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Mental Modes:

Priming of Expertise-Based Dispositions in Expertise-Unrelated Contexts

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Abstract

Why does the general demeanor of others change as soon as they begin to 'talk shop' or do something else that puts them into 'work-mode'? We propose that such phenomena reflect an instance of incidental priming in which environmental cues activate actional 'sets' formed through extensive training in a particular domain (e.g., music). Accordingly, we demonstrated that, by activating a 'musician set,' incidental musically-related stimuli prime musicians to spend more time on a domain-irrelevant task rehearsing nonsense words as compared to controls or non-primed musicians, as this set should involve a tendency towards deliberative practice. This finding provides additional evidence for a central tenet of social cognition research—that the mere presence of ambient stimuli influences behavioral dispositions systematically, in ways that often escape one's awareness.

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It is common knowledge that friends undergo a mild metamorphosis as soon as they begin to 'talk shop,' 'talk business,' or do anything else that puts them into 'workmode.' When confronted with work-related matters, for example, the lawyer friend may become more careful with language; when asked about research, the professor friend may begin to monologue and use fancy words such as 'juxtaposition'; when in a musical environment, the musician may become more motorically animated and, perhaps, more prepared for focused practice. Similarly, the dancer, athlete, and entertainer, too, appear to transform themselves as soon as they start thinking about their vocation or find themselves in a vocation-related situation.

We propose that such phenomena are manifestations of a form of *incidental behavioral priming* (Bargh & Chartrand, 2000), one in which incidental environmental cues activate actional 'sets' formed through extensive training in a particular domain, with the potential for application onto tasks unrelated to the domain itself. From this standpoint, an individual possesses a number of acquired, domain-specific actional sets—highly constructed clusters of actional, motivational, and set tendencies (cf., Pryor & Merluzzi, 1985) that reflect not evolutionary concerns, but idiographic processes developed in ontogeny through extensive training in a particular domain (e.g., music). The notion of such domain-specific sets compliments that of *situated identities* (in which an individual is construed as having multiple identities, with only a subset of identities activated at any one time; cf., Baldwin & Holmes, 1987; Krauss & Pardo, 2005; Markus,

1977) and that of learned mindsets (Dweck, 2006), as well as evolutionary-based mindsets (Tetlock, 2002). To understand how such sets are activated, it is necessary to appreciate the powerful influence of the current environment on behavior (Wood, Quinn, & Kashy, 2002) and the process of environmentally-driven automaticity.

Environmentally-Driven Automaticity

One of the fundamental questions of social cognition is how the mere presence of people and 'things' in the world can influence our actions and motivations in ways that escape our awareness (Bargh, 2001; Bargh & Morsella, 2008; Nisbett & Wilson, 1977). Today, much of these phenomena are explained in terms of incidental behavioral priming, in which supraliminal stimuli (i.e., stimuli that one *is* aware of) influence one systematically, but in ways that one is unaware of (see review in Morsella & Bargh, 2011). Contemporary incidental priming research demonstrates that incidental, environmental stimuli can nonconsciously influence the degree to which behavioral dispositions are expressed. For example, when primed with (typically word) stimuli associated with the stereotypes of 'elderly' or 'library,' people walk slower and speak more quietly, respectively (Aarts & Dijksterhuis, 2003; Bargh, Chen, & Burrows, 1996). These effects have been found not only with verbal stimuli that are semantically related to the goal (as in many studies), but also with material objects. For example, backpacks and briefcases prime cooperation and competitiveness, respectively (Kay, Wheeler, Bargh, & Ross, 2004); candy bars prime tempting hedonic goals (Fishbach, Friedman, & Kruglanski, 2003); dollar bills prime greed (Vohs, Mead, & Goode, 2006); scents such as cleaning fluids prime cleanliness goals (Holland, Hendriks, & Aarts, 2005); sitting in a professor's chair primes social behaviors associated with power (Chen, Lee-Chai, &

Bargh, 2002; Custers, Maas, Wildenbeest, & Aarts, 2008); control-related words prime the reduction of prejudice (Araya, Akrami, Ekehammar, & Hedlund, 2002); and the names of close relationship partners (e.g., mother, friend) prime the goals that those partners have for the individual as well as those goals the individual characteristically pursues when with the significant other (Fitzsimons & Bargh, 2003; Shah, 2003).

