Running Head: Control as Structured Subordination

What is control? A conceptual analysis

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The emergence of dual-process and dual-systems theories represents one of the most significant scientific advances in psychology. As this volume attests, numerous formulations of these models continue to be developed. Most postulate a distinction between psychological processes that are "automatic" and others that are "controlled." Much of the conceptual and theoretical development of this distinction has focused on defining what constitutes an automatic process, with comparably less attention invested in examining what constitutes a controlled process.

In this chapter, we critically examine what is meant by the term "control," and suggest that there are actually two meanings. One meaning of control, as suggested by numerous dual-process and dual-systems theories, refers to whether a process can be characterized by one or more of the features that are associated with automatic processes (i.e., the absence of conscious intention, the absence of conscious awareness, the inability to disrupt, and/or the efficiency of operation; Bargh, 1994). In short, a controlled process is one that is not automatic. There is, however, a second meaning of control – one that refers instead to the extent to which a process helps to attain a desired goal or end. This sense of control refers not to some specific feature of an isolated process, but rather to its relation to other processes from the perspective of the whole. Key to this second meaning of control is the notion of structure – the top-down organization of thoughts, feelings, and behavior to promote a given end. When a process operates in harmony with and sustains the goal-directed structure of the whole, that process can be described as "controlled." When a process, however, is discordant with and undermines the goal-directed structure of the whole, that process can be described as "out-of-control" or "lacking control." Our central thesis is that the conflating of these two meanings of control – as something that is not automatic and something that is goal-directed – has led many to make erroneous conclusions about the nature of controlled processing and its relationship to automaticity. We review empirical evidence that highlights the conceptual independence of these two meanings of control, and argue that it time to recognize that "control" is not necessarily the opposite of "automatic."

What is Automatic?

In an influential review of the literature, Bargh (1994) noted that despite decades of scientific scrutiny, there was a surprising lack of consensus on what was meant by the term "automatic." He noted instead that researchers tended to label a process as automatic to the extent that it had one or more of the following features: 1) it operates without conscious awareness, 2) can be initiated without conscious intention, 3) cannot be interrupted or controlled, and 4) operates efficiently without consuming too many cognitive resources. Bargh and others (e.g., Bargh, 1996; Bargh & Chartrand, 1999; Wegner & Bargh, 1998) have suggested that although these features are conceptually independent, one of two clusters or combinations have traditionally attracted research scrutiny. One major strain of research focuses on intentional processes that are engaged in repeatedly, eventually requiring less effort and becoming more efficient over time. Thus what began as a consciously intended, effortful process that required active initiation and monitoring may, after repeated practice, become routinized and no longer require the same conscious intention and effort. The key emphasis of this line of research is the efficient use of limited cognitive resources, and is exemplified by such processes as skill acquisition and habits. A second strain of research focuses on processes that not only operate effortlessly, but also with little conscious intention or awareness that it has taken place. Research, for example, reveals that people attend to, encode, and are influenced by stimuli presented outside of conscious awareness (e.g., Bargh, 1996; Bargh & Chartrand, 1999; Wegner & Bargh, 1998). The key emphasis of this strain of research is not necessarily on efficiency, but rather on consciousness. That people can process and respond to their environments without conscious intention or awareness has led many to question assumptions about the function and centrality of consciousness in the operation of the mind. Collectively, this work on automatic processes has suggested that a lot of information processing appears to occur "behind the scenes." That they can operate efficiently and with minimal conscious guidance leads to the possibility that automatic processing may promote thoughts, feelings, and

behaviors that are inconsistent with people's conscious intentions and desires. The efficiency and lack of awareness of such processes may render people unable to intervene and to disrupt such undesired processing. Specifically, people may not be aware of that these automatic processes are undermining their conscious intentions; and even when they are aware, these processes may operate so efficiently that they are initiated and completed before comparatively less efficient conscious processing can intervene. These implications have led many to propose automatic processing as an anathema to control.

What is Control?

As stated earlier, we propose that there are actually two meanings of the term "control." Most dual-process and dual-systems models tend to use the term to refer to any process that lacks those features generally associated with automaticity – a controlled process is one that is not automatic. There is a second meaning of control, however, that is independent from issues of automaticity. We argue that the use of the same term to refer to two distinct phenomena has caused conceptual confusion and erroneous conclusions. We focus our subsequent discussion of control on the second of these two meanings.

When entities such as children, people, organizations, and societies are described as "out of control," they are generally characterized by two related features: 1) a lack of governance, and 2) a lack of direction or purpose. By governance, we refer to a set of mechanisms or principles that organize and structure thoughts, feelings, and behaviors. Consider the metaphor of a senate. A senate without mechanisms about how legislation gets introduced, discussed, and voted upon would be out of control. Senators at their own whim could pursue actions that maximize their self-interest and the interests of their constituents to the detriment of others. What one senator might do may contradict or undermine the actions of another. The lack of governance in turn would render impossible engaging in any goal-directed purpose. The chaos caused by a lack of structure or order would allow for the pursuit of too

many contradictory ends, leading the senate to be pushed and pulled by the loudest, most forceful voices at any given moment. Thus, the lack of rules and principles with which to organize discussion and action would lead to an inability to decide at a collective level what is most desired and how best to achieve those ends.

