

Non-conscious activation of behavior and performance; Priming success in the classroom

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Cognitive (social, behavioral, physical) information is processed in context with previous concepts/experiences and stored as a mental representation in memory. This becomes the conceptual framework for future judgment or behavior. Social interaction, judgment or behavior, requires accessing the information from memory. An individual's attention to a stimulus and resultant response requires a conscious cognition of memory. Despite the apparent vastness of memory and the rapidity of neural transmission, attention is limited, thus conscious cognition is limited. Since we can only consciously attend to a finite amount of material, attention becomes a matter of resource management. The most efficient use of attention and memory is when resourcing is limited to a minimum. Hence, the response to situational stimuli appears to utilize as minimal a cognitive effort for an adequate response and devoting attentional and analytical resources to controlled, deliberate information processing reluctantly and only when necessary (Fiske and Taylor, 1991; Kay et al. 2004). As such animals operate out of necessity as cognitive misers (Fiske and Taylor, 1991; Kay et al. 2004). To accomplish this many functions/tasks are removed to lower brain centers and/or subconscious control; "lower centers should be allowed to take fairly complete charge of a large portion of the labor as they can efficiently direct (Jastrow, 1906; p15). "Over-guidance by the higher centers thus cripples the efficiency of the work of the lower centers (Jastrow, 1906; p26). Delimiting memory acquisition and response to the lower centers and the subconscious not only conserves mental resources but also increases the speed and efficiency of the response.

The skill acquisition literature has always assumed that motor processes require a conscious, act of will. Other than the initial act to move (e.g. speaking, walking); much of the subsequent movement is subconscious, outside of conscious control; although certainly subject to conscious regulation. The same is true for social judgments and behavior. When habits, stereotypes, etc reach "the subconscious, subvoluntary all they need is a stimulus (initial start) to activate and run to fruition" (Jastrow, 1906, p. 45). Guidance of an individual's judgment or behavior appears to be based on a subset of the most readily accessible, and perhaps most recently activated concept(s)/cognition(s) at the time of the judgment or behavior (Tversky and Kahneman, 1974, 1973) rather than searching the entire sum of all possible cognitions. The stimulus becomes that which primes memory, activates concepts/cognitions, and prepares, guides, and initiates a response.

The basis for the concept of priming was introduced by Lashley (1951) from his studies on language production. Lashley reported that to understand a sentence one must recall the meaning of earlier elements of the sentence until the end of the sentence. This requires activation of mental representations that must be cued and maintained active until the end of the sentence. Hence, memory was activated and judgments produced based on which elements had been activated. The priming of a particular person-, trait-, or behavioral-concept(s) using stimuli that operate beyond one's consciousness is termed nonconscious priming.

Nonconscious priming can be defined as the passive, nonconscious activation of trait categories or behavioral contexts in one situational context carried over to influence social judgments or behavior in "subsequent, ostensibly unrelated contexts" (Bargh, 2006; Srull and Wyer, 1977). Another view

considers nonconscious priming as a bypass or automation of will (Bargh, et al., 2001). Ultimately priming is a nonconscious stimuli leading to a nonconscious action. Nonconscious priming, then, “minimizes cognitive resources that must be expended in discerning operative norms that facilitate social coordination” (Kay et al., 2004) and would subserve the “cognitive miser” scenario presented above.

Examples of nonconscious priming are ubiquitous throughout social and cognitive psychology and have been observed in language formation, impression formation and stereotypes, normative behavior, and goal-orientation. Cues can be words, trait or category concepts, environmental or material objects. Exposure to words related to *kindness* or *hostility* rendered individuals more likely to judge the same ambiguous character according to the trait activated by the prime; kind or hostile (Srull and Wyer, 1979) or according to positive or negative characterizations (Higgins, Rholes, and Jones, 1977). This includes exhibiting hostility towards the experimenter when so primed (Bargh et al., 1996). Individuals primed with the concept of *politeness* or *rudeness* were less or more likely, respectively, to interrupt a conversation to acquire information (Bargh, et al., 1996). Priming *fairness* significantly altered price negotiations and more cooperative bargaining strategies among individuals (Maxwell, et al., 1999).