Together, these findings have led to the view that there is an automatic *perception-behavior link* from perceptual processing to action planning (Dijksterhuis & Bargh, 2001). With respect to cognitive processing, these effects have been explained in terms of the neural network-based notions of *continuous flow* (Eriksen & Schultz, 1979) or *cascade processing* (McClelland, 1979), in which activation in the nervous system cannot help but flow from perceptuo-semantic stages of processing to action-planning stages (Coles, Gratton, Bashore, Eriksen, & Donchin, 1985). (The nature of such processing is beyond the purview of the present approach; see review in Levine et al., 2007; Morsella, Zarolia & Bargh, 2011.)

We believe that the time has come for social psychological research to begin looking at the nature of these effects in expert populations. Examining such effects in expert populations would provide a portal through which to better appreciate the role of ontogenetic processes in these effects. In this vein, it is important to note that, in most cases, participants are nonconsciously influenced by incidental stimuli (e.g., a businessman's briefcase) only because they have had extensive training with, or exposure to, the relevant stimuli during ontogeny. Even the classic and unfailing Stroop effect (Stroop, 1935) requires that the subject possess vast cultural knowledge (reading) that was acquired over the course of many years. As with all forms of practice, frequent

application of a set (e.g., to read) onto a particular stimulus class (e.g., words) will over time lead to enduring, chronic changes in accessibility of the set (Anderson, 1987; Higgins, 1996; Wyer & Srull, 1989). Not only will chronic access of a stimulus-specific set make its retrieval more automatic, the set may also be over-applied (Bargh & Thein, 1985), as in the Stroop effect and in demonstrations of behavioral priming (e.g., Aarts & Dijksterhuis, 2003; Kay et al., 2004).

To illuminate the nature of anecdotal phenomena mentioned in our opening paragraph and build on incidental priming research, we decided to focus more closely on the nature of incidental priming in expert populations. At a certain level, this form of priming is distinct from priming resulting from general semantic knowledge (e.g., as in Bargh et al., 1996; Kay et al., 2004). Initially, we considered evaluating whether the behavioral dispositions of professionals such as carpenters, mechanics, and engineers are affected by the mere presence of trade-related tools, but found it too challenging to find an adequate control group, for the tools of these trades are well-known to nonprofessionals. Instead, we adopted a more simple, feasible, and informative approach—studying *expertise priming* in musicians. We selected musicians for several reasons, including that they constitute a substantial percentage of the college population, that many of their actions involve automatic processes (Levine et al., 2007; Levitin, 2007), and that previous studies have shown that their skills do transfer to other domains, such as those involving motor ability, auditory acuity, and perceptual acuity (Gilman & Underwood, 2003; Koelsch, Schroger & Tervaniemi, 1999; Levine et al., 2007; Ragert, Schmidt, Altenmuller & Dinse, 2004).

With this in mind, it is clear that there is such a thing as the ‘intentional transfer’ of

knowledge and dispositions by an individual, in which the need to transfer knowledge to a new domain is clear, apparent, and known to the individual (Ericsson & Charness, 1994). Beyond this, there may also be *implicit* transfer, which would be neither consciously deliberate nor necessarily useful in all instances. William James first touched upon his concept of the nonconscious "habit" (James, 1890), claiming that not only are our behaviors for the most part determined by habit, but that even our innate instincts can be modified to fit the situation, with practice.

In addition, the idea of a nonconscious transfer of expertise-based motivations, dispositions, and knowledge is predicted by various models of cognitive processing proposing that frequent use of a strategy over time will lead to enduring, chronic changes in accessibility of those strategies (Anderson, 1987; Higgins, 1989; Wyer & Srull, 1989). Prior experience with a stimulus may influence perception and judgment spontaneously, without explicit, purposeful intention to retrieve or apply that prior experience (Fazio, 1986; Smith, 1984). In this manner, cognitive processes used regularly are likely to be evoked by a current relevant goal, and more likely to be chosen over other competing heuristics of equal potential applicability. For example, Sternberg (1996) commented upon the possible downside of expertise—namely, that there is increased rigidity in responsiveness. It can become difficult for the expert to see a different point of view or a new way of doing things, and strategies that become chronically applied in the context of one domain may not benefit an individual in another context.

Considering these ideas and empirical developments, based on Levitin (2007), we hypothesized that musicians should possess an actional set embodying what it means to be a musician—a mode involving the tendencies associated with motor tasks, practice,

and the ability (or tendency) to repeat and rehearse information. Hence, in a quasi-experimental design, we evaluated whether, when primed covertly with the concept of 'musicianship,' participants who are musicians will display increased rehearsal behaviors in a music-irrelevant task (studying a list of nonsense words). In the first part of the experiment, participants were primed with either music-related or control words while doing a word-search task. In the second part, participants were instructed to study a list of words. We predicted that, as a result of activation of a 'rehearsal set,' primed musicians would spend more time studying nonsense words compared to controls or non-primed musicians.