We might draw a similar parallel to the operation of the mind. When various signals within the mind operate without some structure or organization, they can push and pull the organism in contradictory directions. For example, consider dieters presented with an opportunity to eat an indulgent piece of chocolate cake. Whereas the elements of the mind concerned about immediate hedonics might clamor and urge dieters to eat cake, those elements concerned about weight-loss concerns would encourage restraint. Left unimpeded, whether dieters choose to eat versus not eat cake would depend on the relative strength of those two opposing voices. The dieters' affective, cognitive, and behavioral responses would consequently appear chaotic, and would depend on a variety of factors that may vary situation to situation. What should be clear is that this lack of organization and structure may lead dieters to behave frequently in a manner contrary to their valued goals, eating the cake despite their goal to lose weight. Thus, their thoughts, feelings, and behavior vis-à-vis weight-loss goals would appear "out of control."

Following others (Carver & Scheier, 1982, 1990; Hebb, 1949; Kruglanski, Shah, Fishbach, Friedman, Chun, Sleeth-Keppler 2002; Shanon & Weaver, 1949), we define control as both a state and the act of producing that state in which thoughts, feelings, and behaviors are organized and prioritized around a desired end. What defines control is structure. By structure, we refer to the top-down reductive process of creating coherence from more fragmented and disorganized elemental components. Structure requires the perspective of the whole rather than the individual perspective of the parts. Constituent elements are arranged and integrated in a manner that allows them to work together to support and sustain the whole. When something is highly structured, its constituent

elements are relationally organized, such that knowledge of one element allows one to logically deduce or predict the other elements. Thus, valuing weight-loss should be associated with negative rather than positive thoughts about cake, and positive rather than negative thoughts about eating fruit salad. The resonance and coherence that structure provides among elemental units produces systemic order to one's thoughts, feelings, and behaviors, thus enhancing organized action (i.e., control).

Inherent to creating structure is also the process of constructing hierarchies (e.g., Carver & Scheier, 1982, 1990; Hebb, 1949; Kruglanski, et al., 2002; Shanon & Weaver, 1949). By hierarchies, we refer to appreciation that some elements are nested or embedded within others. To create meaningful structure from the elements "weight-loss," "jogging," and "eating celery," one must recognize that "jogging" and "eating celery" are embedded within the broader element of "weight-loss" as two means to the same end. This understanding of embedded-ness allows one to better recognize goal-relevant opportunities and to coordinate thoughts, feelings, and behaviors appropriately. The construction of hierarchies, however, is not limited to means-ends relationships. Through structure, people may also come to appreciate relationships between specific behaviors (e.g., stealing money) and more general traits (e.g., dishonesty), as well as how subcategories (e.g., poodles) may exemplify broader superordinate categories (e.g., pets). Hierarchies thus help people appreciate the relational links between more elemental units, thus promoting integration and the creation of structure.

Through structure, rather than reflect fragmentation and chaos, thoughts, feelings and behaviors become organized and ends-directed – i.e., controlled. To create structure, people must engage in subordination. Subordination entails the identification and categorization of inputs as relevant or irrelevant to a given end. Information that is relevant to a desired end is "fore-grounded," preferentially weighted and attended to; information that is irrelevant is "back-grounded," preferentially de-weighted and ignored (see Zelazo & Cunningham, 2007). The flavor of the icing on a piece of cake is irrelevant vis-à-vis one's weight-loss goal and thus is subordinated in favor of

information about the cake's calorie count. Similarly, behaviors relevant to eating cake are irrelevant with respect to weight-loss goals, and thus are subordinated in favor of restraint and other behaviors directed toward losing weight (such as exercise or eating alternative foods). Note that by contrast, the hedonist – one who is not committed to weight-loss goals and instead is primarily concerned with the enjoyment of food – should evidence a different pattern of subordination: calorie count would be subordinated in favor of a cake's icing, and restraint behaviors would be subordinated in favor of eating behaviors. Thus irrespective of the content of the desired end state, it is through this process of subordination that thoughts, feelings, and behavior are structured to form a coherent whole.

A psychological process can thus be considered "controlled" to the extent that it operates in a manner that is consistent with and sustains the larger integrated, goal-directed whole. Control, however, does not necessitate that all processes actively promote the goal-directed end. Returning to our senate metaphor, senators can agree to disagree and vote against any legislation. However, when a senate is operating in a controlled manner, all senators agree to follow certain rules. When over-ruled by the majority, senators must comply with the passed legislation and the collective will of the senate. Similarly, there can be discord and inconsistencies in a "controlled mind." Dieters' minds may still be characterized as "controlled" when debating the merits of eating cake versus weight-loss goals, as long as there are in place structures and principles that promote the resolution of this debate in a systematic, goal-directed manner. For the dieter, given the importance and value of their long-term weight-loss goals over their more short-term hedonic desires, control might constitute subordinating thoughts, feelings, and behavior around the former rather than the latter. Thus discord and dissonance have their place in a controlled mind – their impact, however, is limited and does not co-opt the structured, organized pursuit of desired ends.