Likewise, environmental clues can stimulate specific memory and behavior activations. When primed with a picture of a library individuals were quicker to recognize words relating to *silence*, an appropriate behavior for the library, than words unrelated to *silence* (Aarts and Dijksterhuis, 2003). In addition, sound pressure recordings revealed that these individuals also spoke more quietly after the priming in comparison to individuals who were shown pictures of a rail station. Similarly, when shown a picture of an upscale restaurant, individuals were primed to recognize words associated with *well-mannered* behavior typical for an undergraduate’s view of behavior befitting an upscale restaurant. The “upscale restaurant” prime also had an impact on behavior in that during an “eating experiment” appropriately primed individuals spent more time cleaning up after themselves and left their area cleaner than controls.

Another interesting aspect of nonconscious priming can be observed as behavioral mimicry; the nonconscious, unintentional mimicking of another individuals expressions, actions or movements during social interactions. This has been termed the chameleon effect (Chartrand and Bargh, 1999). In a social setting, one individual adopts the expressions and mannerisms of the other individual. In an experimental setting, subjects consistently mimicked smiling, foot shaking and body postures adopted by the experimenter during various cooperation tasks or discussion. The impact on the social setting was garnered from reports that subjects perceived that their interaction with another individual was more positive when that person mimicked the subject’s mannerisms and postures. In contrast, subjects reported perceived negative interactions/experiences with experimenters when the experimenter specifically avoided mimicking the subject’s expressions or movements. This behavioral mimicry has its basis in the general primate behavior as great imitators and it appears that this imitation is active during social interaction to facilitate good will and social approval (Chartrand and Bargh, 1995).

Perhaps the most interesting context of nonconscious priming is that of object priming; the impact that material objects have on human judgment and behavior. When asked to judge the interaction between two people from an ambiguous description, individuals were more likely to judge the interaction as *cooperative* or *competitive* depending upon the presence of a backpack or a briefcase, respectively, in the room (Kay, et al). Objects of business (briefcase, boardroom table, etc) engendered a competitive environment and behavior as opposed to a backpack; purportedly an object of leisure that led to more cooperation between individuals. Interestingly, these observations were equally instigated whether the individual was exposed to the actual object or merely a picture of the object.

In conclusion, appraisal and evaluation, perception and judgment and social behavior all display plasticity to priming effects. The question for the present purpose becomes if and how can the concept of nonconscious priming be applied towards an understanding of classroom dynamics and to facilitate student learning and success. When considering the above discussion, one must wonder what judgments/behaviors are being nonconsciously primed by the classroom itself or the presence of a teacher; the physical appearance of the teacher and so on; success, fear, failure, etc. What about the lecture format, open discussion, group projects – cooperation or competitiveness? Exams, quizzes, assignments – can the teacher activate positive judgments/behaviors? What impact do the very directions for taking a test have on motivation and/or success? Similarly, what judgments or behaviors are being conjured by a chalk board, power point slides, grading procedures, use of a red pen, the teacher's brief case, etc?

In this scenario the issue becomes one of social influence; acting with the intent of changing the attitudes, cognitions, and/or behavior of another individual. One can easily see this as being the role of the teacher with the ultimate goal being student learning and success. Clearly, the issue of social influence has been at the fore of social psychology research. However, much of our knowledge comes from those who have the most to gain from social influence; commercial compliance professionals (sales people, business people, con artists, etc; Cialdini, 1995; 1993). From his work in this arena Cialdini presents the psychological principles of social influence and compliance; reciprocity, social validation, consistency, friendship/liking, scarcity, authority (See Cialdini 1995 for a brief overview of each principle). In many instances when dealing with these commercial compliance professionals the consumer is at some level aware that tactics are being used to sway their decision (motivation or goal-orientation). Hence this is more or less taking place at the conscious level. However, there are certainly some clear implications of nonconscious activation at play here. Teachers clearly use many of these social influence principles in the classroom and there is a conscious association with the student about intent to alter motivation and goal attainment. However, and more recently, researchers have focused on how nonconscious priming applies to attitude, motivations, and goal-pursuit.