Method

Participants. Sixty-eight Yale University undergraduates participated in the study for either class credit or $8 cash. All participants were compensated equally for their participation, regardless of how long they persevered on the task.

To diminish experimental demand, participants were surveyed about their musical training histories only after the conclusion of the experiment. In a verbal debriefing, participants were asked the following questions: *Have you ever received any formal musical training, and for how many years? Please specify age ranges of training, and instruments. Have you ever been capable of reading musical notation? Would you consider yourself an expert sight-reader? Please describe your current involvement in terms of time commitment and personal importance of musicianship. Do you consider yourself a musician?*

Based on the responses to these questions, two judges determined the group to which a given participant was assigned. On the basis of this information, participants

were divided into three categories: musician (n = 27), non-musician (n = 32), or ambiguous/novice (n = 9). Judges reached a consensus regarding all assignments, and this consensus was primarily necessary to qualify ambiguous cases of novice musical ability. It should be noted that although expertise is often considered past ten years of training (Ericsson & Lehmann, 1996), because our participant pool was fairly young (age range = 18-21), for this study we deemed a musician to be an expert if he or she trained for at least six years, reported current and ongoing engagement with their instrument, had the ability to sight-read musical notation, and did consider themselves a musician. Among those within this criterion group, training ranged from six to eleven years (μ = 7.51, σ = 1.47). A participant was considered to be a non-musician if he or she reported having no significant musical training whatsoever, with no ability to read music or play an instrument. Participants not falling squarely into these categories were regarded ambiguous, and their data were excluded from analysis. Ambiguous participants included those who had trained on an instrument less than six years during childhood and reported that they could no longer play or read music, and self-taught hobbyists who reported that they did not consider themselves 'musicians' despite a novice level of musical ability. Vocalists were also considered ambiguous, as they did not fit squarely within the purview of this study.

Procedure. Participants were run individually in a two-task experiment. Each participant was asked to complete a packet and follow the written directions. Participants were asked to notify the experimenter verbally only when they had completed each task by stating, 'I will now move on to the next section.' Sitting across from the participant at a large table, the experimenter feigned engagement in reading a book. The experimenter

avoided eye contact with participants and, with a hidden clock, covertly timed them during the study task (task 2).

The first task in the packet was a simple word search task. Participants were asked to search within a letter matrix (of 130 letters) for each of 16 words listed. Participants were given the cover story that the task was a study of word recognition. There were two versions of the word search task: a control version and one designed to semantically prime musicianship. Participants were randomly assigned to one of the two versions. The experimental version contained eight music related search-words embedded within a list of 16: bar, signature, quarter, conduct, note, flat, staff, scale. To diminish experimental demand, prime words were chosen for their ambiguity, such that each music-related word was a homograph of a word that is unrelated to musicianship (for example, the word 'scale'). All filler words (the 8 remaining search-words: lamp, basket, river, red, king, furnace, grain, ape) were unrelated to music or to motivation/persistence. The control version of the word-search task contained fillers that resembled the primes with respect to orthographic/phonological features, but lacked a semantic relationship to musicianship (for example, 'scalp' to match 'scale').

Upon completion of the word search task, participants were instructed to alert the experimenter that they were ready to commence task 2. At this point, the experimenter covertly started a timer. Although the basic instructions for the second task were to study, the instructions were meant to be highly ambiguous with respect to how long one should perform the task. Instructions for the task merely read, "Please study this list of nonsense words. When you are ready to move on to the next task, notify the experimenter," and a list of 19 non-words followed on the page (e.g., 'mig'). No other

information was given to participants regarding the purpose of the task. Timing continued until the participant notified the experimenter that he or she was done. Piloting (n = 9) revealed that for our purposes, the manipulation was far from obvious. When queried during funneled debriefing (following the procedures of Bargh and Chartrand, 2000), no participants reported having discerned the true purpose of the study nor of the word search manipulation. This brief post experimental survey asked participants to describe what they introspected themselves to be doing while looking at the word list, that is, whether they had employed any particular goals or strategies in approaching the list. The responses did implicate the goals of repetition and practice (78% of participants reported these intentions), rendering our assumption about what participants were actually doing more plausible. In addition, the experimenter's observations of participants' behaviors corroborate the assumption that participants followed instructions and spent their time studying the word list when they were instructed to do so.