Role of Abstraction in Control

Given that we define control as state in which people's thoughts, feelings, and behaviors are integrated and prioritized toward a given end, some mechanism is necessary for identifying which of the many ends that they can possibly pursue is to be the one around which they create structure, and having created structure, how to maintain that prioritization and organization. This is a particularly vexing problem when goals conflict (dieters who want to eat cake but also want to lose weight). How do people appropriately select one goal over another? We propose that abstraction serves as the means by which this identification of goals and maintenance of structure takes place.[1, 2]

Abstraction is the cognitive process of integrating inputs and extracting from them emergent commonalities that may not be evident in any one signal. Abstraction may promote control in two ways. First, abstraction may facilitate the recognition of emerging patterns from lower-level inputs, which may help inform what goals should be pursued. By analogy, the will of the senate cannot be determined by inquiring about the demands of a single senator, but rather requires querying the many that form the broader collective. Some senators may be particularly partisan and support one cause at the expense of others. Other senators may be more neutral, but can still consider the available information and throw their support behind one cause or another. It is the systematic voting process that allows the will of the senate to emerge and become evident. Abstraction may similarly promote a bottom-up, emergent organization of thought, feeling, and behavior toward a single end. In the simplest case, bottom-up processing converges around a single desired end-state and abstraction merely promotes the emergent pattern. In more complicated situations, as is the case when goals conflict, people may have to engage in abstraction to integrate the two competing concerns. Abstraction promotes the ability to compare proverbial "apples and oranges," i.e., inputs that may have features that do not align for direct comparison. Instead, it may facilitate the comparison of competing concerns on some common abstract dimension (such as utility or value) and promote the ability to determine which should be considered primary to the other (e.g., Malkoc, Zauberman, & Ulu, 2005).

The second way that abstraction may promote control is by promoting the ability to recognize discrepancies from coherent organization after thought, feelings, and behavior have been integrated and structured. Metaphorically, an individual senator may fail to recognize that his or her actions are inconsistent with the will of the senate after a vote has passed. It may be easier for the senate leader charged with maintaining order in the senate and who has the broader perspective of the senate as a collective body to see that senator's actions as being problematic. Abstraction, in a similar way, may promote awareness of inconsistencies and promote top-down efforts to maintain and sustain structured organization. Thus abstraction may have roles in both detecting emergent patterns that form the consensual goal in a bottom-up construction process, as well as in imposing structure and order to promote and protect that in a top-down fashion.

On the Flexibility and Stability of Goal-Directed Behavior

One should also not assume that the notion of structure (and corresponding, that of control) necessitates rigidity or lack of flexibility. Creating structure is a dynamic process that can be sensitive to changes to both internal and external environments. One can create and re-create structure. The structure that one forms through abstraction fundamentally depends on the constituent elemental inputs. When those elemental units change, the corresponding structure generated from such elements (along with the goals that are pursued) may also change. Note, however, that although not entirely inflexible, one of the benefits of structure, at least with respect to the notion of control, is that it is relatively more stable than any individual constituent element. Small changes in incidental or peripheral elements within a structure are not likely to generate much change in the overall structure. This in turn promotes consistent goal-directed action across diverse contexts and circumstances. Thus, whether the icing on a piece of cake is chocolate or vanilla, for example, should have little impact on one's striving toward weight-loss goals. Large changes to more central elements, however, may cause more fundamental changes in the structure that is created and to the goals such structure promotes. When

one's dieting has led to life-threatening health conditions, one might expect to see a shift in structure to support health over weight-loss goals. Thus, structure within the mind can both provide stability and yet be sensitive to changing circumstances.

Similarly, structure does not mean that people become insensitive to context. Context provides some of the bottom-up input around which structure is created, thus allowing people to pursue those goals that are best afforded by a given context. As an example, consider the working mother. When at home, the working mother might note that not much work can be done out-of-the-office, and that childcare concerns are pressing. Although part of her might be tempted to work, the perspective of the whole would suggest prioritizing the needs of her child over responding to the off-hour emails that her colleagues send. Creating coherent structure in this context would entail prioritizing childcare over work. Thus, whereas work-related responses would be "out-of-control," childcare-related responses would be "controlled." When she is at work and her child is at school, however, the senate of her mind may note that her child is already well cared for and that she now has the ability to address her to-do list. Although part of her might be tempted to daydream about her child, the perspective of the whole would suggest prioritizing the demands of her colleagues. Creating coherent structure for the working mother in this context would entail prioritizing work over childcare. Thus, work-related responses would be "controlled," whereas childcare-related responses would be "out of control." Although parenting and career goals may initially appear at odds, the creation of structure can organize the pursuit of these goals in a manner that allows the working mother to pursue each in their respective contexts. Creating structure through abstraction is thus a dynamic process that provides both stability and flexibility in the ends that are pursued, and control is defined by the structure created.

Interim Summary

Whereas dual-process and dual-systems models use the term control to denote a process that operates without conscious awareness and intention, is impervious to disruption, and is efficient, we

highlight instead an alternative meaning that refers to the extent to which a process operates within an ordered whole to promote a given end. That researchers can use the same term (i.e., "control") to refer to very different constructs may promote conceptual confusion. Our concern is that many working with have conflated the two meanings, and have mistakenly drawn pre-mature and problematic conclusions about the nature of control and its relationship to automaticity.

To support our argument, we explore three implications that the alternative meaning of control advances. First, it suggests that, in an apparent contrast to the predictions of many dual-process and dual-systems models, it is conceptually possible to have processes that are automatic (i.e., lack conscious intention, lack conscious awareness, cannot be disrupted, and/or are efficient) and controlled at the same time (i.e., operates within and promotes goal-directed structure). That is, rather than positing a strict dichotomy in which a process is either automatic OR controlled, we propose that depending on one's definition of control, it can be possible to describe processes as automatic AND controlled. Second, given the central role of abstraction in goal-directed structure, one might expect that promoting abstraction should promote greater control (at least, when control is defined as structured goal pursuit). Third, the alternative meaning of control suggests the possibility that effortful, conscious (i.e., "not automatic") processing may under some circumstances impair effective goal-directed thought, feelings, and behavior. In what follows, we review empirical evidence for each of these assertions.

