

University of Nevada Reno

An Investigation into Subjectivity and Implicit Cognitions: Explorations in Dissemination

A dissertation submitted in partial fulfillment of the  
Requirements for the degree of  
Doctor of Philosophy in Psychology

by

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December, 2012



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THE GRADUATE SCHOOL

We recommend that the dissertation  
prepared under our supervision by

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entitled

**An Investigation Into Subjectivity And Implicit Cognitions: Explorations In  
Dissemination**

be accepted in partial fulfillment of the  
requirements for the degree of

**DOCTOR OF PHILOSOPHY**

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**Abstract:**

Implicit cognitions and operant subjectivity are two areas that behavior science should be investigating as they bear direct relevance on topics of interest to the majority of the populace. In this investigation, we attempt to combine these two and identify which values led people to choose psychology as their undergraduate major. To do this, 11 undergraduate psychology students completed a Q Sort providing us with a measure of operant subjectivity around their choice. Following this Q Sort, each participant completed an MT-IRAP comparing groups of words representing behavioral (operant, reinforcers, objective, actions, stimuli, & learning) vs mentalistic terminology (mind, thoughts, subjective, perception, experience, mental processes). After the MT-IRAP was completed, the subjects were provided training in which words representing each factor of the Q Sorts (helping & understanding) were placed in a frame of equivalence with stimuli used in the MT-IRAP. After training, the MT-IRAP was administered again and the change from pre-to-post MT-IRAP effects was measured. Of the 11, four participants demonstrated a change in IRAP scores consistent with the values identified in their Q Sort. This paper examines this and discusses the potential implication of the malleability of IRAP scores and their relation to values for a science of behavior.

### *Acknowledgements*

I want to acknowledge five very important people who have impacted who I am and facilitated my journey to obtain this degree; these are my biological and behavioral parents.

I would not be here (literally) were it not for my biological parents: Jordan Pritchard and Rhonda Dunlap. Additionally, I want to thank John Dunlap for supporting me and my mother during my teenage years and into my young adulthood while weathering a variety of storms and providing a role model of his own kind.

All three should be credited with everything good that I have done and abnegated of responsibility for the rest. They provided a fertile, supportive environment that allowed me to fully and safely experience the contingency streams responsible for a skill set that now serves me well in my pursuit of behavior science. I have yet to meet a man who I admire, trust, and believe in more than my father. No matter what trials or tribulations I might be enduring, I was always able to count and lean on my father. His solid presence and model of how I should behave provided me with a safe port in any storm. My mother, on the other hand, might be considered the wind in my sails. She provided the perfect complement of support, motivation, and the occasional goading to get things done. Because of her, I have eagerly approached life and all the experiences contained herein. Through my formative years, my parents have been extremely influential, preparing me to successfully navigate college, graduate school, and the scary real world. John taught me to drive (so blame him) among many other life experiences that have and continue to serve me. Without these three people, I am nothing.

My behavioral parents then took the baton during my college years and applied their own guidance and influence. As such, I owe all that I am and do, professionally, to Jose Martinez-Diaz and Linda Parrot Hayes. As my behavioral father, Jose introduced and mentored me in the field of Applied Behavior Analysis. Through his mentorship, I mastered the basic principles, gained valuable practical experience, and was infected by his passion for our field. He lit my fire for behavior science. In the role of my behavioral mother, Linda took me in and through her special perspective had me questioning all I thought that I knew. Through rigorous training, she taught me the philosophy underlying our and other sciences, and inducted me into the nearly secret society of Interbehaviorism. Linda taught me more than science, though. She taught me what it means to be a mentor, influencing me in profound ways that I doubt she will ever realize. While I am fiercely proud of my heritage, I treasure my personal relationships even more. I doubt that either of these consummate professionals are aware of the impact they have (and continue to have) had on me, my career, and consequently, all of my students.

To all of my parents, I owe you my world. I cannot thank you enough for all that you have done. I hope to make you proud in all that I attempt to do. Thank you.

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*“The term behavior has to be such as to encompass all operations, from any frame of reference, whether ‘inner’ or ‘outer’” (Stephenson, 1953 p 112)*

## **Introduction**

Behaviorism has a long history as the object of misunderstanding (Wann, 1964; Wheeler, 1973), ad hominem attacks (de Mille, 1979; Slater, 2005), and premature declarations of death (Pinker, 2002; Smith, 1992; Zurriff, 1979). This may not come as a surprise, as BF Skinner’s approach to psychology has been described “as controversial as it was influential” (Rutherford, 2009). If there is truth in the repeated declaration of death, behavior science is posthumously growing in scientific power and clinical success – and some from within make efforts to proclaim that behavior science is indeed “alive and loving it” (Schlinger, 2002; Wyatt, 1999) . With the publication of each issue of a myriad of peer-reviewed journals, evidence mounts of the utility of behavior analysis in solving socially significant problems and as Roediger notes, while behaviorism is no longer as much in the mainstream as it once was, “anywhere prediction and control of overt behavior is critical, one finds behavioristic analyses at work.” (Roediger, 2004). In other words, if effective change actually needs to happen, psychology will turn to behavior analysis.

So long as psychology continues to harbor dualistic notions and assert that humans are unlike other members of the animal kingdom, it will be unable to provide a

robust understanding of human behavior of people, much less garner the respect of the natural sciences. Fortunately for psychology, Skinner and Kantor developed a natural science of behavior devoid of the myriad mentalistic notions popular throughout the history of psychology (Skinner, 1953, 1974; Kantor, 1924-26, 1981). Both radical behaviorism and interbehaviorism were inoculated from the pernicious effects of agency in the account of their subject matter. However, this inoculation did not protect these approaches to behavior science from misunderstanding by the psychological community at large. In fact, their contributions have often been discounted as being irrelevant and outmoded. Counter to the assertion of its death by cognitive psychologists in the 1960s, behaviorism is alive, and while still occupying a minor place in academic psychology, its numbers are growing substantially each year. However, this growth, while promising, may not be the indicator of health that it seems at first blush. Many of these new recruits may be more interested in the technology of behavior change than the natural science of behavior from which it has arisen. While this may be good for the short-term dissemination of behavior analysis, the long term well being of the field will depend on its appeal to those whose interests lie in the development and expansion of the philosophy, basic and applied science that undergirds this technology.

The current global “autism epidemic” has added to the growth of behavior analysis, moving it to the forefront of public awareness. It has also fostered the myopic view of behavioral science as a technology to combat the problem of autism. As a comprehensive understanding of human behavior, behaviorism’s well being is still at

risk. One reason for the limited influence of behaviorism on contemporary psychology could be the small number of degree programs offering a behavioral education. In addition, many of the newer programs in behavior analysis reside in a hodgepodge of colleges and departments outside of psychology.

Psychology writ large has rejected the experimental analysis of behavior, behaviorism, and applied behavior analysis as anything other than a historical curiosity (Rutherford, 2009), leading some behaviorists to call for the cleaving of the relationship between behaviorism and psychology (Fraley, 1998, 1999; Ledoux, 2001). Even Skinner was unclear about the discipline in which it might best fit, sometimes indicating that it should reside within biology, and other times psychology (1974). One behaviorist suggests that we are a third branch of physics (McDowell, 1988). However, a survey of the Association for Behavior Analysis International's list of accredited programs reveals that approximately seventy-five percent of its accredited programs reside within psychology departments (2010, ABAI).

Behaviorists have examined the reasons for the lack of acceptance of behavior analysis by mainstream psychology and have provided recommendations to remedy it. In 1970, Kantor provided an analysis of the experimental analysis of behavior (TEAB); and concluded that TEAB has "moved far away from the relatively simple standpoint...in nature and scope it still reflects clearly the reflex-conditioning background" (1970, p104). His solution was that TEAB expand its areas of interest to include "salient components of feeling and emotional behavior, volitional and voluntary actions, the

creative processes of imagination as well as the behavior called inventing, thinking, problem solving, and reasoning in *whatever situations they are performed*" ( P105). In short, he suggested that the experimental analysis of behavior must begin examining and describing psychological events that are of interest to contemporary psychologists. TEAB must address the entire psychological domain of humans as well as other animals. Almost 30 years later, Friman, Hayes & Wilson (1998) make a similar plea – suggesting that behavior analysts cease to avoid the study of anxiety and join mainstream psychologists who have devoted enormous resources to this issue. The fact that the study of private events (the topic of most interest in mainstream psychology) has fallen far behind the study of public events provides the substrate for the argument that if we leave such a ubiquitous subject matter to mainstream psychologists, behavior analysts will continue to be seen as irrelevant.

If our goal as behavior scientists is to get behavior analysis to become the mainstream approach to psychology, it is imperative that behavior analysis education and recruitment of future scientists begin much earlier than the graduate level. Course sequences in behavior analysis are proliferating due to the professionalization of the field. These courses are likely to attract large numbers of students who wish to be technicians to work with autism, rather than scientists developing behavior analysis as a robust natural science. In fact, many of these students learn about these courses through their interest and initial work in autism treatment. If behavior analysis relies on these students for the future development of behavior analysis, it is probable that the

science will continue to devolve into a technology for a single or limited number of psychological diagnoses, rather than persist as a robust science of psychological events.

After a cursory review of introductory psychology text books it is possible to gain insight into the topics that psychology students find appealing. Interestingly, a survey of these texts yields two important facts: a) most of the subject matter has been addressed by behavior analysis to some degree at least, and b) most texts do not include a behavior analytic interpretation of said phenomena.

An examination of these topics and the typical treatment in mainstream psychology may be telling in the reason for the exclusion of behavior analytic thinking in their descriptions. For example, most of the explanations of psychological events found in introductory text books appeal to some agent which drives human behavior. Given the explicit denial of agency, free-will, and mentalisms in a natural science of behavior, it is not surprising that a psychology text replete with explanations based on these concepts could not include behavioral explanations without appearing self-contradictory. Moreover, it is unlikely that the behavioral approach would have wide appeal, given the popularity of mentalistic explanations for behavior in the culture at large. In the almost forty years since Skinner published Beyond Freedom and Dignity, psychology has yet to rid itself of dualism, choosing instead to hold onto the idea of free will, soul, and agency in its account of psychological events. Analyses which threaten these ideas are likely to be off-putting, especially to a new student who has not yet been introduced to the value of a scientific approach to human behavior. This leaves the field

with somewhat limited options in the recruitment and training of high quality students, the kind of students likely to contribute to the understanding and development of a natural science of behavior.

To maintain its relevance, behavior analysis must be capable of understanding and investigating these same topics, while holding true to its natural science approach to psychology. The exploration of things such as subjectivity and implicit cognitions may be a first step in this direction. By answering Friman, Hayes, & Wilson's (1998) plea to engage in investigations that are of interest to mainstream psychology, behavior science is likely to see sustainable growth.

It is not without caution that these actions are suggested. In fact, it is with the understanding that there are significant barriers to the widespread acceptance of behaviorism as a philosophy, and subsequently behavior analysis as a science of psychology. Not only are these misconceptions common in critical articles of psychology and philosophy, there are entire books built around them (Proctor & Weeks, 1990), and even introductory psychology textbooks are anti-behavioral (Bavelas, 1978). In the introduction of About Behaviorism, Skinner introduced 20 things commonly said about behaviorism which he believed to be wrong (1972). The essences of some of the more relevant misunderstandings follow:

**Free Will.** The essence of the objection surrounding free will is that behaviorism dehumanizes man, is reductionistic and is indifferent to the warmth and richness of

human life, and by only studying animals, it can be said to only work with animals, but not people (Skinner, 1974). Machan (1974; 2004) defends free will, and criticizes the determinism in the science of behavior, asserting that the statement, "the mistake...is to put the responsibility anywhere, to suppose that somewhere a causal sequence is initiated." (Skinner, 1972) is wrong-headed, suggesting that the Skinner sought to reject the American way of life, and that "to pave the way toward the rejection of these facts and corresponding ideas about human affairs, Skinner has to attack the very possibility of human freedom of choice" (Machlan, 1974). Further, it limits itself to prediction and control and misses the essential nature of being man.