Attitudes/goals become automated through repeated selection in a given situation. As with any process receding into the subconscious, no conscious choice need be made to activate. Situational cues are enough to activate knowledge structures (perceptual categories, semantic concepts, stereotypes, etc) then attitudes and goals should be similarly activated (Gollwitzer & Wicklund, 1985; Wicklund & Gollwitzer, 1982); what Bargh describes as the automated will (Bargh, et al., 2001). Such automatic attitudes/goal-orientation is generally in line with individual values, life goals and purposes (Bargh, et al., 2001). However, activated attitudes/goals can replace or override long-held goals or attitudes. Automatic attitudes can be transiently altered by current goals or needs (Ferguson and Bargh, 2004; Sherman, et al., 2003; Moskowitz, 1999) with the subject reverting back to long-held positions upon removal of the primed attitude/goal. For instance a smoker's negative attitude towards smoking is affected by the time since the last cigarette (Sherman, et al., 2003). An individual can overlook their fear or negative attitude about rats to complete a task when they have been primed with pictures of rats (Ferguson and Bargh, 2004). Extended to the classroom; do the current goals/needs of a grade overcome the negative attitudes of home work at a nonconscious level and can such be primed? Could these negative attitudes be impacted in a positive, nonconscious way so as to present a more effective study experience and improve the learning experience? Such localized goals/attitudes can be altered by the relationship between the individuals involved; towards another's individual's goals (e.g. mother; Shah and Kruglanski, 2002) or towards the goals shared when the individuals are together (Fitzsimons and Bargh, 2003).

Nonconscious priming for achievement leads to a greater performance (compared to a control group) on a given task (Bargh, et al., 2001). Interestingly, this prime also led individuals to judge a fictitious individual to be achievement-oriented after reading an ambiguous description of the fictitious individual. Thus both achievement (goal-orientation) and judgment were altered. As applied to the classroom the former would be desirable; getting students to be more achievement oriented. However, an unexpected and perhaps negative consequence would be the perception that others in the class were also more achievement oriented and thus setting up unnecessary nonconscious activation of competition. This is of further interest when considering the impact of nonconscious priming of cooperation, achievement, and goal attainment (Bargh, et al., 2001; Locke and Latham, 1990) that could be accomplished through group work in or out of the classroom. Further, a group dynamic could alter an individual's negative motivation or attitude towards an assignment or vice versa as per Shah and Kruglanski (2002) or Fitzsimons and Bargh (2003) above. Certainly teachers have long used group projects with varying levels of success but usually with some level of drama on the part of the student groups. An interesting caveat with regards to achievement and application to the classroom; people with an additional goal to perform well outperform those who were merely instructed to do their best on a task (Bargh, et al., 2001; Locke and Latham, 1990). This suggests that there may be an impact of the stated/written instructions on the outcome of a given assignment or test or even guidance given for group work.

One remaining question about priming that would have specific implication to use in the classroom is decay; how long will a given prime last? This is perhaps an esoteric and difficult question to answer. One study showed that trait characteristics primed for positive or negative desirability remained active for 10-14 days (Higgins, Rholes, & Jones, 1977). The implication of decay of prime has not garnered much specific attention in the literature (e.g. hours or days to recession), but undoubtedly would be specific to a given situation and greatly variable and difficult to study given the multitude of influences present. Suffice it to say that the use of nonconscious priming in the classroom would likely require frequent and directed activation.

In closing, the title of Bargh's recent review (2006) says it all; what have we been priming all these years. The concept of nonconscious priming raises many interesting issues regarding what is being activated nonconsciously in an academic classroom and what are the possible applications of nonconscious priming with regards to student learning and success. In all of this it is important to remember that this transient activation is happening without conscious recognition of the individual(s). Presumably a student's goals/attitudes could be impacted in a positive way without their conscious participation or knowledge. An interesting, if not oversimplified concept. However, given everything reviewed the issue very likely centers on control. Indeed one of the frontiers for nonconscious priming research is control (Bargh, 2006); control over what is being primed systematically or naturally and under what circumstance(s). Control includes interference; interference implies both delay in response and a competition between activations. Stated simply, among multiple activations, which one wins! But perhaps the most interesting and useful application of this aspect of social psychology is the use of nonconscious priming to locally and transiently alter academic goals and attitudes towards greater success in the classroom.

Annotated Readings

Aarts, H. & Dijksterhuis, A. (2003). The silence of the library: Environment, situational norms, and social behavior. *Journal of Personality and Social Psychology*, 84, 18-28.