Evidence of Automatic AND Controlled

Implementation Intentions

Research on implementation intentions highlights goal-directed (i.e., "controlled") processes that are consciously intended, yet operate efficiently. Implementation intentions are behavioral plans that detail a specific behavior that is cued by a specific cue (e.g., Gollwitzer, 1999). These plans are structured in an "if-then" format, such that IF the cue is encountered, THEN the behavior is to be

enacted. A dieter with the goal of losing weight, for example, might generate the implementation intention: "If I see dessert on the table, then I will avert my gaze." By specifying a goal-directed behavior in response to a critical cue, implementation intentions preferentially background other potential goal-irrelevant responses in that specific context. Thus rather than attend to the cake, by generating an implementation intention, the dieter in the example above has subordinated that response in service of his or her dieting goals. Research indeed demonstrates that implementation intentions can help promote the pursuit of desired ends. For example, students intending to complete a homework assignment over a holiday break are more likely to do so if they had generated implementations intentions (Gollwitzer & Brandstätter, 1997). Implementation intentions not only promote goal-directed behavioral responses, but also appear to aid in the control of cognitive and emotional responses (e.g., Achtziger, Gollwitzer, & Sheeran, 2008; Bayer, Gollwitzer, & Achtziger, 2010; Cohen, Bayer, Jaudas, & Gollwitzer, 2008; Schweiger Gallo, Keil, McCulloch, Rockstroh, & Gollwitzer, 2009).[3]

Like habits and acquired skills, implementation intentions begin as consciously intended cognitive processes. What is remarkable about implementation intentions, however, is unlike habits and acquired skills, they do not appear to require repeated practice to automate. Indeed, simply repeating an implementation intention several times ("If I see the number 5 on the computer screen, then I will type in my response particularly fast!") is sufficient in prompting cognitively efficient goal-directed behavior when the context specified by the plan is later encountered (Brandstätter, Lengfelder, & Gollwitzer, 2001). Not only are these goal-directed behaviors more efficient (i.e., apparent under conditions of cognitive load), they also do not appear to require conscious awareness of the critical cue. Research suggests that once an implementation intention is formed, even when the cues specified in the "if" component, are presented subliminally outside of conscious awareness, participants still evidence goal-directed responding consistent with the "then" component (Bayer, Achtziger, Gollwitzer, & Moskowitz, 2009). Thus, implementation intentions represent a controlled response (i.e., subordinates

some responses in favor of others in service of one's goals) that are automatic in that once formed, they appear to prompt goal-directed behavior efficiently and in the absence of conscious intention.

Goal-Shielding

Research on goal-shielding has also illuminated cognitive processes that are automatic (in that they operate outside of conscious awareness) yet also represent a means of maintaining subordination and structure to promote control. Goal-shielding refers to the inhibition of goal-irrelevant inputs when a person is engaged in goal-directed behavior, preventing competing desires and goals from interfering with ongoing goal-directed action. As a concrete example, consider an individual who wishes to mail a letter. On her way to the post office, this individual might encounter a number of stimuli that cue alternative courses of action, such as the bakery which suggests stopping for a snack or a television that suggests watching cartoons instead. Ignoring these alternative goals (i.e., through cognitive inhibition) prevents them from distracting the individual from her focal goal: mailing the letter. Goal-shielding is thus a critical mechanism by which structure is created and maintained.

Supporting the existence of goal-shielding mechanisms is research that indicates that identifying and thinking about one goal makes it more difficult to remember and to think about alternative competing goals (e.g., McCulloch, Aarts, Fujita, & Bargh, 2008; Shah, Friedman, & Kruglanski, 2002). Not only do people indeed engage in goal-shielding, but they may be able to do so without conscious intention or awareness. To test this, Shah and colleagues (2002) asked participants to list several personal goals, summarized in one-word phrases (e.g., "diet," "church," "grades"). They then embedded these goals into a lexical-decision task that capitalized on subliminal priming procedures. In critical trials, participants were subliminally primed with one of their goals, and then presented with a second of their goals as a target and asked to identify it as word or non-word. Participants' lexical judgments were slower when one goal primed a second goal. This suggests that the activation of one goal (the primed goal) interfered with the activation of the second goal (i.e., the target goal). That

activation of one goal outside of awareness leads to the inhibition of competing goals may suggest that goal-shielding represents a controlled process (i.e., maintains structure and subordination) that also happens to be automatic (i.e., initiated and operates without conscious intention).

Asymmetric Temptation-Goal Associations

As noted earlier, self-control dilemmas are a prototypical context in which to understand the operation of controlled processes. People must subordinate the temptation to pursue immediate rewards in favor of pursuing more valuable yet distal rewards. Research has highlighted a number of automatic processes – those that are initiated without conscious awareness or intention – that help people in this subordination process, and thus enhance people's self-control. One such mechanism may be asymmetric cognitive associations between immediate temptation and distal goal concepts (Fishbach, Friedman, & Kruglanski, 2003; see also Papies, Stroebe, & Aarts, 2008). Specifically, self-control is enhanced to the extent that the activation of temptation concepts promotes the activation of goal concepts, but the activation of goal concepts does not reciprocally promote activation of temptation concepts. This asymmetric pattern of associations subordinates the activation of temptations in favor their distal goals when they encounter salient proximal temptations, thus increasing the likelihood of self-control success.