**Stimulus-Response Psychology.** Variations of this criticism have surfaced, ranging from the fact that behaviorists believe that people are simply automatons to the fact that behaviorism is simply a science based on reflexes. Kantor (1970) pointed to a reason this is likely prevalent; behaviorism arose from the examination of reflexive behavior in animals such as rats and pigeons. However, it did not remain at this level, and with the introduction of the operant, Skinner (1938) decidedly focused the science on non-reflexive behavior. Relational frame theory and its investigation into language and cognition further dispute the idea that behavior science is strictly stimulus-response psychology (Hayes, Barnes-Holmes, & Roche, 2000). Moreover, it is said to ignore consciousness, feelings, and states of mind, and fails to attempt to account for cognitions.

**Black Box Theory.** Criticisms of behavior science include the idea that it considers the organism to be a black box and thus ignores the 'inner happenings' such as thoughts,

feelings, and cognitions. It cannot deal with the depths of mind or personality, nor can it explain creative achievements. Furthermore, because of this purported ignorance, behaviorism is criticized as being unable to provide a complete account of people's behavior, as it misses the essence of humanity. Not only did Skinner never indicate that those events were off limits, or considered unimportant, he addressed them as 'private' events, and considered them as part of the subject matter for the science of behavior (Skinner, 1938; 1953; 1954; 1972). Moreover, Epstein and Skinner's research teaching pigeons to communicate, exhibit problem solving, and insight demonstrates behaviorism's ability to account for creativity and allow for its prediction and influence (1979; 1980; 1981). Epstein has continued in the tradition of creativity research (1986), and published a series of essays titled as such: *Cognition, creativity, and behavior: Selected essays (1996)*.

An area of application in which subjectivity and implicit cognitions may be of particular use is the dissemination of a natural science of behavior to the culture at large, in addition to other academicians in the social sciences. One potential solution for this problem has been an effort to translate behavioral concepts into more lay-friendly explanations and engage these budding scientists with these interpretations, piquing their interest, exposing them to the power and utility of a behavioral approach, and only then introducing them to the technical terminology and philosophical underpinnings. This solution relies on the ability of current behaviorists to so enamor students with these factors that they are willing to adjust their assumptions and embrace a thoroughly natural approach to psychology, often at the expense of long held

more traditional views. History does not suggest that this approach will be successful. For example, Lindsley took this approach with precision teaching, and while precision teaching has been successful in its own right, it has barely infiltrated the educational mainstream (Potts, Eshleman, & Cooper, 1993). It is an optimistic approach, but one which seems to ignore the contingencies likely at work on a college student obtaining a degree in psychology.

Another approach, mentioned by Critchfield (2006) is to examine the training of some of those in the field who have found success in interdisciplinary endeavours. He suggests that graduate training may need to be modified to prevent the splintering of our field. The fact that he does not mention undergraduate training is telling. It has been the practice of behavior science to recruit mainly graduate students, and rely on their work to develop the field. If the goal is to expand the acceptance and influence of behavior science on both an academic and popular understanding of behavior, waiting until graduate school to begin recruiting and training behavior scientists is too late. It is time that a concerted effort be exerted to recruit students earlier in their careers. To accomplish this, behaviorists must examine why undergraduate students pursue a degree in psychology, identify these values, and look for ways by which the philosophy, utility, and understanding inherent in behavioral sciences can be aligned with those values. An examination of this sort could provide fodder for future dissemination efforts and foster the growth of undergraduate curricula in behavior analysis, which might have important implications for the future of our field. If means can be found by which behavior scientists can engage the uninitiated freshman in psychology, it is likely

that these findings can be generalized and modified to create successful interactions with society at large.

Behavior scientists are tasked with the identification of values and subsequent recruitment of undergraduates to study behavior science and the exploration and investigation of topics of interest within the mainstream psychology and the larger popular culture. Below, details of tools to examine subjectivity and implicit cognitions are described, as well as their utility to a behavior scientist. Using these tools to further explore the things and events happening within our field should enhance the breadth of our understanding as well as produce the future scientists to develop the depth necessary to continue to be a progressive enterprise.

### **Implicit Cognitions**

Ever since the initial Patristic influence on the study of humans and behavior, psychologists have been searching for a method by which to examine the underlying immaterial substrate believed to cause humans to do what they do (Kantor, 1963). Even as psychology moved from an explicitly spiritual to a more material approach, the psychological scientist continued to study variations of these underlying things and events (Kantor, 1963). Whether called the will, instincts, mind, and most recently the brain, almost all accounts of human behavior have relied on some underlying causal mechanism at a level of analysis different from the events available for examination (Boring, 1953). Psychology has long been interested in trying to “unlock the mind”, to examine the “unconscious”, and to understand the relationship between the mind and

body. Most recently these underlying factors have been categorized as implicit cognitions such as attitudes, values, and beliefs. This dualistic account of psychology's subject matter undermines the development of a scientific account of human behavior.

The aforementioned reception of radical behaviorism by the scientific community, as well as a part of the lay population, may be amenable to change if these implicit cognitions do, in fact, impact overt behavior, perhaps by way of verbal relations or rule governance (Sidman, 1997; Blakely & Schlinger, 1987; Hayes, 1989). These implicit cognitions have been described by psychologists in terms such as attitudes, values, and prejudices, and have been considered to be the result of societal pressure, rather than originating from within the individual (De Houwer, 2001). Members of the lay community often succumb to the social pressures of our vernacular; one heavily laden with terms such as mind, will, and conscious (Skinner, 1989). As Kantor indicates, it is imperative for a logician of science to defend against the imposition of the pressures from society on the scientist's investigation of the things and events comprising his/her subject matter (1957). There is emerging evidence that these societal pressures, or implicit cognitions, are indeed malleable (Cullen, et al 2009). Thus, toward the goal of dissemination, it may be productive to identify implicit cognitions which may influence the acceptance of a natural behavior science and assess their impact. Additionally, examining these phenomena in their own right may be relevant to the science of behavior through coinciding interests with mainstream psychologists and the culture at large.

The unconsciousness, described by von Schiller and named in the 18<sup>th</sup> century by Reigel, was popularized in the late 19<sup>th</sup> century by Freud and Jung. It continued to be a large area of psychological study at the time Wundt founded one of the first formal laboratories using introspection as his main tool in developing experimental psychology. In 1910, Titchener defined the data from introspection as “the sum-total of human experience”. Watson attacked the practice of introspection in his 1913 behavioral manifesto, and as the behavioral movement rose, the popularity of introspection declined. However, in the 1950s, cognitive psychologists staged the “cognitive revolution,” asserting that behaviorism was dead (Broadbent, 1958; Neisser, 1967; Chomsky, 1959; Simon 1992). With this pronouncement, introspection regained its popularity. This approach to psychology assumes that a person can detect the internal influences on their behavior by way of introspection; and further that most behavior is the result of these inner mechanisms.

Introspection continued to be a main method of experimental psychology for more than half a century until, in 1977, Nisbett and Wilson examined the validity of introspection as an experimental tool. They noted that many studies by social scientists asked people why they liked certain things (Guadet, 1955, Kornhouser & Lazarsfeld, 1934), chose occupations and careers (Davis, 1964) as well as what had made them a criminal (Burt, 1925), relying heavily on introspection as a valid measurement tool. A more insidious problem arose when several cognitive psychologists suggested that these introspective activities about real events could be replaced with introspection about

potential experiences, such that the participants could be asked how their cognitive process would work if they were confronted with certain situations (Brown, 1962; Kelman, 1966).

About that time, other cognitive psychologists were beginning to question whether or not a person had direct access to what they termed the “higher order mental processes” involved in problem solving behavior (Mandler, 1975). Nisbett and Wilson (1977) approached this assertion as an empirical problem, to be solved with data as opposed to anecdotal evidence. Thus, they reviewed the available literature to determine whether verbal report was in fact correlated with the variables manipulated in experiments. They concluded that people rarely report accurately on the effects of particular stimuli on higher order, inference-based responses. When reporting on the effects of stimuli, people may not interrogate a memory of the cognitive processes; instead they may base their reports on implicit, a priori theories about causation. Finally, they suggested that subjective reports about higher mental processes are sometimes correct, but even the instances of correct report are not due to direct introspective awareness. In light of these conclusions, the practice of introspection has waned, although it has not disappeared altogether.

Assuming influential processes were not directly available, scientists began to explore the solutions available indirectly, namely that which resides in the “unconscious”. Although the unconscious as a subject matter of psychology had been popularized as early as 1895, experimental psychologists were skeptical of the term

(Breuer & Freud, 1955), and until 1974, it had faded from textbooks and vocabulary of many psychologists (Erdelyi, 1974). However, Greenwald (1992) suggested that unconscious cognitions were not only important, but could be examined empirically. He argued that the failure of introspection to account for the causes of behavior indicates that there are two important domains in unconscious cognition: a) cognition without attention and b) verbally unreportable cognition. In 1992, he issued the challenge that unconscious cognitions must be explored. Three years later, Greenwald and Banaji (1995) defined implicit social cognitions as the type of cognitions that are verbally unreportable, yet influence current actions. They list methods by which individual differences in implicit cognitions may be measured and point out that measuring response latency to judgments of stimuli could be a future direction in psychological research on implicit cognitions.

### **Implicit Association Test [IAT]**

Shortly thereafter, Greenwald et al published an article describing a tool by which to measure these response latencies to judgments: the Implicit Association Test [IAT] (Greenwald, McGhee, Schwartz, 1998). They viewed this tool as a reply to the attacks on the theories of social consistency via introspection of earlier decades. Greenwald (2002) subsequently used the IAT to provide measures of implicit cognition from which he developed a unified theory of implicit social cognitions in which he articulated three terms: concept, association strength, and concept activation. *Concept* was defined as a feature that represents persons, groups, or attributes. Positive and

negative valences were especially important to the latter. Attribute concepts were those typically used as stimuli in implicit tests. *Associations* were “relations between pairs of concepts” (Greenwald, 2002). They relied on diagrams of concept structures in which associations were links between related sub-concepts within the structure. For example the concept of “Me” can be linked to a range of sub-concepts such as “father, strong, athletic” and in this diagram, the “Me” and each sub-concept would be linked with a line indicating an association. *Association Strength* was the potential for one concept to activate the other. This would be indicated in the diagram by the thickness of the lines which represent the associations. Finally, *concept activation* was the occurrence of activation by external stimulation or excitation through associated concepts.

The IAT consisted of a computer program in which responses were mapped onto a left key and a right key (See Appendix B). In the training phase, participants were instructed to press the left key if a sample stimulus (presented mid-screen) fell within a target concept (e.g. sample stimulus of “tulip” would fall within the concept of “flower”), and to press the right key for another set of concept-stimuli relations. If incorrect responses occurred, a red X appeared on the screen, and the correct answer was required to continue. In the second phase of training, the participant was instructed to press a left key if the sample stimulus had a target attribute (e.g. sample stimulus of “beautiful” has the attribute “good”), and to press the right key for the opposing set of attribute-stimuli relations. For the combined test phase, the participant

was instructed to press the left key if the sample stimulus was a member of the concept class or had the attribute that was trained earlier on the left and right key, respectively. Next, the participant was instructed to reverse the key presses on which the target concepts been mapped. For instance, the left key was the response for a stimulus that fell into the flower concept, it should now be the right key. Finally, the participant was tested with the new reversed concept-key mappings.