Social norms are the basis from which social behavior is directed. Social norms are learned but under what circumstances do particular social norms become activated in directing behavior. In two

pilot studies the authors determined, by questionnaire, what the typical undergraduate would consider to be normative behavior with respect to the present experiments; behave silently in a library and well-mannered in an exclusive restaurant. When primed with a picture of a library and a goal (an indication that they would be visiting a library), subjects latency time for recognizing appropriate, “silence” words (silent, quiet, still, whisper) was significantly faster than unrelated, control words (middle, strong, proceed, etc) or subjects who observed a picture of a rail station or a library without the visit goal. Further, the same goal-directed prime resulted in subjects speaking in quieter tones (sound pressure levels) than control or non-goal primed subjects. The level of priming activation was independent of recency or frequency of visits to the library. A third experiment tested the same situational norm-behavior processing but in a different situational context; behavior in an exclusive restaurant. When primed with a picture of an exclusive restaurant, subjects word recognition or behavior-environment matching latency were significantly faster for “well-mannered” words (decent, orderly, tidy, etc) or appropriate environmental behaviors. Additionally, when given a biscuit to eat, under the legitimate guise of the experiment, subjects with the restaurant prime cleaned up crumbs more frequently and left the table cleaner than controls (video analysis). As with the library experiments the results were independent of frequency or recency of eating at an exclusive restaurant.

Bargh, J.A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action. *Journal of Personality and Social Psychology*, 71, 230-244.

The automaticity or nonconscious activation of social behavior was studied in a series of three experiments. In the first subjects were asked to complete a task and then seek the experimenter, who would be in the hallway, for the next task. The experimenter was involved in a conversation with another individual when the subject arrived for task #2. Subjects who had been primed with words associated with politeness (respect, honor, considerate, etc) took significantly longer to interrupt the experimenters conversation than those who had been primed with words associated with rudeness (bold, disturb, intrude, etc). In Experiment #2 individuals primed with words stereotyping the elderly and associated with slowness (Florida, old, lonely, retired, etc) walked at a significantly slower pace than those primed with age-independent terms. In Experiment #3 subjects were asked to complete a tedious and boring survey. After 130 trials of the task a contrived message that there was a computer error and that the work was not saved and needed to be repeated. Individuals who had been primed with a subliminal image of African-American male reacted significantly more hostile to the news of the computer error as those primed with the image of a Caucasian male. The hostility response was independent of assessments related to level of racist beliefs. In total, nonconscious activation of a trait construct or a stereotype led to specific behavior outcomes in an unrelated context.

Bargh, J.A., Lee-Chai, A., Barndollar, K., Gollwitzer, P.M., & Trotschel, R. (2001). The automated will: nonconscious activation and pursuit of behavioral goals. *Journal of Personality Social Psychology*, 81, 1014-1027.

Five experiments were performed to test if goals could be active without awareness and nonconsciously guide subsequent situational demands. In Experiment #1 individuals primed with words relating high performance (e.g. win, compete, strive, etc) performed significantly better on a series of word-search tasks than individuals exposed to neutral primes (e.g carpet, robin, hat, etc). In Experiment #2 individuals primed with words associated with cooperation (e.g dependable, helpful, honest, support, etc) were more likely to cooperate with another individual by limiting profits and maintaining lake stock in a fishing profit scenario. Whereas neutral primed individuals would maximize profits (at the risk of

losing all profits) while disregarding the conditions of the other “fisherman”; thus they were less likely to cooperate. The effects of Exp #1 and #2 were verified to be nonconscious activation of goals to perform well rather than activation of semantic categories of performance and cooperation of behavior. Using a prime-delay-task design it was observed that the delay between the prime and task affected impression formation and word-search performance in the opposite directions. In agreement with previous impression formation studies the perceptual effects of the prime decayed with time, whereas word-search performance was enhanced with time. It is important to note that the nonconscious priming had results similar to those of individual’s that were consciously aware of the goal to perform well. Experiments #4 and #5 were performed to test whether nonconsciously activated goals produce the same “classic qualities” of persistence and resumption as postulated and observed for consciously set goals (Gollwitzer & Wicklund, 1985; Wicklund & Gollwitzer, 1982). Repeating Experiment #1 individuals were told to stop work after two minutes rather than 10-minutes. Video analysis (as there was no experimenter in the room when the stop work command was given) revealed that 57% of the high-performance primed individuals continued to work compared to 22% of the neutral group. In Experiment #5 individuals were told that they would complete two tasks; first a word-search task (intellectual task) and then a cartoon-rating task (fun task). After a contrived 6 minute interruption during the word-search task individuals were given a choice to resume or switch tasks under the guise of limited time. Individuals primed for goal performance were more likely to return the word-search task (66%) than controls (32%) indicating a nonconscious desire to perform well on the intellectual task.

Chartrand, L. & Bargh, J.A. (1999). The chameleon effect: The perception-behavior link and social interaction. *Journal of Personality and Social Psychology*, 76, 893-910.