Research not only highlights the operation of asymmetric temptation-goal associations, but also suggests that such operations may occur efficiently and outside of conscious awareness (Fishbach, Friedman, & Kruglanski, 2003; see also Papies, Stroebe, & Aarts, 2008). Fishbach and colleagues (2003), for example, demonstrated that whereas the subliminal presentation of temptation-related concepts (e.g., cake) facilitated the lexical identification of goal-related concepts (e.g., diet), the subliminal presentation of goal-related concepts interfered with the identification of temptation-related concepts. Not only do these asymmetric associations appear to operate outside of awareness, they also appear to be cognitively efficient: they are evident even when people are under cognitive load. Supporting the

functional role of these associations in promoting control are findings that individual differences in these associations reliably distinguish those who report being successful versus unsuccessful in overcoming temptation in favor of their goals. Moreover, exposure to temptation cues can ironically promote rather than impair goal-directed behavior, as would be expected by the operation of these asymmetric temptation-goal associations. Thus, research has documented the existence of asymmetric temptation-goal associations as a controlled process that operates efficiently and in the absence of conscious intention and awareness.

Goal-Directed Evaluative Associations

Beyond semantic networks, there also appear to be control processes that operate on people's evaluative networks that are automatic in the sense that they operate efficiently. People's attitudes appear to be sensitive to their goals, and these goal-directed changes in evaluation can be detected even on measures that do not require participants to consciously deliberate (i.e. implicit measures). Thus goal-directed changes in evaluation appear to be supported by processes that require little conscious intention or effort. For example, Ferguson & Bargh (2004) had participants complete an implicit measure of attitudes toward goal-relevant objects – namely, an evaluative priming task – either during the active pursuit of a goal, or shortly after successful completion of that goal. Those actively pursuing the goal evidenced greater ease of associating positivity to goal-related concepts relative to those who had successfully completed the goal. Note that the parameters of the evaluative priming task that Ferguson & Bargh (2004) used – a stimulus-onset asynchrony of less than 350ms between prime and target –suggest that participants' behavioral responses were not the result of conscious reflection, but rather from the operation of more cognitively efficient processes. Thus, people's attitudes and evaluations can shift to promote control (i.e., goal-directed structure), yet these processes may still operate in a manner that can be characterized as automatic (see also Fishbach & Shah, 2006).

More recent research suggests that such goal-directed changes in evaluation may occur outside of conscious awareness as well. Fishbach and colleagues (Fishbach, Zhang, & Trope, 2010) presented participants with an evaluative priming task which presented prime stimuli subliminally. Results indicated that participants evaluated goal-directed concepts more positively and goal-undermining concepts (those relevant to short-term temptations to detract from successful goal attainment) more negatively, even when they were consciously unaware of the stimuli that they were evaluating. Goal-directed evaluations, then, can also be characterized as processes that are controlled and automatic.

Goal-Directed Early Attention

Even more compelling evidence for processes that are both automatic and controlled comes from psychophysiological experiments examining how goals can modulate even the very earliest levels of attentional processing. Research has suggested that people differentiate own-race and other-race faces within 100-150 ms of stimulus presentation (e.g., Ito & Urland, 2003). Specifically, people appear to allocate greater attentional resources to faces of one's own race rather than of other races. Early unsuccessful efforts to modulate this difference in race-based attention has led some researchers to conclude that "automatic attentional allocation cannot be inhibited" except under conditions of perceptual load (Ito et al., 2007, p. 410) or during subsequent conscious effortful processing (e.g., Devine, 1989). Yet, more recent research suggests that even these very early attentional processes are malleable and sensitive to one's motivational states. Cunningham et al. (2012), for example, collected electrophysiological recordings of participants who were engaged in approach versus avoidance behaviors using a joystick in response to Black and White faces. They reasoned that a social target that one approaches is more motivationally relevant than a social target that one avoids, and that this approach behavior would promote individuation rather than processing in terms of category membership (e.g., Neuberg & Fiske, 1987). Replicating past research, when participants were given the goal to avoid Black and approach White faces, they evidenced early attentional bias as indexed by the

P100 component of participants' event-related potential waveforms. Yet, adopting the alternative goal to approach Black and avoid White faces attenuated this difference in early attention. This suggests that even automatic processes that occur within the first 100-150 ms of encountering a stimulus are sensitive to one's goals and can be considered "controlled."

Evidence that Abstraction Promotes Control

As noted earlier, our analysis of the alternative meaning of control suggests that abstraction plays a critical role in promoting the creation and maintenance of structure that advances desired ends. Empirical research supports this assertion. Cognitive neuroscience research, for example, highlights the central role of abstraction in cognitive control and working memory (e.g., Badre, 2008; Hazy, Frank & O'Reilly, 2007; O'Reilly, Noelle, Braver, & Cohen, 2002). Bottom-up processing of inputs is stimulus-driven and may or may not promote a single desired end-state. To ensure that these bottom-up inputs are goal-consistent, computational models of cognitive control suggest that there are areas in the cortex that are responsible for the abstraction processes necessary to identify and maintain desired goals. Mechanistically, these cortical areas are hypothesized to promote some cognitive associations preferentially over others. In this way, people are able to maintain cognitive activation patterns that sustain their goals. This promotes two important control functions. First, it maintains goal activation in the absence of direct sensory inputs, allowing one to keep goals in mind even when the immediate environment does not provide concrete cues. Second, it helps facilitate the processing of inputs in a goal-relevant manner. For example, holding in mind the abstract goal to lose weight may preferentially facilitate associations that promote attention to a cake's calorie content at the expense of other associations that might promote processing of its taste (Cunningham & Zelazo, 2007; Fishbach, Friedman, & Kruglanski, 2003; Fujita & Sasota, 2011; Todd, Cunningham, Anderson, & Thompson, 2012; Zhang, Fishbach, & Trope, 2010). Thus, by biasing some cognitive associations over others, regions of the

brain responsible for high-level abstraction promote control by maintaining patterns of cognitive activation that sustain goal-directed processing.