Greenwald (2002) states that his unified theory is grounded in understandings of social cognition which replaced the “law-of-effect conceptions of reward and punishment based on the learning-theory traditions of Thorndike, Hull, and Skinner” in the 1960s with thorough-going cognitive alternatives. Based on his description of its origin, the unified theory of implicit social cognition resides squarely within a cognitive realm, shunning the ‘law-of-effect’ influence of behavioral thinking.

Since its development, the IAT has been used in a wide variety of disciplines including social and cognitive psychology (Greenwald & Nosek, 2001; Fazio & Olson, 2003), clinical psychology (de Jong, Pasman, Kindt, & van den Hout, 2001; Teachman, Gregg, & Woody, 2001), developmental psychology (Baron & Banaji, 2004; Dunham, Baron, & Banaji, 2004), neuroscience (Phelps et al., 2000; Richeson et al., 2003), market research (Maison, Greenwald, & Bruin, 2001), and health psychology (Teachman, Gapinski, Brownell, Rawlins, & Jeyaram, S., 2003). It has also been used to address an equally diverse range of topics including attitudes (Bargh, chaiken, Raymond, 1996; Chaiken & Bargh, 1993), beliefs (Banaji & Hardin, 1996; Banaji, Hardin & Rothman, 1993;

Dovidio, Evand, & Tyler, 1986), impression formation (Higgins, Rholes, & Jones, 1977; Levy & Dweck), person perception (Anderson & Sedikides, 1991; Bargh, 1989), self perception (Fazio, Paul, & Olney, 1984; Greenwald & Banaji). In fact, Yale and Harvard both have a website on which browsers can take the IAT. By 2003, over 150,00 IATs had been delivered through the Yale site alone.

Despite its widespread use and popularity, some aspects of the IAT have been criticized and other variations of implicit cognition measurement tests have evolved. These criticisms include the fact that the IAT only measures associations of targets/attributes based on the complementary relationship. For example, if examining relationships between flowers and bugs as concepts, the IAT will allow the investigator to measure the associations of “good” and “bad” attributes of flowers, but only as compared to bugs. If a participant’s results indicate that flowers are associated with “good”, it does not indicate that in and of itself, the concept of “flower” is associated with “good”, but rather that in relation to “bugs” the concept “flower” is associated with “good”. This leaves the experimenter with only a measure of relative association strength between concepts, rather than an absolute strength of the concept (2002, Dehouwer). Thus, the IAT lacks precision and strength in understanding the *nature* of attitudes/associations and shows an inability to assess the associations involving specific exemplars. In the aforementioned example, there could be several explanations: the participant truly finds flowers to be “good” or the participant finds both flowers and insects to be “bad”, but insects more so.

### **Go/No-Go Association Task [GNAT]**

Nosek and Banaji (2001) developed the Go/No-Go Association Task [GNAT] to remedy the limitation that the IAT can measure only a relation between two concepts, and provided a tool to measure the implicit social cognition toward a single target concept. In their introduction to the new tool, Nosek and Banaji demonstrate its utility by separating two concepts in racial attitudes: in-group favoritism and out-group derogation. Because of its capacity to separate measures of attitudes towards a single concept, the GNAT was able to demonstrate the dual presence of both out-group derogation and in-group favoritism.

The GNAT is a computer program in which the participant must either respond or withhold their response based on the sample stimuli and target concepts/attributes (See Appendix C). The procedure consists of two practice phases and a test phase. In the first practice phase, the participant is instructed to press a key when the sample stimulus that appears on the screen falls within the concept category and to withhold a response when the sample stimulus does not. During the second practice phase, the participant is instructed to press a key when the sample stimulus has the specified attribute and withhold a response when the sample stimulus does not. In both phases, correct responses are consequted with a green circle, and incorrect responses with a red x. During the test phase, the participant is instructed to press the key if the sample stimuli is either a member of the concept category or has the target attribute, and withhold response if it does not.

Based upon signal detection theory, the GNAT works by having the participant detect signals (matching of stimuli to category with an attribute) and ignore noise (non-categorical stimuli). The participant presses a single key (e.g. spacebar) when the signal occurs, and withholds a response when noise is presented. Because of these features, the GNAT can assess preferences for a category in the context of a single other concept, superordinate category, generic category, or no categories just evaluative/attributive contexts (Blair, Ma, & Lenton, 2001). These options were explored in six different experiments reported in Nosek and Banaji's paper (2001), the first five of which were to explore the parameters and the sixth to demonstrate the utility of the tool in a well-examined phenomenon: racial stereotyping.

While the GNAT provides some new avenues to explore implicit cognitions, it was also demonstrated to have some limitations. The most important of these was that the sensitivity of measurement of cognitions did not vary by the target concept or evaluative category, implying that the GNAT measures association between target and category, rather than the relative association between complementary and non-complementary. Nosek and Banaji acknowledge that no single implicit measurement tool can answer all research questions and recommend that the IAT be used in instances in which the relative association between naturally dichotomized stimuli may be of interest (2001). For instance, if a person were interested in the relative strength of association for a participant of hot and cold, the IAT would be a candidate. If, on the other hand, a scientist wished to examine the strength of "goodness" associated with a

singular category that does not have an opposite and complementary category, such as food, the GNAT would be a better option.

### **Extrinsic Affective Simon Task [EAST]**

De Houwer (2003) suggests that measurement of implicit cognitions should occur within a single task to remedy a limitation of the IAT (and the GNAT). He asserts that a reliance on comparison of performance in two separate tasks is problematic because, by virtue of these two tasks, there is a potential that participants 'recode' the tasks to simplify them. In their discussion of other explanations underlying the IAT effect, Mierke and Klauer (2001) point out that in a task in which two concepts are mapped onto one key (flower and positive to left key) and the other two concepts mapped onto the other key (insects and negative to the right key), a participant may simplify the task by pressing a left key for all positive stimuli (which includes flowers) and vice versa for the right key. This short-cutting by participants can lead to sequence effects. De Houwer (2003) developed the Extrinsic Affective Simon Task [EAST] as a means to avoid this problem as it allows for the comparison of performances within a task.

The EAST is similar to the other implicit cognition tests in that a left and right key are assigned to some attribute (e.g. good/bad), and stimuli are presented to the participant (See Appendix D). However, it differs from previous tests specifically in the instructions provided. The participant is trained to respond on the appropriate

response key based on the stimulus word's meaning, *if the word is a certain color* (generally white). In a second phase of training, the participant is trained to respond on the left or right key based on a subtle color difference (e.g. blue/green). During the testing, the participant must respond differentially based on the color, and sometimes the meaning of the word (De Houwer, 2003). Because of this procedure, the EAST allows for the measurement of single as well as multiple associations. While the IAT necessarily uses complementary pairs of concepts and attributes (Greenwald and Farnham, 2000), the EAST allows for a more precise examination of a single concept because one may measure the attitude towards said concept by comparing the time needed to make a positive response with that needed to make a negative response to the same stimuli.

While the IAT is still predominantly used in the social cognitive tradition to measure implicit social cognitions (De Houwer, 2003; De Houwer, 2001; Nosek and Banaji, 2001; Nosek, Greenwald & Banaji, 2007), the addition of the EAST and GNAT has allowed for an examination of a variety of implicit attitudes, as much as relations between and across concepts, stimuli, and attitudes. While the IAT and GNAT are found to exhibit larger mean effects than the EAST (De Houwer, 2001), it has been suggested that the size of mean effects are of little importance (Perugini & Banse, 2007, Blanton & Jaccard, 2006; Greenwald, Nosek, & Sriram, 2006) in this line of research. In a recent assessment of the standing of cognitive psychology in regard to implicit cognitions, Banse and Greenwald say that the state of the field "inspire[s] optimism that this work

will ultimately yield substantial results” and that “output of the bottom-up approach investigating the underlying mechanisms of implicit measures” will yield substantial results (2007). Further, they conclude that with these tests they “have more suitable tools to measure automatic behavior tendencies for personality constructs that differentially determine behavior across persons....and should be able to better predict and understand human self-regulatory behavior in general, and in particular problematic behaviors such as aggression, dieting, addiction, and many types of pathological and delinquent behaviour” (Banse & Greenwald, 2007).

Regardless of the accuracy, ease of use, and robust effects seen with these measurement tools, as long as the experimenter is measuring constructs linked to a bankrupt theory of behavior, the measurements will be worth only as much as their theoretical counterparts – in this case, nothing. For instance, the social cognitive theory focuses on independent variables that are not subject to manipulation (i.e., personality constructs) which at best this can lead to prediction, but not control. As Banse and Greenwald (2007) admit, brute force empiricism does not equate to scientific progress. Conceptual systemization is critical to the development of a progressive science of behavior.

Skinner (1990) states that because psychology has been “unable to offer a useful conception of its subject matter”, it has “given neurologists an impossible assignment, and the search for internal determiners has obscured any help it could give genetics.” The logician of science must guide the psychological scientist away from the

confusion with constructs of things and events seen in the underlying mechanisms presumed to account for the effects of implicit cognition. Nonetheless, the response latency is a component of behavior in a functional relationship with *some* environmental factor, and thus, this large body of data might be of use in further understanding human behavior.

Behavior analysts would do well to find methods by which to examine things and events which other psychologists have purported to study, but in a way that is scientifically and conceptually coherent. Moreover, the aforementioned cognitive methods have yielded empirical data even though their descriptions of these phenomena may be incoherent with a behavioral worldview and approach to science. Although these interpretations may be wrong-headed, their data and methods are still of interest, and should not simply be discarded. Rather, an examination of these “misinterpretations” is supported by one of most significant contributors to our intellectual lineage: “many of the facts, and even some of the principles, that psychologists have discovered when they may have thought they were discovering something else are useful” (Skinner, 1987). Happily for behavior scientists, there have been developments within the behavior analytic traditions which examine these same phenomena without recourse to internal processes or mentalistic explanations. While these methods are still in development, and are likely to need additional validation and empirical support, they offer promise of a bridge from the behavioral perspective to large amounts of data,

which may, with some reinterpretation, yield effective action towards the dissemination/adaptation of a natural science of behavior.

### **Implicit Relational Assessment Procedure [IRAP]**

According to Relational Frame Theory [RFT], the capacity to derive relations among stimuli (ie., same/different, me/you, here/there), based on arbitrary cues, provides the basic foundation of language and cognition (Hayes, Barnes-Holmes, & Roche, 2001). Based on the findings of O'Toole et al (2007), some relational frame theorists developed a tool called the Implicit Relational Assessment Procedure [IRAP].

Barnes-Holmes et al (2008) introduced the IRAP as a derivative of the Relational Evaluation Procedure [REP]. The REP was a procedure in which participants were presented with a task that required them to evaluate/report on the stimulus relation presented on each trial. The REP was used to analyze relational responding in adults in a number of studies and was readily adapted for an assessment of relational responding that could be interpreted as 'implicit' (O'hora et al, 2004, 2005; Stewart, Barnes-Holmes, & Roche, 2002, 2004).

The IRAP is a combination of the REP and the IAT in that it involves presenting specific relational terms ( e.g. SAME, DIFFERENT, GOOD, BAD) to allow for the assessment of relations among relevant stimuli. In addition to the relational assessment, the IRAP asks participants to respond quickly and accurately under different conditions of instruction (e.g. consistently or inconsistently). While the dependent

variable is response latency, as with the IAT, the underlying assumptions proposed to explain the IRAP effect is that average response latencies should be shorter across blocks of consistent trials as compared to those in inconsistent trials (Barnes-Holmes et al, 2008). An appeal to response competition, relating of different strengths, or the idea that relations which are at strength will be exhibited with greater fluency does not require the invention of mentalistic or internal causal factors (O'Toole et al., 2007; De Houwer, 2003).