Results and Discussion. Analyses were carried out only on those participants (n = 59) who were not considered 'ambiguous' cases. Responses were analyzed in a 2x2 between-subjects ANOVA, with musicianship status (musician versus non-musician) and priming condition (primed versus control) as factors. As predicted and illustrated in Figure 1, there was a significant interaction between musicianship status and priming condition, $F(1, 55) = 11.75$, $p = .0012$ (η_p^2=.18), in which musicians spent substantially more time on task only when primed by musically-related stimuli. There was also a significant main effect of priming, $F(1, 55) = 18.284$, $p < .001$ ($\eta_p^2 = .25$) and musicianship status, $F(1, 55) = 5.16$, $p = .027$ ($\eta_p^2 = .09$). Figure 1 reveals which contrasts between the four cells were significantly different from each other (ps < .05).

Because of the possibility that the time at task data might be skewed, we conducted tests of normality and found that the data were positively skewed ($Z = 4.58$), and the kurtosis was significantly positive ($Z = 3.28$). Therefore, we transformed the data into logarithm base 10, putting the skewness ($Z = .502$) and the kurtosis ($Z = -1.31$) well within normal range. The resulting log-transformed ANOVA output shows a significant main effect of the priming condition, $F(1, 55) = 11.231$, $p < .005$ ($\eta_p^2 = .17$), along with a significant interaction effect between musicianship status and priming condition, $F(1, 55) = 8.634$, $p < .005$ ($\eta_p^2 = .136$). Within the priming condition there remains a significant difference between musicians and non-musicians, in support of the current hypothesis.

In conclusion, musicians spent more time than non-musicians studying nonsense words (an expertise-unrelated task) after receiving the covert musicianship prime.

General Discussion and Limitations of the Current Approach

The incidental priming demonstrated in our study sheds some light on why the general demeanor of others changes as soon as they begin to 'talk shop' or do something else that puts them into 'work-mode.' When covertly primed with music-related stimuli, musicians spent more time studying nonsense words than non-primed musicians or controls. This finding supports the idea that people do transform themselves to some degree when talking shop or placing themselves in a work/trade-related context.

It is important to note that research on behavioral priming tends to reflect only the subset of behaviors that the experimenter chooses to observe (for example, rate of walking, speech volume, etc.), but in no way does this suggest that one prime yields only one single effect (Bargh & Chartrand, 2000). Nor does it necessarily suggest that one prime yields equivalent expression in any two individuals, as illustrated in the present

study. Clearly, this study forms only an initial inquiry into a special case of the perception-behavior link, and much remains to be elucidated to fully understand environmentally-driven automaticity. For example, it is unclear how expertise priming may cause differential effects in a participant who plays one or another specific instrument. For our purposes, all musicians were grouped together regardless of the particulars of their instrument of choice. Future work in this direction might aim to further investigate such subtle nuances.

Evidence of cue-elicited activation is obvious in everyday action slips (Heckhausen & Beckmann, 1990) and in rare neuropsychological conditions. Caused by damage to the frontal lobes, the syndrome *utilization behavior*, for example, induces a state of disinhibition in which patients are incapable of suppressing actions that are elicited by action-related objects (Lhermitte, 1983). A patient afflicted with this syndrome will manipulate an object (e.g., a cup) even when instructed not to do so (Rossetti & Pisella, 2003). Naturally, these 'stimulus control' findings have to be reconciled with the fact that, in normal everyday situations, it is certainly *not* the case that one impulsively responds to every action related stimulus that comes one's way. Although it may helps one prepare for all possible near futures in our environment, the adaptive value of multiple stimulus-elicited active action plans must still be reconciled with the temporal limitations of the skeletomotor system, in which words and actions can be expressed only one at a time (Morsella, 2005; Wundt, 1900). In this arrangement, expertise priming is only one of many kinds of nonconscious modulators of overt behavior.

Regarding the limitations of our experimental approach, it may be that the musically-related primes activated, not a specific rehearsal goal, but a more general achievement goal. Although somewhat ambiguous, the instructions used in this study directed subjects to 'study the nonsense words,' which implies a goal state. Theories regarding *accessibility* and *applicability* (Higgins, 1996; Tulving & Pearlstone, 1966) informed our use of this task, because, although priming effects are powerful behavioral elicitors, only those behaviors which are situationally applicable can be elicited in this manner. As noted earlier, a large majority of subjects did report the intention of achieving some degree of memorization. Nevertheless, as our interest was in finding enhanced practice time rather than enhanced ability to memorize words, we did not ask any participant to actually recall the word list. Such an additional performance measure could certainly be included in replications and extensions of this paradigm. Future studies can focus to a greater extent on the exact effects that our prime had on musicians. Certainly the musicianship prime may activate other goals in musicians, such as the goal to perform well or to achieve. Future investigations may examine the larger breadth of priming effects on expert populations.