Behavioral research has also suggested that abstraction promotes subordination and structure, and thus control. Much of this work relies on the technique of priming abstraction as a procedural mindset. Specifically, research suggests that inducing people to engage in cognitive abstraction in one task leads them to use similar abstraction processes to represent subsequent unrelated tasks. For example, having participants generate superordinate category labels rather than subordinate exemplars for a series of 40 disparate objects (e.g., "pet" vs. "poodle" for the target "dog") leads them to be more likely in an unrelated task to identify actions in terms of the superordinate ends achieved rather than by the subordinate behaviors necessary to execute them (e.g., "caring for the environment" vs. "bagging paper, glass, and cans" for the action "recycling;" Fujita, Trope, Liberman, Levin-Sagi, 2006). Findings like this suggest that getting people to engage in abstraction in one task procedurally primes the tendency to use abstraction in latter tasks.

Using such procedural priming procedures, Torelli & Kaikati (2009; see also Eyal, Sagristano, Trope, Liberman, & Chaiken, 2009; Giancomantonio, de Dreu, Shalvi, Sligte, & Leder, 2010) demonstrated that when engaged in greater cognitive abstraction, people demonstrate greater value-behavior consistency – the correspondence between people's expressed values and their actual behavior. In one study, participants first completed a measure of universalism – a value that promotes protecting the welfare of all (Sagiv & Schwartz, 1995). Some time later, following a manipulation of abstraction as described above, participants were given an opportunity to participate in a volunteer program designed to provide tutoring for the youth of underserved populations. Inducing abstraction led to greater correspondence between participant's endorsement of universalism and how much time they were willing to volunteer for in this tutoring program. This suggests that abstraction helps people

align their current judgments, decisions, and behavior in line with their more global values, an indication of enhanced subordination and control.

Research on self-control may be the most relevant to documenting the role of abstraction in subordination and control (e.g., Fujita, 2008; Fujita & Carnevale, 2012; Fujita, Trope, & Liberman, 2006; Rachlin, 1995). In a self-control conflict, immediately available rewards tempt people to abandon more distal and more valued ends (Ainslie, 1975; Fujita, 2011; Mischel, Shoda, & Rodriguez, 1989; Strotz, 1955). The conflict is structured such that the two choice options are mutually exclusive. For example, the ability to indulge in a piece of chocolate cake now may tempt dieters to sacrifice their more long-term weight loss goal. As dieters cannot engage in both behaviors simultaneously (eating cake necessitates deviation from one's weight-loss goal), they must choose one option or the other. To maintain control and adherence to the more valued yet imperiled end of weight-loss, dieters must subordinate chocolate cake in favor of the dieting goal. Research suggests that abstraction enhances this subordination process. For example, inducing cognitive abstraction via the procedural priming procedures described earlier enhanced preferences to eat an apple over a candy in a population concerned about watching their weight (i.e., female undergraduate students; Fujita & Han, 2009). This suggests that cognitive abstraction promoted the subordination of the immediate rewards of chocolate in favor of the more distal rewards of weight loss. Similarly, abstraction reduces temporal discounting – the tendency to prefer smaller yet more immediate rewards in favor of larger yet delayed rewards (Fujita, et al., 2006; Malkoc, Zauberman, & Bettman, 2010). Abstraction in this instance appears to have enhanced the ability to subordinate the pursuit of smaller-immediate rewards in favor of larger-delayed rewards.

These behavioral changes in control as a function of abstraction may be supported and sustained by some of the goal-directed automatic processes reviewed earlier, such as asymmetric temptation goal-associations and goal-directed evaluation associations. That is, abstraction may initiate

those goal-directed automatic processes to create and sustain the structure necessary for behavioral control. For example, Fujita & Sasota (2011) manipulated abstraction using the procedural priming techniques described above, and found evidence for goal-directed asymmetries in temptation-goal associations only among those who were engaged in abstraction (vs. not). Similarly, research by Fujita & Han (2009) suggests that abstraction promotes goal-directed evaluative associations, making it easier to associate positivity with goal-promoting stimuli and negativity with goal-undermining stimuli. These data further support the notion that abstraction is a critical component to subordination and control, helping to determine what end to pursue and setting into motion those processes necessary to create and maintain structure around that end.

Effortful Processing Can Impair Control

Conflating the two meanings of control that we have distinguished may lead some to conclude that conscious effortful processing is beneficial (particularly when they operate in opposition to "out-of-control" automatic processes). Understanding that control has two distinct meanings, however, leads to alternative possibility: conscious effortful processes may at times impair rather than enhance control. This is especially likely to be the case when effortful processing interferes with the structure and organization created by more automatic processes.