Researchers tentatively suggest that responses may be emitted with longer latencies when participants are responding out of keeping with previously established derived verbal relations (Barnes-Holmes et al, 2008). Moreover, they suggest that each trial of the IRAP presents a target stimulus with contextual cues specifying relational and functional dimensions which produce immediate, private relational responses before the participant actually presses a response key. The probability of these initial responses is a function of historical and current contextual variables (both verbal and nonverbal). Thus, the relation at strength will occur more immediately, and the consistent trial will actualize correct key-pressing functions while the inconsistent trials will not (Barnes-Holmes et al, 2008).

Within just a few years, multiple studies have found that the IRAP demonstrates predicted differences between known groups in a variety of areas: attitudes towards country and city life (Barnes-Holmes, Waldron, Barnes-Holmes & Stewart, 2009), meats and vegetables (Barnes-Holmes et al , 2010), different nationalities(Power, Barnes-

Holmes, Barnes-Holmes & Stewart, 2009), ages (Cullen, Barnes-Holmes, & Stewart, 2009), & race (Chan, Barnes-Holmes, Barnes-Holmes & Stewart, 2009), self-esteem (Scanlon, Barnes-Holmes, Barnes-Holmes & Stewart, under review; Vahey, Barnes-Holmes, Barnes-Holmes & Stewart, 2009), and sexual attitudes (Dawson, Barnes-Holmes, Gresswell, Hart, & Gore, 2009; Cullen & Barnes-Holmes, 2008). Additionally, compared to the IAT, the IRAP is much more difficult to fake (McKenna, Barnes-Holmes, Barnes-Holmes, & Stewart, 2007). In comparison to explicit reports, the IRAP also demonstrates divergent patterns (like the IAT) in situations that would evoke deceptive responses such as attitudes towards different nationalities and races (Barnes-Holmes, et al 2010; Power et al, 2009).

Studies conducting a comparison between the IAT and IRAP found that the IRAP was as good, if not better at predicting behavioral intentions and had comparable internal consistency (Barnes-Holmes et al, 2009; Barnes-Holmes, Murtagh et al, 2010; Roddy, Stewart & Barnes-Holmes, 2010; Roddy et al, 2010). A recent study demonstrated that a public versus private context did not have an impact on the IRAP effect, supporting the validity of its findings (Barnes-Holmes, Murphy, Barnes-Holmes, & Stewart 2010). This is in contrast with the effect on IAT results conducted in public relative to private contexts (Boysen et al, 2006). An additional benefit of the IRAP over the IAT is the former's ability to examine each effect individually.

### **Mixed Trial Implicit Relational Assessment Procedure [MT-IRAP]**

While the IRAP provides a step towards a behavior analytic account of implicit cognitions, it also suffers from a few limitations. First, the IRAP remains a measurement at the level of the group. Second, it can detect effects on a concept level, but not with respect to individual stimuli. Finally, it utilizes block designs which could produce practice effects (as seen in the IAT) and during which corrective feedback can be confounding.

Fortunately, a variation of the IRAP, called the Mixed Trial Implicit Relational Assessment Procedure [MT-IRAP], adds additional precision by combining the consistent and inconsistent trial types into each test block to eliminate block sequence effects (Levin, 2011). The use of contextual cues (“truth” and “lie”) to signal the participant to exhibit either consistent or inconsistent responses eliminates the problems with the trial blocks and the corrective feedback in the IRAP procedure. Another benefit of the MT-IRAP is that by using these contextual cues, the experimenter does not choose the direction of the responses beforehand. By allowing the participant to define, by responding, their perspective of “truth” and “lie,” and by requiring only consistent responding based on these perspectives, the potential assessment and training effects are minimized. This is very important when examining the IRAP effects on an individual level and with respect to individual stimuli. After an initial examination of the reliability and capacity to detect implicit relations, Levin concluded that the “modifications made with the MT-IRAP provide the necessary precision to examine individual stimulus effects. It is less clear whether the MT-IRAP is sufficiently reliable and accurate to

detect individual participant effects” (in press). As with the IRAP, future empirical studies are required to further validate and explore the accuracy and utility of the MT-IRAP.

### **Science of Subjectivity**

In response to Titchener’s introspective approaches, Watson made the case that “psychology as the behaviorist views it is a purely objective experimental branch of natural science” (1913, p 158). Since then, he and many other behaviorists have insisted that the emphasis be on objectivity, implying a rejection of subjectivity. However it is not the case that all behaviorisms deny subjectivity as a legitimate subject matter (Midgely & Morris, 2002). Rather, those behaviorists who have developed the most thorough-going natural scientific approach to behavior have suggested that subjectivity does indeed belong within the things and events eligible for study (Skinner, 1974; Kantor, 1975). The question often raised is how to best accommodate subjectivity and whether its accommodation threatens the very basis of a natural science.

Johnston and Pennypacker, in a popular research methods text book for behavior analysts , indicate that while many people believe science to be a strictly objective science, “scientists, and those who study how science really works, know better” (2009, p 299). They further expand that scientific methods should accommodate subjectivity, not only because it is unavoidable, but also because of its value. One such example of this value according to Wolf (1978), is the relevance of

social validity as an important component in the applied science of behavior. The first dimension of applied behavior analysis, “applied,” requires that change be of social significance (Baer, Wolf, Risley, 1968). Social significance is largely a subjective construct, and as such must be explored subjectively. Wolf tempered this recommendation by pointing to a potential problem, namely that “subjective data may not have any relationship with actual events” (p 212). Traditional views of behavior analysis often leave the impression that while subjective data, and subjectivity, as topics of interest may be valued, they are beyond the reach of investigation.

This was not held to be the case by mainstream psychologists who utilized R methodology, developing many techniques to collect data on subjectivity. In fact, an entire discipline, psychometrics, is devoted to just this sort of thing, and around the same time that Watson began exalting objectivity, correlational and factor analytic techniques were developed. While acknowledging that the development of psychometrics is “one of the great empirical ventures” of the 1920s and 30s, Rogers (1995) calls attention to a strange paradox formed through its methodology, namely, its revelation of commonalities among tests rather than people, although purporting to examine the latter. Brown (1980) explains this problem best:

“correlation of and factor analysis of scale responses leads not to a taxonomy of behavior as commonly thought, but to a taxonomy of tests. This misconception might be compared to that of a physicist, who, if upon discovering a high correlation between the measurement of his watch and his wall clock, assumes

he has measured time. All he has really shown is that his two *measuring devices are related*, which says *nothing about time*. There is no underlying dimension, such as time, which is causing the two time pieces to correlate or load heavily on the same factor; it is simply that their mechanisms have been constructed in virtually identical ways (emphasis added, Brown, 1980 p5).”

Fortunately, Stephenson (1953) provides a methodology by which a natural science of behavior can readily investigate subjectivity. He literally turned R methodology on its side in 1935 when he noted that “previously a large number of people were given a small number of tests, now we give a small number of people a large number of test-items.” Stephenson understood that in contrast with most questionnaires, which were sequential, a ranking activity, such as a Q Sort better fit a psychological field theory derived from his physics training. In questionnaires, the end result is simply a sum of its parts; but a Q Sort is a holistic procedure in which all elements are interdependent. Moreover, the result of a Q Sort is one in which the investigator must break away from the notion of each ‘part’ being an individual datum, and instead examine the whole of the configuration (Rogers, 1995). Stephenson had developed a methodology that measures the dynamic expressions of people when exposed to a large number of statements about a topic. From this examination, Stephenson studied what he would eventually call operant subjectivity. While not typically considered a ‘behaviorist’, Stephenson identifies himself as a “Kantorian” (1986), and as such, developed a method to study this subjectivity which fits well within

both the radical and interbehavioral traditions. To any behavior scientist who may question the utility of investigating subjectivity, as being “in direct conflict with objective observations” (Skinner, 1953), Brown asserts, “lies, deceptions, and untestable statements may also be lawful, and in any event are the life-blood of a culture.” Accordingly, a robust science of behavior must not arbitrarily restrict itself to the assessment of “true assertions” (Brown, 2002).

Stephenson first introduced this approach, Q methodology, in a letter to Nature (1936), which he later explained should be used by psychologists to study ‘subjectivity’ as an actual event in its own right (1953). Due to his Kantorian influence, Stephenson defined subjectivity as the “condition of viewing things exclusively through the medium of one’s own standpoint or situation” (Stephenson, 1981 p 73). To a behaviorist feeling uncomfortable with this departure from objectivity, and the feeling that talk of ‘standpoints’ or ‘perspectives’ treads dangerously close to phenomenology, Stephenson made reassurances: “What has hitherto been conceived as consciousness, can be experimentally investigated along Q-lines, minus *categorical, culturally determined, and transcendental* presumptions” (emphasis added, 1982, p 240). Moreover, Stephenson (1968) made the proclamation that a scientific psychology can accommodate “subjectivity, but not consciousness. Consciousness goes out, but subjectivity remains in.”

Kantor describes the “behavior of specific individuals in relation to concrete objects and events” as interbehavior (1959), occurring within a complex field of other

factors. Within this interbehavioral field, subjectivity is a participant in the psychological event – the concatenation of stimulus and response functions, history of interactions, current setting, medium of contact and specificity of the event. Subjectivity is about the individual in that it is specific to the individual engaged in the event and as with all events, by virtue of being personal, is unique. For instance, if a person is interacting with some object in the environment, the psychological event field is that in which the person and the object are interacting; however, if this event is being studied in an investigative sense, there is another unique psychological event field containing the investigator interacting with the psychological event of the person interacting with an object in their environment (Midgely & Morris, 2002). The notion that each event is unique to its participants provided Stephenson a substrate upon which to build an objective investigation of the things and events with which he was most interested, namely subjectivity. Subjectivity is nothing more, or less, than shared statements about a topic, such that it is simply the communication around topics and ideas. While it may appear on its face to be a statistical procedure for “reading minds”, or to provide indicators of mental happenings, it remains a purely empirical approach by which factors of operant subjectivity emerge naturally. In the tradition of Kantor (1983), the fundamental data consist of “specific individuals operating with the objects in the Q sample and in relation to the field conditions of the concrete situation” (Brown, 2006).

In Q Methodology, the objects in the Q Sample are derived from a concourse, or the “the flow of communicability surrounding any topic...in ordinary conversation,

commentary, and discourse of everyday life” (Brown, 1993). Accordingly, Stephenson (1978) describes a concourse theory of communication in which includes the “basis upon which to determine structures of subjectivity in non-categorical, *operant* factor terms” (p 22). In his theory of concourses, Stephenson makes the following points (1978):

- 1) Subjective communication is grounded in statistical quantities of “statements “ about a subject
- 2) Each “statement” is equally probable and equipotential, a priori
- 3) All “statements” of a concourse have self-referent possibilities
- 4) Concourses will concern meanings rather than facts
- 5) All subjective communication is reducible to concourses
- 6) Complex subjective situations are so reduced to concourses is not a reductionist assumption
- 7) There are infinite number of concourses (and these need not be verbal)
- 8) Concourses are empirically grounded

From these premises, Stephenson describes a theory which rejects the examination of facts, as such, focusing instead on the subjective perspective of a person based on their history and context. Because of pragmatic concerns in the development of an experiment, samples must be taken from the concourse (in which statements are both infinite and equally probable). All statements are self-referent, allowing the investigator to examine the relationship between statements and the participant. When Stephenson discusses self-reference, he is simply making the point that each observer is observing from a particular vantage point, and statements of ‘self-reference’ implicate the observers’ vantage. In this way, Stephenson considered his theory of communication to be the reverse of the theory of information in that the latter is

concerned with facts while the former focuses on meanings (1978). Moreover, for each objective statement of fact such as “here is a tree” there can also be many subjective statements (e.g. “it is beautiful”, “why is that tree blocking my view”, “I bet that’d be fun to climb”, etc.). Each of the subjective statements has a self-referential quality with the implicit prefix “*I believe that,*” (Brown, 2006).