Despite the shortcomings, what should be noted is that, while a large majority of the subjects did in fact report during debriefing a specific intention to practice the words (including the primed novices), only the expert spent increased time at task, as predicted. What distinguished experimental from control subjects in this study was the rehearsal time in the pursuit of the intention to study.

At this stage of understanding, it seems that expertise priming is a form of the more general process of incidental priming, a central phenomenon in social cognition

research. Previous research has demonstrated that incidental priming can influence behavioral dispositions systematically (Aarts & Dijksterhuis, 2003; Bargh et al., 1996; Carver et al., 1983; Dijksterhuis, Chartrand, Aarts, 2007; Kay et al., 2004; Wood et al., 2002). Our study extends this research by demonstrating that such effects are not limited to discrete actions, nor to behavioral dispositions based on general semantic knowledge (e.g., as in Bargh et al., 1996; Kay et al., 2004), but can also be based on dispositions stemming from extensive training in a particular domain. One can readily imagine scenarios that illustrate the evolutionary advantage of having learned, object-related responses potentiated regardless of an actor's present intentions (Bargh, 1997).

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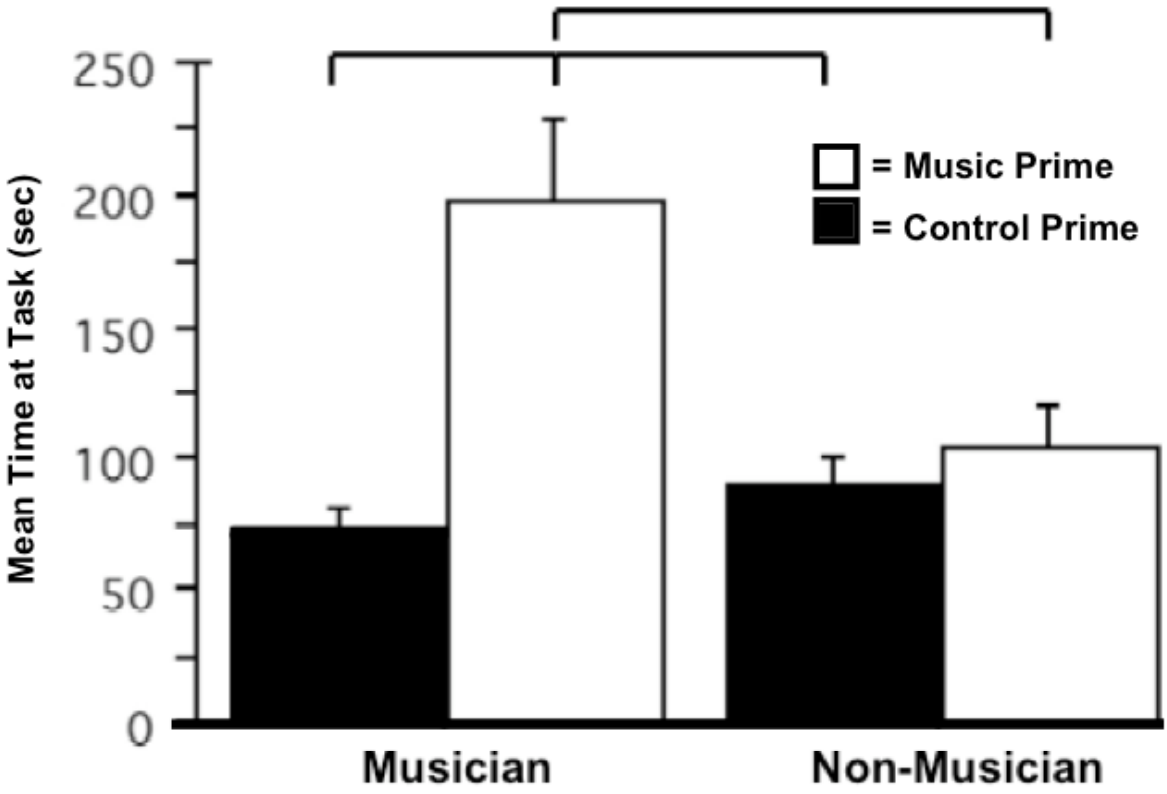
Figure Captions

Figure 1: Mean persistence at task (sec) as a function of training (musician versus non-musician control) and priming condition (music-related priming versus control). Error bars signify $\pm$ *SEM*. Horizontal lines signify significant contrasts (*p*s < .05).

Figure 1


250
200
150
100
50
0
Mean Time at Task (sec)
= Music Prime
= Control Prime
Musician
Non-Musician