Some evidence for this assertion comes from research examining the effect of effortful processing on preferences and decisions (e.g., Dijksterhuis, 2004; Dijksterhuis, Bos, Nordgren, & van Baaren, 2006; Wilson, Lisle, Schooler, Hodges, Klaaren, & LaFleur, 1993; Wilson & Schooler, 1991). This work suggests that under some circumstances, consciously and effortfully working through a decision problem can lead to poorer decisions, whether measured according to some objective criteria or by post-decisional satisfaction. For example, verbalizing one's reasons for choosing one jam over another led research participants to prefer jams that were objectively of lesser quality (Wilson & Scholer, 1991). Similarly, when asked to choose among posters, those who consciously weighed their decision by

elaborating reasons why they should select one over the other were later less satisfied with their choice as compared to those who did not elaborate reasons (Wilson et al., 1993). To the extent that one's goal is to select the best jam or poster, these examples suggest that conscious effortful processing can impair control. Note too that researchers suggest that these phenomena occur because people's effortful processing interferes with the structure that more automatic processes create. Conscious elaboration of a decision problem can lead people to attend and over-weight features that are incidental or secondary to the choice (Wilson et al., 1993; Wilson & Scholer, 1991). Similarly, effortful processing may interfere with the integration and abstraction mechanisms set into motion by more automatic processes, making it more difficult to attend to and parse decision information in a goal-directed manner (e.g., Dijksterhuis, 2004). Thus, effortful processes can at times impair control, and this is particularly likely when such processing runs afoul with the structure created by more automatic processes. Such findings further highlight the conceptual independence between conscious effortful processing and control.

Reactive versus Proactive Control

That the term "control" has two meanings that are often not distinguished from one another may not only create conceptual confusion, but may also obstruct research progress, as it carries implicit assumptions about the nature of control as being something that is necessarily slow, effortful, and reactive. That is, influenced by the dual-process and dual-motive automatic vs. controlled dichotomies, many researchers have explicitly modeled control as a corrective response that is initiated only after a problem has already begun to develop. By contrast, we might propose that control is not necessarily retroactive, and need not be limited solely to addressing deviations from structured organization as they occur. Instead, we might propose that control can be directed prospectively, with people pro-actively preparing for anticipated problems and setting up anticipatory mechanisms that address them before

they occur. The distinction between retroactive and proactive control is applicable at both cognitive and behavioral levels.

Research on the control of racial bias provides evidence for proactive control at the cognitive level. Much research has shown that racial cues can facilitate the activation of stereotypic associations. For example, exposure to Black versus White faces facilitates the identification of objects as guns versus tools, respectively, presumably because people tend to stereotypically associate Black individuals with guns (e.g., Payne, 2005). Control of this racial bias by non-prejudiced individuals may occur in a reactive manner, as suggested by various dual-process models (e.g., Devine, 1989; Macrae, Bodenhausen, Milne, & Jetten, 1994). Specifically, in performing a sequential priming paradigm in which the presentation of Black and White faces immediately precedes the identification of guns and tools, participants may notice that the influence of the faces on their responses. Concerned about racial bias, they may engage in corrective attempts to limit this unwanted influence of the primed faces, imposing control during the identification of guns and tools to ensure high accuracy. Noting the initiation of a stereotypic response (misidentifying a tool as a gun following the presentation of a Black face), they may attempt to alter this response before it affects their behavior.[4] More recent research, however, has suggested the possibility of proactive mechanisms as well. Rather than engage in corrective control during the presentation of the critical targets (guns vs. tools), electrophysiological recordings suggest that low-prejudice individuals initiate anticipatory or pro-active control during the presentation of the primes (Black vs. White faces; Amodio, 2010). Rather than inhibit an undesired response after activation, it appears that low-prejudice individuals use the presentation of the prime as a cue that a potential problem may occur and engage in processing to prevent the problematic activation in the first place. This provides some evidence that cognitive control need not be a reactive or corrective process; instead, control can be directed forward in an anticipatory manner.

Like Odysseus, who had himself tied to the mast of his ship so that he could listen to the song of the Sirens without endangering his men, people also engage in a number of behavioral forms of pro-active control, structuring and organizing their social environments in ways to promote desired ends. That is, rather than trying to correct and inhibit a response after it has been initiated in a particular context, people will adopt a variety of behavioral pre-commitment or counteractive control strategies to reduce or eliminate one's ability to engage in the undesired behavior in the first place. Research suggests, for example, that people will deposit their money into "Christmas club accounts," savings accounts that pay little interest yet entail steep early withdrawal fees (Thaler & Shefrin, 1981). This financially counter-normative behavior promotes savings behavior by prospectively making it difficult to withdraw one's money to squander impulsively. Similarly, people will make "side-bets" with themselves, imposing penalties for goal-inconsistent behavior (e.g., Ainslie, 1975; Trope & Fishbach, 2000). For example, when faced with the prospect of a diagnostic yet uncomfortable health assessment, people will willingly impose steeper cancellation fees to motivate successful completion of the assessment (e.g., Trope & Fishbach, 2000). They will similarly engineer their environments to reward themselves when they have successfully engaged in goal-directed behavior. When given a choice between being paid before or after a diagnostic yet uncomfortable health assessment, people prefer to be paid after to make payment contingent upon (and thus provide greater motivation for) successful completion of the assessment (e.g., Trope & Fishbach, 2000). People will moreover restrict exposure to and availability of goal-undermining alternatives. For example, smokers will purchase cigarettes by the pack rather by cheaper bulk cartons to limit the ability to smoke freely (Wertenbroch, 1988). Learning to implement these behavioral forms of proactive control appears to explain age-related differences in delay-of-gratification. Whereas 4-year-old children mistakenly believe that exposure to goal-undermining temptation promotes control, 7- and 8-year-old children understand that occluding or removing these cues is a more effective goal-promoting strategy (e.g., Mischel & Mischel, 1983). Thus,

research suggests that control need not be a reaction to an undesired response to an environmental stimulus. Instead, people can anticipate these situations and take pro-active steps to create social environments that prevent disruption of goal-directed behavior.