Although it is assumed that all subjective communication can be reduced to concourses, this does not mean that one can use concourses as an explanatory or predictive construction – thus rejecting the seeming reductionism in premise six. The proposition underscores the importance of viewing the results of a Q Sort in its entirety, rather than simply as a sum of parts. Finally, although concourses are infinite in number, they are empirically grounded such that concourses of different cultures and communities vary, and they can be obtained from any situation in which communication is involved.

From this core theory, Q methodology rests on the synthesis of configurations of statements from a concourse, mediated by “focalizing attention” of a participant and thus giving rise to operant structures (Stephenson 1978, p 30). Thus, the use of subjective self-report via Q sort can be naturalized by way of the objective structure in multidimensional space that arises, providing a universal unit of measurement and a “new kind of fact for science to consider. It can be observed for subjectivity wherever it is expressed” (Stephenson, 1978, p 35). In other words, the result of the Q Sort, a Q

Factor structure, must be viewed in its entirety as the unit of analysis, rather than be reduced to its parts.

The Q Factor structure is the participant's overview of a concourse, obtained through the use of a Q Sort. In a typical Q Sort, a participant is provided with a deck of cards on which statements derived from a concourse of interest are written. The participant is asked to rank-order the set of statements from agree to disagree based on a condition of instruction. Following this sorting, the Q Sorts are subjected to three sets of statistical procedures: correlation, factor analysis, and the computation of factor scores (McKeown & Thomas, 1988). From these statistical procedures, the investigator obtains factor loadings, which are correlation coefficients indicating the extent to which each Q sort is similar or dissimilar to a model Q sort for that subjective type.

Subjectivity is ubiquitous, and it is thus readily available for investigation by a behavior scientist with the right tool. Stephenson provided one such tool, the Q Sort, which makes available the measurement of operant subjectivity (1977). Operant subjectivity is named such because its emergence is independent of the device by which it is measured (much like a pigeon's operant in a Skinner Box). Although the use of 'operant' is borrowed from Skinner, it was also influenced, partly, by Charles Spearman's pursuit of 'g' (general intellective ability). Stephenson did not want to measure subjectivity with a tool that influenced the event it was supposed to be measuring. Brown indicates that the bane of conventional R factor analysis is this very problem – and that R factor analysis "skates dangerously near tautology" (1999).

From the aforementioned theory of communication, a concourse is the place from which an investigation of subjectivity should begin. Stephenson provides a measurement procedure as the “instrumental arm of his comprehensive science of subjectivity” (Brown, 1999) called Q methodology. This methodology has been used in a diverse range of disciplines outside of psychology. To date there have been over 2500 studies involving Q Methodology (Brown, 2008). Despite origins in an experimental psychology laboratory, Q Methodology was mostly rejected as inferior to R method by psychologists following Sir Cyril Burt’s dismissal. While Q Methodology did not gain popularity within psychology at the time, it did become widely used outside of academic psychology and psychometry (Brown, 1999). It has recently come to the attention of behavior analysts, and several have begun to examine its utility in the study of behavior.

Brown (2002) calls for a subjective behavior analysis, describing some of the circumstances in which Q methodology may be of use to behavior analysis. Midgley & Morris (2002) point out the convergence of Q Methodology with Skinner’s radical behaviorism and Kantor’s interbehaviorism. They make the case that subjectivity can be understood in both traditions as synonymous with Skinner’s (1974) notion of privacy and Kantor’s notion of specificity (1981, p 228). Q methodology provides a systematic way of accessing the “private” or “specific” events of interest without “compromising fidelity to observables” (Delprato & Brown, 2002). By incorporating Skinner’s notion of the operant within the Kantorian interbehavioral field theory, Q methodology provides us with a measurement tool capable of a behavioral investigation of subjectivity. At the

same time, Delprato & Brown describe seven major characteristics of the operant construct. Of these seven characteristics, four are most relevant here: the fact that Q factor structures are operant and subjective; operant factor structure is not evaluated; operant factor structure follows operations; and operants are naturally-occurring events (Delprato & Brown, 2002).

*Q Factor Structures are Operant and Subjective.* The operant, coined in 1953 by Skinner is a “set of acts under the control of the same variables” (p 65) instead of just a single response. It is critical to understand that operants are not controlled exclusively by antecedent stimuli (such as a reflex would be) and that its members are not wholly predictable. The use of the operant as unit of analysis for the science of behavior acknowledges the complexity and sheer number of topographical options which may occur as a result of an organism’s history and current context. These classes of responses comprise operants and, as such, highlight function as opposed to structure. The operant properties of Q factor structure allow for the measurement of subjectivity by way of self-referential communicability (Stephenson, 1987). Delprato & Midgley (1992) have described the opportunity provided by the operant to encompass mentality within a nondualistic behaviorism. They concluded that the Q factor structure is operant due to the inherent behavioral nature of all it represents (2002).

*Operant factor structure is not evaluated.* The participant in a Q sort gives a subjective operant response to the statements provided. This response is neither right nor wrong. Likewise, there are no evaluative attributes as might be seen in a

conventional assessment. Because Stephenson's aim was to investigate subjectivity and to keep it within the realm of natural science, he did not require that subjectivity be subject to validation or evaluation. Furthermore, he suggested that the substance of subjectivity is self-reference such that an objective statement (fact) about the world can engender an infinite number of subjective self-referent statements (Stephenson, 1980). Accordingly, self-referent statements are not right or wrong, but occur contextually – much as a lever press by a rat is emitted rather than elicited (2002). As a free-operant, subjectivity can be seen as spontaneous because the organization of the Q sort is not a pattern prescribed by the experimenter.

*Operant factor structure follows operations.* By utilizing an inductive approach, the factor structure, as an operant, follows operations rather than the other way around. The investigator can then follow the data, allowing for the emergence of things and events of interest, rather than trying to force the factors into a preconceived construct/hypothesis. Brown makes the point that in Q operants, “nothing is postulated beforehand; the behavior is merely there” (1980, p 4)

*Operants are naturally occurring events.* Stephenson has insisted upon the notion that factors are naturalistic and exist in the same way that other objects and events are found in the world (Stephenson, 1973; 1987). Brown has demonstrated that operants are reproducible (1980), and thus, they fit into the Kantorian interbehavioral field as confrontable spatiotemporal things and events.

Given these four characteristics, it seems apparent that Q Methodology is not only compatible with a natural science of behavior, but necessary if the science is to include both objective and subjective events as its legitimate subject matter. Behavior scientists would do well to examine and explore Q Methodology as a means to investigate some of the things and events that are currently being ignored on the grounds that they are believed to be inaccessible.

### **Purposes of the study**

It is imperative for behaviorists to begin recruiting and training highly qualified and motivated undergraduates who value science and are able to contribute to the progressive development of a natural science of behavior. By utilizing Q Methodology to develop some Q factor structures which exposed viewpoints surrounding the main reasons undergraduate students pursue psychology as their major, behavior science can take one step closer to understanding how to best recruit them. Identifying some reasons that students join the psychological discipline, the MT-IRAP can allow scientists to study the cognitive relations students exhibit regarding concepts and topics implicit in behaviorism versus mentalism.

A freshman psychology student may not have an elaborate history with behaviorism, given its limited treatment in introductory textbooks. Because of this limited history, it is important for the investigator to contrive one based on popular criticisms to a behavioral account of the world. By doing this, an analogue to the

cultural imposition likely to impact future decisions of the student is created. By creating this analogue, implicit cognitions may form which reflect those shown by many psychologists after gaining a history through professors, books, and critical reviews during their undergraduate years. In addition, the creation of this analogue history allows the investigator to better understand how these implicit cognitions may form and interact with a student's acceptance of behaviorism.

While an understanding of how a history with behaviorism may influence a student's behavior towards it, it is not pragmatic to attempt to intervene on the histories of all undergraduates that are candidates for recruitment into the science. Instead, a behavior scientist would do well to identify a method by which they could intervene after the history has formed, to change the acceptance, and perhaps implicit cognitions of the student towards behaviorism. Added to this there is little evidence to suggest a change in implicit cognitions yields a change in explicit behavior, such as choosing to pursue a degree in behavior analysis.

### **Research Questions.**

From the aforementioned goals, several empirical questions arise:

#### ***Primary Questions:***

- 1.) Within some constraints regarding areas in which behaviorism can be aligned, what perspectives arise when undergraduate students are asked to communicate about why they chose psychology as a major?

- 2.) What are some implicit cognitive relations exhibited by undergraduate psychology students around topics important to behaviorism and mentalism?
- 3.) What happens to those cognitions if the participant is trained in equivalence relations aligning some topics in behaviorism with the participant's perspective as emerged from a Q sort?

## **Method**

### **Participants**

The study population consisted of 13 undergraduate students pursuing a degree in psychology who have volunteered and are earning extra credit at the University of Nevada, Reno. All participants were seated at a computer in a private room in a research laboratory at the University of Nevada, Reno. The entire experiment was conducted on a computer equipped with Windows XP, an LCD monitor, keyboard and mouse.

### **Order of tasks:**

Each participant was presented with various tasks throughout this experiment, the order and detailed descriptions of which are delineated below. The MT-IRAP was the same tool presented pre and post intervention. During each task change, the participant was provided with a 2-5 minute break, if they choose. All participants received credit through the University SONA system. The total duration of a session ranged between 120 and 180 minutes.

After arriving for the session, the participant was provided with a Q Sort to complete. After they this, they were given an MT-IRAP which compared behaviorism and mentalism with value-based attributes (e.g. interesting/uninteresting). Following this MT-IRAP, the participants underwent equivalence training in which they were provided a statement that included the behavioral stimuli from the MT-IRAP that were then trained to equivalence in alignment [Valued Explanation] with the values identified in the Values Q Sort or control [no values alignment]. After the intervention, each participant completed a post-training MT-IRAP.

### **The Psychology Values Q Sort.**

**Purpose.** This Q Sort explored and identified the values that motivate undergraduates to pursue degrees in psychology. The concourse for this Q Sort was created from surveys of students, professionals, and academicians in psychology, by asking them why they chose to enter the discipline. The survey was sent to a professional list-serv of behavior analysts (TBA list-serv) from which 74 members responded. Pilot samples were conducted to verify the clarity of statements to determine their inclusion with 52 undergraduate psychology majors. Specifically, this Q Sort was created using an unstructured sampling. The items were chosen based on their presumed relevance to pursuit of a psychology degree without undue effort to ensure broad coverage of all possible sub-issues (McKeown & Thomas, 1988 p 28). While this approach has the potential weakness of introducing a bias into the Q sample from under-sampled components, due to the exploratory nature and intervention options

available, it was necessary to focus on a few subtopics in this study. The subtopics chosen for this study were based on the ability of the experimenter to provide aligned statements to criticisms of behavioral positions drawn from research literature. In this case, the subtopics converged around the why they have chosen psychology (e.g. to help people and the desire to understand people) and how they assess that (e.g. knowledge vs experience).