The chameleon effect is defined as an individual’s unintentional, nonconscious mimicry of facial expressions, or body postures or mannerisms during a social interaction. During a picture description task led by an investigator with a “confederate” investigator, experimental subjects displayed facial expressions (smiling vs. non-smiling) and mannerisms (foot shaking or face rubbing) consistent with that of the contrived confederate (video analysis). In a similar setting, subjects reported that they “liked” and had a “smoother interaction” with a confederate that mimicked their expressions/movements during a similar picture-describing task compared with a non-mimicking confederate. The apparent improvement in social interaction was independent of the level of eye contact, smiling, apparent friendliness with the confederate, and the experimental subject’s awareness that they were being mimicked. Hence, it is hypothesized that the chameleon effect serves an adaptive function that improves rapport and satisfaction during social interactions. During a third picture describing experiment, individuals who were determined to be perspective-takers (by questionnaire) mimicked the mannerisms of the confederate to a significantly higher degree than those who not considered perspective-takers. In contrast, high and low levels of empathic concern did not discriminate between levels of mimicking. This indicates to the authors that the action of mimicry would support a perspective-takers ability to guide a successful social interaction.

Devine, P.G. (1989). Stereotypes and prejudice: Their automatic and controlled components. *Journal of Personality and Social Psychology*, 56, 5-18.

Stereotypes become automatically, and independent of conscious control, active when primed with only the physical features of a particular stereotyped group. Further, this activation was associated with simple knowledge of stereotype features and not related to level of racial prejudice. However, the level of prejudice did affect the extent which individual’s would go to inhibit the stereotype process and what individuals were willing to report about African-Americans. In separate experiments, an African-

American stereotype was primed using words like musical, athletic, etc. This prime also activated the trait of hostility as indicated by judgments of an ambiguous target person. Thus, automatically activated stereotypes can result in behaviors that are not necessarily consistent with current attitudes or beliefs. The authors suggest that the differences are associated with a limited capacity to process information. A conflict arises when the value system (low-prejudice group) has been altered and initiation of “stereotype-inhibiting” processes that require frequent activation for cessation of a habit (an apparently unsupported hostility response).

Higgins, E.T., Rholes, W.S., & Jones, C.R. (1977). Category accessibility and impression formation. *Journal of Experimental Social Psychology*, 13, 141-154.

Under the guise of a memory and reading comprehension study, subjects were primed with either positive or negative trait terms that were applicable or non-applicable to trait categories addressed in the present experiments. The priming words were presented within a memory task to conceal their meaning. Next subjects read a paragraph (reading comprehension task) about a specific target person and containing ambiguous references to four trait categories. With reference to the paragraph, subjects were asked to evaluate the target person’s desirability characteristics in four trait categories and to answer 8 factual questions about the paragraph (which effectively masked the “priming” intent of the study as indicated by post-experiment questioning of the subjects). When asked to characterize the target person, primed subjects chose the positive or negative connotation of ambiguous references based on the trait activated during memory task 95% of the time. When primed with non-applicable trait characteristics subjects were mixed in their categorization of the target person. For example, when the target person was described as “well aware of his ability to do many things”; the priming term self-confident conjured a positive character reflection, while the priming word conceited conjured a negative character reflection. To complete the study subjects were asked to rewrite the paragraph “word-for-word” as the authors predicted that subjects would “distort” the reproduction according to activated trait categories; this was not the case. After 10-14 day decay period the subjects positive or negative desirability of the target person remained consistent with their original primed evaluation (27 out of 40) while the non-applicable priming showed an opposite trend with an increased tendency to polarize their characterization of the target person; i.e. only 9 out 20 gave a mixed characterization. Interestingly, there was an increased polarization of desirability characterization of the target person as compared to no such polarization during the initial reproduction of the paragraph.

Joblonski, E.M., & Mueller, J.H. (1972). Anagram solution as a function of instructions, priming, and imagery. *Journal of Experimental Psychology*, 94, 84-89.

Solving anagrams would expectedly require activation and availability of the solution word. Hence, one may be able to solve anagrams more frequently and rapidly with words activation primes. Word meaningfulness to the population was assessed in a pilot study and found to be appropriately high for use in these experiments (priming and anagram words). Direct priming (20 word primes that included the anagram solution words) resulted in the greatest (8/8) and fastest (14 seconds) anagram solutions. Associative priming (e.g. anagram- sheep; prime wool) yielded a high number of solutions (6.2/8) but with a slow response time (162 seconds). Interestingly, controls (no primes or directions) solved 6.6 anagrams in an average of 128 seconds; significantly faster than the associative primes. In this case it appears that the associative primes impaired anagram solution in contrast to an expected facilitation. From further analysis it appears that the impairment may be due to a weakness of the associative primes to the anagram words which then allows other issues to interfere (instructions, warm-up, etc) with the activation.