We discussed earlier the role of abstraction in control, and how promoting abstraction not only promotes goal-consistent behavior, but also promotes automatic forms of controlled processing (namely, asymmetric temptation-goal associations and goal-directed evaluative associations). We might add here that research also highlights the role of abstraction in pro-active forms of control. Specifically, research suggests that inducing abstraction promotes the likelihood that people will adopt strategies like self-imposed punishment to forestall the possibility of future goal failures (Fujita & Roberts, 2010). In one study, for example, participants were presented with an opportunity to participate in a psychology study that would assess their cognitive skills at night. They were led to believe that this feedback would be diagnostic and useful, yet assessing these skills would entail uncomfortable procedures (i.e., appearing for the study in the middle of the night). Participants were asked how much they would pay as a cancellation fee if they failed to appear for their scheduled session. Those induced to engage in abstraction via a procedural priming manipulation similar to the ones discussed earlier were willing to pay 50% more in cancellation fees, presumably as a deterrent for failing to appear. Thus abstraction appears to promote not only automatic forms of control, but also proactive forms as well.

Although we have noted examples of proactive control above, we note that the overwhelming emphasis on control in psychology has focused on corrective or reactive mechanisms. We might speculate that such lack of attention to pro-active forms of control in psychology may have resulted from the underlying assumptions that control must be the opposite of automatic. That is, to the extent that controlled processing is slower and more effortful than automatic processing, one might reasonably assume that control must be a reaction to undesired situations prompted by automatic processes. We might instead suggest that it is time to question this assumption that control is necessarily a reaction to

automatic processing, and instead recognize that there are two meanings to the term control. Researchers must appreciate that there are forms of control that are not only automatic but also proactive.

Summary & Conclusions

In this chapter, we examined what is meant by the term "control," and explored the implications of this conceptual analysis for our understanding of the distinction between automatic vs. control. We have suggested that there are two meanings to the term "control." One meaning highlights the absence of features that are emblematic of automatic processes: lack of conscious intention, lack of conscious awareness, inability to be disrupted, and cognitive efficiency. A second meaning ignores whether a process is automatic or not, and instead focuses on the degree to which a process sustains and promotes structured goal pursuit. To have control, thoughts, feelings, and behaviors must be prioritized and organized around desired ends. The target of analysis from the perspective of this second meaning of control is thus not on the conditions under which a process operates, but rather the relationship of that process to others around it. A process can be considered controlled to the extent that it promotes and operates within this top-down structure to promote a given goal.

We have argued that abstraction promotes the creation and maintenance of this structure, helping to identify those ends around which processing must be organized. Abstraction may also help to detect processing that deviates from this structured organization, and activate the subordination processes necessary to promote or fore-ground goal-directed over goal-irrelevant processing. To understand control as structured goal pursuit, then, we suggest that more needs to be understood about the mechanisms of abstraction and its role in structuring thought, feeling, and behavior to promote the attainment of desired ends.

We might further suggest that whether a process is automatic or not may at times be irrelevant to understanding control. At minimum, researchers need to take greater care in distinguishing and

explicitly explaining to which meaning of the term they are referring. We, however, might take a step further and recommend that researchers abandon altogether the use of the term "control" when referring to processes that are not automatic. Greater clarity might be gained instead by labeling the opposite of "automatic" as "not automatic." This would allow researchers to reserve the term "control" to refer to structured goal pursuit and prevent any potential conceptual confusion. Thus, we argue that rather than representing two extremes of a dichotomy, the labels "automatic" and "controlled" should be conceptualized as independent concepts. The opposite of "control" is not "automatic," but rather "a lack of control" or "out-of-control." Similarly, the opposite of "automatic" is not "control," but rather "not automatic." Although this may seem like semantic squabbling to some, we have highlighted in this chapter some of the conceptual confusion and erroneous conclusions that semantics can create.

Although we have reviewed supporting evidence for independence of the two meanings of control, we recognize that more work needs to be done to more fully appreciate control as structured goal pursuit. We hope researchers will follow our lead and question whether the latent assumptions that underlie the distinction between automatic versus controlled processing are necessary, appreciating instead that control is a phenomenon that is independent of automaticity. We look forward to the insights that future research may have with this heightened conceptual clarity.

Footnotes

1. We use the term "goal" to describe the desired end-state to which thoughts, feelings, and behavior are directed. Goals do not necessarily need to be consciously adopted, nor do people need to be consciously aware that they are pursuing a particular end-state (for reviews, see Bargh, 1990; McClelland, Koestner, & Weinberger, 1989; Schultheiss & Brunstein, 2010). Moreover, what goal people are pursuing in a given situation may shift dynamically, as we detail in the next section.

2. An important point to note is that although enhanced control via structure may promote goal pursuit, it says nothing about the worthiness of the goal being pursued. People may pursue harmful or dangerous goals with great control. Whether a goal is worthy of attainment is an independent question from the efficiency and efficacy of the goal pursuit (i.e., issues of control).

3. We note that implementation intentions do not universally promote control. Under some conditions (i.e., negation of an undesired behavior), implementation intentions may impair rather than promote control (e.g., Adriaanse, van Oosten, de Ridder, de Wit, & Catharine Evers, 2011).

4. Parenthetically, although research suggests that people attempt to control biased responses through reactive control, some attempts may ironically enhance the biased responses (e.g., Payne, Lambert, & Jacoby, 2002).

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