This Q Set consisted of statements that focused on two main issues, motivation to help people and motivation to understand people. See Appendix A for Q Method Table.

### **Method.**

Each participant (n=52) was provided an on-screen deck of cards, each with one statement from the Q sample. They were asked to sort the cards, one at a time, into one of three piles: agree, neutral, or disagree. After sorting all statements, they were then provided with an on-screen map in which squares were arranged in a normal distribution on which the statement cards were meant to be placed. Each column of squares were labeled with a numeric value (+4 for strong agreement, 0 for neutral, and -4 for strong disagreement). The participant was then presented with on-screen instructions directing them to read through their statements and place them in the order in which the statements fit the distribution map, placing a statement from each "pile" from the previous step. This was to focus them on the entire distribution, so that

they interacted with all ranges of their statements (rather than focus solely on the group of “agree”, then “neutral”, then “disagree). After the instructions, they were then provided with the statements in the “piles” that they sorted during the first step. After they placed all of the cards into their chosen locations in the distribution map, they were asked to once again review placement, and make any changes they would like before continuing to the next step. Following this distribution arrangement, the participants were asked to describe why they most agreed or disagreed with the statements that were placed in the tails of the distribution map.

Following this, they were provided with a survey in which they could answer questions about the Q Sort statements, such as their thoughts on the rankings of the top and bottom ranked statements as well as a neutral statement. These were important for the understanding and interpretation of each segment of subjectivity and were used for the refinement and further development of the Q Sample to use in future investigations.

### **MT-IRAP**

**Purpose.** The MT-IRAP is a measurement tool to assess the strengths of implicit relations surrounding presented stimuli. It was used in this instance as a method by which to measure the implicit value relations of behaviorism as it is compared with mentalism.

**Method.** The MT-IRAP consisted of trials in which participants (n=13) were required to choose the relation between two stimuli. The label stimuli were the dichotomous value stimuli: “Interesting” and “Uninteresting”. The target stimuli were behavioral: operant, objective, actions, learning, reinforcers, and stimulus or mentalistic: mind, thoughts, subjective, perception, experience, and mental processes. During each trial, the participants were exposed to a target stimulus (e.g. operant) and a label stimulus (e.g. interesting), as well as a trial-type cue (truth/lie). They were then asked to respond by using the keyboard to select one of two relational cues which specify the relation between the target stimulus and the label stimulus. These were “agree/disagree”. For each target stimulus, there were four different combinations of trials. The sequence of each trial type and stimulus presentation was randomized throughout the block. Following these instructions, the participant was presented with two blocks of practice trials.

The label stimulus, target stimulus, and relational response options then appeared, and the participant was required to respond within 2 seconds, or the words “Too Slow” appeared on the screen. There was a 400 millisecond inter-trial interval that occurred after a response.

Truth Trial Type	Lie Trial Type
<p style="text-align: center;"><b>Uninteresting</b> <i>[label]</i></p> <p style="text-align: center;"><b>Reinforcers</b> <i>[target]</i></p> <p style="text-align: center;">Truth <i>[trial type cue]</i></p> <p>Press d for <span style="float: right;">press k for</span></p> <p>Agree <span style="float: right;">Disagree</span></p> <p style="text-align: center;">←<i>[relational cue]</i>→</p>	<p style="text-align: center;"><b>Uninteresting</b> <i>[label]</i></p> <p style="text-align: center;"><b>Reinforcers</b> <i>[target]</i></p> <p style="text-align: center;">Lie <i>[trial type cue]</i></p> <p>Press d for <span style="float: right;">press k for</span></p> <p>Agree <span style="float: right;">Disagree</span></p> <p style="text-align: center;">←<i>[relational cue]</i>→</p>

↓

The MT-IRAP began with a series of instructions after which the participant successfully completed two blocks of practice trials by getting 80% accurate and consistent. In the first practice block, only one trial type cue (truth) was presented so that the participant could become accustomed to the IRAP procedure. After the first practice block, the mixed-trial components were introduced. In this block, both trial type cues are presented randomly. During the practice trials, strongly valenced words were used which were not related to any of the target stimuli in the test blocks. (“great”, “nice”, “awful”, and “horrible”) These were presented with the label stimuli: “interesting”/“uninteresting”. These practice trials permitted measurement of relational responses that were expected, thereby allowing for corrective feedback to assure instruction following. These corrections took the form of a small red X appearing on the screen until the participant made the correct response. To exit the practice blocks, the participant was required to relate 4 stimuli 4 times each with at least 80%

accuracy, and with no more than a 2 second mean latency (Barnes-Holmes, Murphy et al., 2010). If the participants did not exit within 6 attempts during the first practice phase, they were excused from the study (n=2). The second practice block was identical to the first with the exception of the “lie” trial type cue being randomly inserted as well. The same exit criteria were applied for the participant to move from practice to test trials.

During test trials, the participant was instructed to maintain approximately the same speed and accuracy that they achieved during practice. During this block of trials, no feedback was provided, and the speed/accuracy criteria for responding were removed. Participants were informed that if they responded inconsistently, the study would take longer to complete. If their consistency fell below 75% on a given target stimulus relation, the test block would be reset. There were 6 blocks of test trials, (2 for each word set); each block consisting of 72 trials. Each participant was provided with the same order of test blocks.

### **Intervention: Equivalence Training**

**Purpose.** The equivalence training is an intervention in which the participant was provided computer-based training that aligned stimuli used in the MT-IRAP with the types of values present in the Q Sort (helping and understanding). By randomizing which of the stimuli the participants were trained on, any changes in pre-post MT-IRAP scores of each stimuli could be analyzed for their impact. Moreover, an examination of

the relationship between the stimuli trained and their effect on the MT-IRAP scores allowed for the investigation as to whether the values found in the Q Sort had any predictive power.

**Method.** The participant was provided with a statement that read:

“**Operant** is a term for **actions** that are related which you’ll find in the **behavioral** lingo. **Reinforcers** are **stimuli** which have been used by behaviorists **to help** many different people. Taking an **objective** approach to human **learning** has led to a greater **understanding** of people.”

This statement provided the foundation for the equivalence training. Each bold word in the statement was trained to equivalence with the others. The training consisted of a standard match to sample equivalence training task in which one sample stimuli was presented onscreen at a time. For training, the members of stimuli group A (operant, reinforcers, objective) were trained to a respective member in stimuli group B (behavioral, help, understanding). Additionally, each member in stimulus group C (actions, stimuli, learning) was trained to its respective member in group A.

Training consisted of a presentation of one of the training words (e.g. from group A or C) as the sample stimulus and an array of the members of another group (e.g. B). The participant was then instructed to select the word that matched the sample stimulus from the array by clicking on it. For each incorrect selection, they were provided feedback with a red square that included the word “wrong” and a green square with “correct” for accurate selections. The participant was trained in with blocks of 18 trials out of which they had to get above 90% accurate before moving to the next block.

The first block directly trained A to B (operant:behavioral; reinforcers:help; objective: understanding). The second block trained A to C (operant: actions; reinforcers:stimuli; objective: learning). The third block tested whether the derived relation occurred by presenting sample stimuli from B or C and the array from the other. This differed from the other in that no feedback was provided.

If criterion (90% accurate) on any block was not met, they repeated that block for up to six iterations.

### **Post-Intervention IRAP**

**Purpose.** The post-intervention IRAP provides the second measurement opportunity such that the response changes within subject can be examined.

**Method.** This post-intervention IRAP procedure was exactly the same as the pre-intervention IRAP.

## Results

### **Q Sort Factors:**

There are three factors which emerged from the Q Sort that will be called: Helping Value, Science Value and Pay it Forward Value. This is represented in Table 1.

<Insert Table 1>

### **Factor A: Helping Value**

This factor values the ability to help people more than the ability to understand why. They can be likened to a medical doctor or a nurse who knows how to treat illness, but may or may not know or care the etiology of them. They likely are interested in becoming clinicians and providing treatment. They are most interested in asking how to rather than under what conditions make treatments work. Some statements of distinction include:

<insert Table 2>

During the interview, some comments about why they chose the most unimportant (statements of distinction for factor B: science-value):

“What is important is that the career I choose motivates me and fills me with passion and offers me a chance to improve the world.”

### **Factor B: Science Value**

This factor values understanding how things worked (and how treatments help people) over against the ability to help. Those from this perspective seem most likely to pursue research careers and value the science over the practice. They tend to view people as mysteries to unravel rather than suffering beings to help. Some statements of distinction include:

“I want to know how they are being treated and see if I agree before I put my patients through a treatment I don’t understand.”

“In the medical field, you are always looking for new ways to solve issues and treat patients. If you focus on understanding the patient and their issues, you can better attempt to treat them.”

<insert Table 3>

**Factor C: Pay it Forward:**

This perspectives are interested in both helping and understanding with neither trumping the other. These are characterized by an interest in the helping people who suffer from the human condition while valuing the understanding and ability of each to enhance the other.

<insert Table 4>

Each Q Sort and the loadings per factor are included in Table 5. <Insert Table 5>

**Limitations of this Q Sort.** This Q Sort is limited in that it was focused on limited available reasons that people joined the psychology major. The concourse development was guided by the suggestions of helping or understanding people, rather than opening to the full range that people joined psychology. Some other areas that showed up include the perceived ease of the major, the perspective of psychology focusing on helping relieve suffering vs building positive experiences, and potential job opportunities such as availability and remuneration.

**MT-IRAP results**

In this investigation, the MT-IRAP was used to examine the affirmation of consistent relations and the negation of inconsistencies. Of the trial types presented, two of the four types assess the affirmation while the other two assess negation of stimulus relations. The results of the mixed-trial IRAP demonstrated differential responding to the behavioral and mentalistic words in the group of participants. Some stimuli were evaluated positively (affirmed) while others were negated, while some had mixed results. Figure 2 shows the results of the mixed-trial IRAP by stimulus (and group) for the 13 participants. In this figure, the d-IRAP score (standardized effect size) is represented by strength of effect size of each evaluation. The results are arranged in order of effect size (small = .2 to .5; medium = .5 to .8; large = greater than .8). The d-IRAP was calculated by subtracting mean latency for negating trials from the mean latency of affirming stimulus trials and dividing by pooled standard deviation. A positive score indicates that the stimulus was affirmed as related to interesting and different than not interesting and a negative score is the reverse (negating). Nine participants responded with a positive effect size (.2-1) towards affirming and 3 participants responded towards negating the stimuli in the behavioral group. The mentalistic group stimuli had 9 responding with a negative d-IRAP score and 5 responding with a positive d-IRAP score. The range of responding positively was a range of 2 to 9 individuals who responded positively to any of the individual stimuli (subjective and actions/learning, respectively) and the same range for those responding negatively to any individual stimulus (objective and subjective, respectively). Planned one-

sample t-tests analysis was conducted on each to determine whether the d-IRAP scores were significantly different from 0 for each group and word, results are presented in Table 2. Of these, the behavioral stimuli as a group and 3 of 6 of its individual stimuli (operant, objective, actions) and 1 of 6 of the mentalistic (subjective) individual stimuli were statistically significant ( $p < .05$ ).

### **Results of MT-IRAP individual pre vs post training**

Of the thirteen participants who completed the pre-test, the results of two were removed due to failure in the equivalence testing procedure. The remaining eleven participants completed all phases. Of these, four were undifferentiated (in that there was no significant difference between pre- and post-test latencies, three showed a slight (not statistically significant) change from pre to post test, four showed a change in pre to post-test latencies in accordance with values training.