Kay, A.C., Wheeler, S.C., Bargh, J.A., & Ross, L. (2004). Material priming: The influence of mundane physical objects on situational construal and competitive behavioral choice. *Organizational Behavior and Human Decision Processes*, 95, 83-96.

The goal of these experiments was to explore the possibility that material objects can activate nonconscious behaviors. Priming was instituted by having subjects match pictures with descriptions. When primed with pictures of business objects (briefcase, suit, boardroom table, etc) individuals selected words that were more aggressive or competitive during a word completion task. Similarly, subjects perceived an ambiguous interaction between two people (from reading a paragraph) to be argumentative, competitive, and uncooperative following activation of trait concepts with pictures of business objects. In a separate study individuals were asked to propose a split of \$10 between themselves and another individual; a proposal that could be accepted or rejected by the other subject. If rejected no one would receive any money. When primed with business objects 8 out of 12 subjects proposed an uneven split of the money (e.g. \$7 vs \$3 in favor of themselves) whereas 10 out of 11 controls chose a 50-50 split leading the authors to conclude that the primed individuals were more aggressive and risky analogous to a typical business setting. Similar results were observed when subjects were primed with the actual objects rather than pictures. Finally, the priming effects were found to be greatest with greater situational ambiguity. In other words, in an effort to minimize cognitive resources, priming would have the greatest effect in cases of greatest ambiguity.

Strull, T.K., & Wyer, R.S. Jr. (1979). The role of category accessibility in the interpretation of information about persons: Some determinants and implications. *Journal of Personality and Social Psychology*, 37, 1660-1667.

Under the guise of a language study subjects performed a sentence construction task (priming task) with words associated with the trait concepts of hostility (Exp 1) or kindness (Exp 2). Hypothetically, exposing subjects to words related to hostility or kindness would “cause” them to subsequently view a target person as more hostile or kind than the impression formed by a control group. The priming task consisted of forming two sentences from groups of four words, e.g. “leg break arm his” (hostility) or “the hug boy kiss” (kindness interspersed with nondescript filler words (her found knew D). Following the sentence construction task, subjects completed an impression formation task by reading a vignette and judging a target person who was described in a series five behaviors that were conducted in the course of a single afternoon and were ambiguous with respect to hostility or kindness. Judgments of ambiguous behaviors were significantly influenced by the activated trait (hostility or kindness), meaning that subjects were more likely to judge the target as being hostile using the most readily accessible trait concept (when hostility was primed) and vice versa. Analysis revealed that the trait concept of hostility was easier to prime (requiring as few as 6 priming instances) and that once activated, hostility judgments decayed at a slower rate compared to the trait concept of kindness. A post-experiment questionnaire indicated that only 5 of the 96 subjects associated the sentence construction task with the impression formation task and only 1 of 96 identified that the priming task was specifically related to the impression formation task.

Warren, R.E. (1972). Stimulus encoding and memory. *Journal of Experimental Psychology*, 94, 90-100. Based on the concept that encoding memory is accomplished in a series of bits (logogens), the impact of activating multiple logogens on interference of verbal production was studied using the Stroop color naming task (Stroop, 1938). The task requires subjects to state the color of a printed word while ignoring the actual word. Theoretically activating multiple logogens will lead to interference in verbal

production; increased latency between cue and verbal production. Verbal response latency was significantly delayed when subjects were not pre-activated, or activated with irrelevant and relevant words (increasing magnitude of latency). For example, the greatest latencies for indicating print color of the word AUNT when primed with the words AUNT UNCLE COUSIN. In subsequent experiments the decay of word logogen activation on verbal production was shown to be impacted by additional stimuli in the form of memory tasks (e.g. recall the priming words following color naming trials). The cross-trial rehearsal necessary for accurate recall of words “caused” multiple word logogens to remain active longer and hence there was no apparent decay in latency with varying stimulus-response lag time. However, when there was no additional activation (recall) tasks imposed there was a decline in verbal production latency interference within 10 seconds, continuing linearly through 50 seconds. Within the time frame studied (50 seconds), the interference latency was not completely extinguished.

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