported by the results from the informed experimenter, as measurements in the “old age” condition were significantly different than the “medium age” condition. Coherency between the experimenter and participant through more subjective modalities of perception could explain this prediction as information could be relayed across physical space and time through source consciousness or a hierarchical quantum sea of zero point energy fields. This idea of an informed experimenter having influence on participant behavior is a

potential area of study in future experiments, especially those investigating the influence of “old age” stimuli on automatic behavior.

The internal system of pattern recognition would be a direct connection to source consciousness through implicit, positive, and automatic processing. The automatic processing of information through the heart instantly responds to the changes in the external environment and provides a foundational base for this automatic processing alongside executive control. Positive emotions and intent seem to play a significant role in the activation of optimal and imaginative thought and internal imagery allows executive control potential access to this implicit information. This access, though, seems to be limited by the level of integration and potential productivity of the imagery in the external environment and is mediated by the ability of the imagery to lower the entropy of physical particles while finding ordered states of high potential energy. If the system of imagery automatically results in internal and external consciousness evolution misguided efforts that impede this process would reduce the level of imagery, increase the entropy between automatic and selective pattern recognition, and would decrease the potential energy of conscious awareness.

After viewing the “old age” stimuli humans walk around the preferred minimal cost walking speed (6.53 seconds across thirty feet) because it allows efficient minimal cost energy expenditure while allowing relaxed, optimal cognitive processing. This minimal cost energy expenditure allowing optimal thought is supported by findings on the neurological heart as an information processor, which stabilizes cognitive processing and allows for sprouting, imaginative thought. This stabilization of lower level neurological functioning through efficient energy use could be part of an optimal

evolutionary mode of processing in which thought is largely implicit and imagery plays an important function in aligning the contents of conscious awareness with the external environment.

It also seems possible that the collective social group of that person limits the level of internal imagery utilized. This could be sustained through cultural ego, sustained cultural belief traps, a limited collective understanding of reality, and culturally sensitive and inappropriate areas of conversation and any other factor that would limit the potential of individual imagery through potentially increasing the entropy of another's consciousness and subsequently source consciousness. One could argue that the truth is always open for discussion but if sensitive information is not communicated correctly it could potentially increase the entropy of evolving consciousness at an individual and social level. Information communicated at a social level could activate emotions and automatic responses in others that negatively influence the automatic processing of the physical heart. This aggravation of the physical heart and its electromagnetic field would decrease the level of internal imagery in all affected people and subsequently disrupt the cognitive processing of the individuals.

The mental construct "old age" would encourage a preferred minimal cost speed because the mental representation causes a slower preferred speed of processing and encourages positive emotions. Across a lifetime the elderly generally improve in finding optimal gate speed through accessing potential states of information, extremes in the possible balance between energy expenditure and quality of processing, and progressing with the most evolutionarily preferable solutions. This knowledge of the preferred minimal cost energy expenditure of the elderly seems to be unconsciously engrained in

the imagery of the mental construct and “old age” related stimuli enacts evolutionarily beneficial change in walking speed.

This optimal balance between energy expenditure and cognitive processing occurs through the physiological coherence of the heart, which shifts the autonomic nervous system towards increased parasympathetic activity and increases heart-brain synchronization and entrainment. Executive control is engaged to supplement this automatic processing when the details of the external environment conflict with the intent of the automatic processing. Through intent driven decisions and processing, this executive control becomes less necessary and more optimal automatic processing is activated. Instances of executive control that significantly improve the external environment would produce optimal cognitive processing when the efforts are sustained by positive emotions.

An interconnected hierarchical system of efficient minimal energy zero point energy systems naturally evolving primordial source consciousness across a fractal distribution could explain the efficiency of the “old age” stimuli in unconsciously altering walking speed. The stimuli activates an evolutionarily ingrained response to use efficient, minimal cost energy expenditure in individual physical and cognitive functioning and would also sustain efficiency in a hierarchical social collective. Information is processed independently at all levels while continually maintaining and evolving a singularized distributed non-physical source consciousness, which finds optimal states through accessing potential states of information while progressing with optimal results and this underlying pattern in reality is accessible and observable through the internal imagery of conscious awareness.

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Appendix A - Poster examples

 **Learned wisdom.**



Chuck Grassley, Political Science Education '65, is the senior United States senator from Iowa.



Did you know that Louise Braklow is UNI's most loyal and mature alumna at 106?

 **Intense persistence.**



Sarah Pratt, Elementary Education '99, became the Iowa State Fair's fifth butter sculptor in 2008.



Jerry Jauron, Accounting '90, was the CFO of the Iowa Speedway during the addition of the NASCAR Nationwide and Trucks series.

 **Helpful generosity.**



Did you know that former president Robert Koob, Chemistry '62, was the 1st UNI graduate to serve as UNI president before retiring in 2006?



Ramona Otto, Elementary Education '71, kindly gave a flag made of tickets to Bob Barker, the experienced host of "The Price is Right."