### **Induced IRAP effects and latencies per representative individuals**

For ease of description, the participants that demonstrated an effect will be described as Participants 1-4. The following four individuals (P1,P2,P3,P4) demonstrated latency changes based on induced effects consistent with value alignment.

Participant 1(P1) sorted a Factor A (helping) whose factor load z-score was .78. His IRAP scores and mean latencies are presented in the following table:

<Insert Table 6>

P1's IRAP score shows a differentiation of affirmations from negations towards behavioral stimuli (.38) as compared to mentalistic stimuli (.04) before the equivalence training with a faster responding to affirming the stimuli "operant" (1.27), "action" (.45), "reinforcer" (.7) thought (.49) "perception" (.39), and "mental processes" (.14). Additionally, there was a negative IRAP effect towards "stimulus" (-.54) and "subjective" (-.51). However, after equivalence training there is a subtle decrease in speed of responding towards the behavioral terms in consistent truth trials suggesting an insignificant change in the implicit cognitions (decrease of .06). During the post-test IRAP, P1 showed positive IRAP effects for "operant" (.59), "objective" (.21), "Action" (.31), "Learning" (.42), "Reinforcer" (.46), "experience" (.19), "thoughts" (.65), and "perception" (.42). Moreover, after the equivalence training, P1's orientation switched from neutral to positive for "objective", the stimulus directly trained to helping values, demonstrated an reduction in "reinforcer" (from .7 to .46), the stimulus in a derived relation with the helping values and towards "operant" (from 1.27 to .68) and was faster at affirming interest in the stimulus "objective" (increase of .21 in D-IRAP score).

The latency change of interest is most pronounced in the terms "operant" and "objective", suggesting that the alignment of latter with his values (per Q Sort) via equivalence training may have had an effect of enhancing fluency while the former (not aligned) had an opposite effect. While there was variation across all latencies, the directly trained relations yielded faster responding than those derived. The control stimuli were slightly faster than to the mentalistic terms, but

significantly slower than the trained and derived relations. An examination of the mean latency trials shows patterns in responding that show changes of affirmation/negation of trials in which the stimuli to which he was trained directly, indirectly, and simply exposed. This is the pattern of responding expected if values alignment influences automatic evaluation.

[Insert Figure P1Cluster]

Participant 2(P2) sorted a Factor A (helping) whose factor load z-score was .71 suggesting a similar correlation to that of P1.

<insert Table 7>

P2's IRAP score shows a small IRAP effect of affirmation of interest toward behavioral (.22) as compared to no effect toward mentalistic (.11) stimuli words before the equivalence training. P2 demonstrated significantly faster responding of affirmation towards "operant" (.35), "action" (.31), "reinforcer" (.46), and "subjective" (.57). P2 demonstrated a subtle, but not significantly faster responding towards "objective" (.11), "Learning" (.12), "experience" (.12), "perception" (.10), and "mental processes" (.09). After the equivalence training, P2's behavioral affirmation increased (.31) while the mental stimuli dropped by almost half (.06). On the individual stimulus level, P2 demonstrated significantly faster affirmation in "operant" (.45), "objective" (.35), "actions"(.39), "reinforcer" (.62) and "subjectivity" (.56), with subtle responding affirmatively to "learning" (.15), "experience" (.12).

While there was variation across all latencies, the majority of directly trained relations yielded faster responding than derived (with the exception of “reinforcer”). The control stimuli were slightly faster than mentalistic terms, but significantly slower than the trained and derived relations. An examination of the mean latency trials shows patterns in responding that show changes of affirmation/negation of trials with stimuli to which he was trained directly, indirectly, and simply exposed. The increasing speed of affirming and the slower negating of “operant” is in line with the pattern of responding expected if values alignment influences automatic evaluation. The derived relations in which “learning” participates did not yield the expected results (both affirmation and negation were slower). The stimuli “reinforcer” (derived help value) did not yield a large increase in speed, but did result in an increase in latency to negation of the stimulus. The fact that one of the control stimuli also resulted in faster automatic evaluations suggests that there may be an influence due to exposure. Accordingly, P2’s automatic evaluation of all the behavioral terms increased compared to the mentalistic terms (to which she had no extra exposure).

[Insert Figure P2Cluster]

<insert Table 8>

Participant 3 (P3) yielded a z score of .56 for Factor C and a .34 for Factor A. His score for Factor C (helping) was significant as a defining sort.

P3 demonstrated a small IRAP effect towards behavioral (.23) vs mentalistic (.05) stimuli words before the equivalence training. However, after the training there was almost no impact on overall performance based on groups of words. After training, the effect for behavioral (.24) and mentalistic (.04) terms remained close to the same level. On an individual level, P3 showed strong IRAP effects towards, “action” (.5), “learning” (.44), “thoughts” (.55), “perceptions” (.43) and “reinforcers” (.77). P3 also demonstrated moderate effects “objective” (.26). After training, there were strong effects for “learning” (.48), “reinforcers” (.51), “thoughts” (.58), and “perception” (.47).

An examination of the individual graph of response latency changes indicates effects on all terms that were directly trained, and because of his values (per Q Sort), the only non-aligned terms are the control. In P3’s situation, the control stimuli yielded slightly slower evaluations than “operant”. P3’s automatic evaluation of all the behavioral terms increased compared to the mentalistic terms (to which he had no extra exposure).

[Insert Figure P3Cluster]

<insert Table 9>

Participant 4 (P4) had a z score of .5 for Factor B. P3’s IRAP score for behavioral terms was a moderate positive effect (.28) while the mentalistic terms had a strong positive IRAP effect (.46). After training, the effect for behavioral (.45) was almost equal to that for mentalistic (.45) terms. The training there was a

significant increase in speed of responding towards the automatic evaluation of behavioral terms and no significant change towards mentalistic terms.

On an individual level, P4 showed strong IRAP effects towards, “objective” (.85), and “mental processes (.93). P4 showed moderate effects for “operant” (.49) “action (.44), and “thought (.34). P4 showed small effects negating “learning” (-.22), “mind” (-.20), and a small positive effect toward “subjective” (.2). After training, there were strong effects for “operant” (1.12), “objective”(.76), “actions” (.52), “experience” (1.5), and “mental processes” (.95).

The latency change of interest is most pronounced in the terms operant and actions, the two terms that were trained and derived in alignment with his values (per Q Sort). In P4’s case, the fact that the control stimuli yielded slightly slower evaluations suggests the increase in speed is due to the equivalence training. P4’s automatic evaluation of all the behavioral terms increased compared to the mentalistic terms (to which he had no extra exposure). Unlike the previous respondent, P4 responded quicker to the affirmation of interest in the stimuli to which he was trained directly and indirectly, but not for simple exposure. This is the pattern of responding expected if values alignment influences automatic evaluation.

[Insert Figure P4Cluster]

### **Induced IRAP effects and latencies for remaining individuals**

For the remaining 7 individuals, (designated as non-responders), the latency change from the pre-IRAP to the post-IRAP of stimuli that were trained in equivalence to the aligned words were not significantly different than the control nor than the mentalistic stimuli.

<insert Table 10>

Non-Responder 1 (NSR1) had a z score of .65 for Factor A. NSR1's IRAP score yielded a small positive effect toward behavioral stimuli (.18) and a strong positive effect towards mentalistic stimuli (.46). After training, the IRAP effect direction and strength towards behavioral and mentalistic stimuli remained largely the same (-.16 and .61, respectively).

On an individual level, NS1 showed significantly faster responding affirming interest in "operant" (1.49), "objective" (.32), "learning" (.46), "stimulus" (.57), "perception" (.78) "Mental Processes" (.48), and "subjective" (.66). After training, there were strong effects for "operant" (1.76), "objective" (.88), "learning" (.52), "stimulus" (1.09), "thoughts" (.57), "perception" (.97), "subjective" (.65), and "mental processes" (.73).

The latency changes indicated a strengthening of affirmation towards the group of mentalistic terms and a small negative change towards behavioral terms. NSR1 demonstrated a positive change towards stimuli that he was directly trained but also to those of mere exposure. These results do not support a functional

relation between equivalence training of values-aligned words and stimuli effects on Post-IRAP scores.

[Insert Figure NSR1 Cluster]

<insert Table 11>

Non-responder 2 (NSR2) had a z-score of .51 for Factor B. NSR2's IRAP score yielded a strong positive effect towards behavioral terms (.45) and mentalistic terms (.33). After training the IRAP effect of the behavioral and mentalistic stimuli became very similar (.34 and .33, respectively).

On an individual level, NS2 showed significantly faster responding affirming interest in "operant" (.95), "stimulus (1.46), "stimulus" (1.16), "perception" (.56), and "subjective" (.90). There were no significantly slower responses towards any of the individual stimuli words. After training, however, NS2 demonstrated a negative IRAP score for "learning" (-.77) and "reinforcers" (-.90). The affirmation towards "experience" increased (1.88).

The latency changes indicated no significant change for either behavioral or mentalistic terms as a group, and a decline in IRAP effect by behavioral terms placed in equivalence (both direct and derived training) with the science and help values. If anything, NSR2 had the opposite effect that might be expected of a person identifying with Factor B.

[Insert Figure NSR2 Cluster]

<insert Table 12>

Non-Responder 3 (NSR3) had a z-score of .56 for Factor B and the IRAP score yielded a small negative effect towards behavioral (-.22) and mentalistic (-.09) stimuli. After training, NSR3's IRAP scores hardly changed for both behavioral (-.02) and mentalistic (-.18) terms.

On an individual level, there were strong positive IRAP effects for "operant" (.43) and strong negative IRAP effects for "reinforcer" (-.61) and "experience" (-.64). After training, there were some significant changes in both direction and size of IRAP effects. The stimuli "Operant" (.53), "Learning" (.53), and "Experience" (.47) all yielded strong positive effects while "action" (-.39), "reinforcer" (-.59), and "mind" (-.68) showed strong negative IRAP effects.

The latency changes indicated only a significant change in the stimulus which was placed in a derived relation of equivalence with the aligned values for Factor B. As two other stimuli demonstrated the same direction and size of change the data do not support a functional relation between the equivalence training and change in IRAP effect on the stimulus "learning".

[Insert Figure NSR3 Cluster]

<insert Table 13>

Non-Responder 4 (NSR4) had a z-score of .51 for Factor A. Her IRAP score for behavioral (.20) and mentalistic (-.03) stimuli were small and in opposing directions.

On an individual level, the stimuli with strong positive IRAP effects were “operant” (.48), “objective” (.52), “action”, (.41), “stimulus” (.46), “perception” (.74). “thoughts” (-.42) had a strong negative IRAP effect prior to training. After training, the stimuli with strong positive IRAP effects included “learning” (.52) and “perception” (.55).

The latency changes from pre to post test on individual and group IRAP scores do not support the idea that aligning stimuli with helping/science values does not impact the IRAP changes, differentially.

[Insert Figure NSR4 Cluster]

<insert Table 14, 15, & 16>

Non-Responders 5-7 (NSR5, NSR6, NSR7) did not yield a significant z-score on any of the three factors. As such, their results are summarized in Table 17, but not reported at the level of detail of the prior eight participants.

## **Results Summary**

Table 17 shows the summarized results of the changes from pre to post-test by participant including their defining sort and z-score, latency change for directly trained stimuli that were in alignment with their sort, indirectly trained stimuli that

were in alignment with their sort, the control stimuli, the behavioral word group, and the mentalistic word group. P2 & P4 showed the strongest effect of values-aligned equivalence training while P1 did not show the same strength with the indirectly trained stimuli and P3 responded with mixed results. All NSRs showed varied results, suggesting that for these participants, there were no functional relations between the equivalence training, their Q Sort factor and IRAP score changes.

[insert Table 17]

### **Discussion**

This is the first use of within-subject examination on IRAP scores although this was mentioned as a potential in Levin (2011). While the IRAP effect sizes between groups of words and stimuli were of interest, an examination of individual response latencies (and the changes from yoked pre-test trials) provided some insight into the impact of the training to values on the IRAP effect.

There were three changes of interest observed in the three strong responders. The first was a reduction in latency to truth-based selection of interest [TI] and lie-based selection of disinterest [LD] to classes of words (help, knowledge, control). The second, an increase in latency to truth-based selection of disinterest [TD] and lie-based selection of interest [LI] to the same. Third, the latency different in each of these across terms with no exposure compared to the controlled exposure.

If values-alignment relational training did have an impact, there should be a shift in selection of stimuli that were directly trained to words that aligned with their values. The data provide supportive evidence of the relational elaboration and coherence (REC) model of implicit cognition with these four participants. Of the four, three responded in the expected direction of alignment to the values.

For all participants, the equivalence training trained the following words with values that follow. Operant, objective, and actions were directly trained to the values (science, helping, control, respectively). These will be referred to as DTS for directly trained science, DTH for directly trained helping, and DTC for directly trained control. Learning, reinforcers, and stimulus were not directly trained, but were in derived relations with the proposed valued stimulus and will be referred to as DRS (science), DRH (helping), and DRC (control), respectively. The IRAP score is discussed in a way that positive scores refer to a decrease in latency of affirming relations and/or an increase in latency towards negating relations. Thus a person who demonstrates an increase in IRAP score related to a stimulus are more fluent at affirming the interest in that stimulus and slower at negating it. Because this can happen by either increasing fluency of the affirmation (with no change in negation) or decreasing fluency in negation (with no change in affirmation) or by a combination of both (increase in fluency of affirmation and decrease in fluency of negation), the IRAP score alone may not provide a comprehensive picture. An examination at the individual level can enhance the understanding of the interaction of the equivalence training with the post-test scores.

### **Individual analysis interpretation**

*Participant 1 (P1)* had a Factor A (Helping) , so it may be expected that alignment of sample stimuli with the helping stimuli [DTH & DRH] could yield an increase in IRAP scores for those stimuli which were directly (and perhaps indirectly) trained.

P1 did increase the IRAP score towards DTH, although there were decreased IRAP scores in DTS and DRH stimuli. Both DTS and DRH had the highest pre-test IRAP scores, so their decrease may be a result of that. Participant 1 had an insignificant IRAP effect at pre-test for DTH, which may have impacted/enhanced its malleability. Even given this, the data for P1 demonstrates a pattern of responding that is consistent with a higher IRAP score for the stimulus that was directly trained to his value (per Q Sort). An examination of the individual trial differences reveal that the training increased fluency of affirmation for those trained in coordination with helping (P1's value per Q Factor). Visual inspection of the individual trial of the DTH for P1 show a pattern of responding that suggests there may have been an outlier in the affirming of the DRH stimulus (thus impacting the averaged data). The combination of this with the fact that the DRH had a high IRAP score pre-test may explain part of the reason for the slight decrement in pre to post-test fluency.

*Participant 2 (P2)* was also a Factor A (Helping), so it may be expected that alignment of sample stimuli with the helping stimuli [DTH & DRH] could yield an

increase in IRAP scores for those stimuli which were directly (and perhaps indirectly) trained.

P2 showed an increased IRAP score post-training for DTH and a smaller increase in IRAP score for DRH. This indicates a potential impact of the equivalence training aligned with the valued statements on the IRAP scores. It also suggests that there might be an impact (slight) of any training since the directly trained control (DTC) also increased after training. If this *is* the case, the derivation of the relation, did not yield similar results, indicating that an examination of the shift in IRAP scores of derived relations may be most sensitive to effects of values-alignment in equivalence training.

*Participant 3 (P3)* was a Factor C (Pay it Forward) which has values mixed between science and helping. Equivalence training did not provide a direct or derived training in alignment with the values. As such, it was not surprising that the change in fluency from pre to post IRAP was not seen in a specific category. Rather, P3 demonstrated the largest change with the stimulus in a derived relation with helping value and the largest improvement in fluency in the derived control stimulus. While there are mostly mixed results across pre-post IRAP scores, there is a slight increase in behavioral terms and a slight decrease in mentalistic terms. This suggests that either Factor C persons share mixed values with Factors A and B such that all behavioral terms join, to some degree, a stimulus class to which responding becomes more fluent, or it suggests that mere exposure may result in better fluency. The fact that half of the

stimuli yield an increased and half yield a decreased IRAP suggests that mere exposure does not have predictable increases in IRAP scores.

*Participant 4 (P4)* was a Factor B (Science). Values aligned IRAP score changes would yield an increase in IRAP scores on the directly trained science stimulus and perhaps the derived relation science stimulus. P4 did, in fact, yield results that fit this pattern. The increase in IRAP score from pre to post on the DTS is the largest of the group (.64 IRAP increase) and the increase of the DRS is also significant (even though it brings the stimulus from a negative to positive (but insignificant) IRAP effect. Both helping stimuli, DTH & DRH, yielded a decrease in IRAP scores while the controls yielded a slight increase for the directly trained and decrease for the derived. This supports the idea that training stimuli in correspondence to the values identified in the Q Sort can yield a shift of IRAP scores within session.

### **Fluency, Fatigue, and Extraneous Factors**

In any task that involves repetition, there is the potential for the influence of the dependent variable (in our case, latency) to be impacted by fatigue, order effects, and other extraneous variables. While the graphs display the trials clustered together based on stimuli, they are arranged in this manner for the benefit of visual inspection. If fatigue were a factor, there should be longer latencies towards the end of the experiment. An examination of each participant's data indicates that for all of the participants, the longer latencies are not occurring more frequently later.

<insert figures 12-15>

### **Summary**

In the three subjects who demonstrated expected patterns, results were likely due to a recruitment of words into similar stimulus classes resulting in higher fluency with them due to stimulus transformation rather than strictly based on practice or familiarity with the words. It appears that by training equivalence to words that were already in a relation of coordination with stimuli to which the participants responded fluently, there was a subsequent shift in fluency to newly recruited words. Moreover, the data show a decrease in fluency when the participants were required to engage in oppositional framing (as seen when they had to “lie”).

In the cases in which change occurred, the evidence supports a behavioral (over against the associationist) approach to implicit cognitions. The fact that implicit cognitions are amenable to change as a function of equivalence training supports the idea that faster response times are not due to their location in memory (association) but are better conceptualized as demonstration of fluency. In other words, as people engage in relating behavior, it follows that they become more fluent at it. Frames of coordination have been suggested as the first relational operant that people acquire and as such, it makes sense that many people become most fluent in relating this way. It also makes sense then, for stimulus equivalence which trains relations of coordination to yield an increase in fluency to stimuli which become related to others.

Within this framework, attitudes, prejudices, and other implicit cognitions are understood as behavior and can then be treated from a fully naturalistic approach. These combined experiments demonstrate that implicit relations can be manipulated within session. While this is not the first experiment to do so, it is the first to do this with actual words. Using actual words brings with it some limitations for the interpretation and generalizability of the findings. These words are likely to have diverse histories across each participant. These histories can interact with the effect of the equivalence training in ways that are unknown to the experimenter. For the participants who did show the expected results, it is likely that these histories were not as impactful. For the remainder, however, it is unclear whether the procedure did not have the expected effect, or whether there was an interference of the reinforcement history and the procedure.

Hughes and Barnes-Holmes (2011) demonstrated that the IRAP is a sensitive tool to create histories of relational framing using nonsense words and stories. In their study, they used strongly valenced words (nasty, killers vs wise, wonderful) to shift these relations. In comparison, the value-alignments in this study were much more subtle. In the Hughes and Barnes-Holmes (2011) study, they only examined directly trained relations as compared to the current study that investigated the effect of derived relations as well. Using the results from both studies suggest that both derived and directly trained relations as well as stories can induce changes in fluency of relating stimuli in an IRAP test.

Limitations of this study include that only a small proportion of the participants (N=3 of 13) showed a detectable shift in latency based on categories and values across the MT-IRAP phases. In fact, the majority of respondents demonstrated an undifferentiated or opposing shift in latencies and MT-IRAP scores. This suggests that while there appears to be potential for within-session malleability of MT-IRAP scores, it did not (perhaps will not) happen in most cases. This should be examined in further detail in future studies. As such, most of the discussion focused on the change that did occur, and its relation to the sorts created by the participants whose behavior did shift.

Future studies should examine the impact of value alignment on words that were novel prior to the study during which their history was created. This would allow for a better understanding of the processes involved and the mechanisms by which we may be able to more effectively change these fluencies. It recommends, however, a line of research in which the elaboration of the processes involved should be investigated with an eye towards the ability for scientists to develop learning history around stimuli and then examine the impact of fluency training and values alignment.

Additionally, studies should examine the ability to create relational histories and investigate exactly how malleable they can be. In both this and Hughes and Barnes-Holmes (2011) study, the frames developed were mainly of coordination. It would be helpful to understand whether other relational framing tasks can develop strong IRAP effects. In the current investigation derived effects were examined and while effects were noticed occasionally, they were much smaller than the directly trained relations. A

combination of the methods used in this examination and that of the Barnes-Holmes (2011) study would allow for a better understanding of the maintenance of the relations formed.

Another investigation of interest would be a fuller examination of the reason that students enter psychology as an undergraduate major. While it served its purpose for this study, the Q sort was limited to boundaries imposed by the deductive approach, leading to a smaller than usual q set and limited value as a measure of potential perspectives. The use of the information from interviews after participants completed their sorts in combination with the statements from which the concourse was originally derived would allow for a broader Q Sort to provide a better picture of potential factors. After a broader examination of these factors, it would be of interest to examine the interaction between the values as discussed in this study with the history of the person and their experiences with the subject matter.

Further investigation of the utility of Q Sort, MT-IRAP, and latency-based measures should examine what characteristics of the participants yield malleability and what preclude it. One extension of this study would be to utilize nonsense words in a pre-IRAP measure, train them to equivalence with valued words (per Q Sort) and measure whether changes from pre to post IRAP scores occur.

## Conclusion

This investigation has yielded mixed results regarding the malleability of implicit cognitions within session. It is a benign intervention that did appear to change the value in approximately one third of the subjects. Of the subjects that were model performers, the effects seen support the idea that implicit cognitions can be shifted within session given equivalence training. The use of this training to change IRAP scores supports the relational elaboration and coherence (REC) model of implicit cognition over against the associationist model.

Additionally, this is the first instance of an individualized examination of the IRAP effect using the MT-IRAP with a single-subject approach. It provides some insight into the utility of an examination of trial-by-trial latency data in understanding the relations involved.

In the interest of dissemination of a contextual approach, behavior science is far from a technology to induce the appropriate implicit cognitions that would yield changes in overt behavior or strong shifts in philosophical approaches to the subject matter. However, the very use of behavioral tools to examine behavior of interest to others (implicit cognitions) has led to cross-fertilization of science from the functional contextual wing spilling into the traditionally associationist approaches found in social sciences (DeHouwer & Barnes-Holmes, 2012). Rather than attempting to use our science to change the “minds” of potential students and researchers, it seems that this

line of research may lead to the replacement of mentalistic models in the mainstream psychology with naturalistic ones coherent with a behavioristic philosophy. If behavior scientists endure in this vein and continue to see successes such as these, instead of recruiting students from the traditional psychology to the behavioral psychology, a natural science of behavior may supplant the dualistic model such that all psychology students will be studying a truly behavioral science they refer to as psychology.

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