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Brief report

Priming motivation through unattended speech

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This study examines whether motivation can be primed through unattended speech. Study 1 used a dichotic-listening paradigm and repeated strength measures. In comparison to the baseline condition, in which the unattended channel was only composed by neutral words, the presence of words related to high (low) intensity of motivation led participants to exert more (less) strength when squeezing a hand dynamometer. In a second study, a barely audible conversation was played while participants' attention was mobilized on a demanding task. Participants who were exposed to a conversation depicting intrinsic motivation performed better and persevered longer in a subsequent word-fragment completion task than those exposed to the same conversation made unintelligible. These findings suggest that motivation can be primed without attention.

Numerous recent studies have yielded indisputable evidence that motivation can be elicited unconsciously (see Custers & Aarts, 2010). For example, in the study by Aarts, Custers, and Marien (2008), participants who were subliminally exposed to words related to a high intensity of motivation (e.g., vigorous) exerted more strength in squeezing a handgrip than participants who were not exposed to any subliminal words. Similar results were also obtained when subliminal words reflected general motivational orientation. For example, Radel, Sarrazin, and Pelletier (2009) exposed some of their participants to subliminal words related to intrinsic motivation (IM). This form of motivation, which refers to doing an activity for the pleasure of doing it, is generally associated with positive outcomes (Deci, 1975). Accordingly, these participants exerted more effort and persevered longer in a subsequent motor task than those primed with neutral words, whereas participants were not able to report the primed words.

If unconsciousness is defined by the incapacity to report an event, it is interesting to note that different causes can account for this incapacity (Dehaene, Changeux, Naccache, Sackur, & Sergent, 2006; Moors & De Houwer, 2006). In their taxonomy, Dehaene *et al.* (2006) distinguish subliminal perception in which a stimulus is unconscious because of its low perceptual intensity, from pre-conscious perception, in which a stimulus is intense enough to penetrate into consciousness but fails to do so because no attentional resource

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is paid on its direction. In a rudimentary task of number categorization, van den Bussche, Hughes, Humbeeck, and Reynvoet (2010) observed that if the amount of priming for subliminal attended primes and for visible unattended primes is very similar, differential mechanisms lie at the basis of the priming of these two processing states. Although this finding points out the necessity to distinguish these states, this distinction has still not been taken into account in research on unconscious motivation. For instance, in the above studies, primes were attended but could not penetrate into the stream of conscious thoughts as they were too quickly displayed. However, no studies have ever tried to manipulate the level of attention paid on primes to activate motivational states.

Attention refers to the selective processing of one aspect when ignoring other irrelevant aspects. When stimuli are attended, they receive a higher processing, generating greater activation of the sensory areas (Bahrami, Lavie, & Rees, 2007), which often causes conscious processing (Dehaene *et al.*, 2006). For this reason, attention and consciousness have often been confounded, albeit they are clearly distinct processes (Koch & Tsuchiya, 2006). For example, even if attention facilitates consciousness, an intense stimulus does not require attention to reach consciousness. In contrast, even if very weak stimuli are fully attended (as it is the case with subliminal perception), they will not reach consciousness. In a very influential study, Dijksterhuis and Aarts (2010) attempted to disentangle the role of attention and consciousness in motivation. Based on the evidence of subliminal priming of motivation, they came to the conclusion that motivation would not depend on the level of consciousness but rather on the level of attention. Nevertheless, although the findings they reviewed indicate that attention seems necessary to guide motivational behaviour, nothing is actually said concerning the earlier stage of the activation of the motivational state. As pre-conscious perception is capable of engendering significant activation similar to subliminal perception (van den Bussche *et al.*, 2010), it is possible that attention would not be so important in the initial stage of the motivational process. Accordingly, the present research examined this question. In two studies, unattended speech (i.e., audible speech that is not attended by participants) was used to test the role of attention in the activation of motivation.

STUDY 1

In Study 1, we used the dichotic-listening paradigm (Cherry, 1953) to test whether motivation can be primed outside of attention. This paradigm has been used for decades to study the level of processing of unattended speech. Using a modern version designed by Rivenez, Darwin, and Guillaume (2006), participants were asked to find target words belonging to a specific semantic category in a list of spoken words played in one ear, while ignoring speech played in their other. To prevent attentional switches, words were played at a fast pace in the attended channel, and the unattended speech was composed of concatenated, nonsensical sentences instead of isolated words (see Dupoux, Kouider, & Mehler, 2003; Holender, 1986). Words related to a high or low intensity of motivation were inserted in the unattended speech, and the priming influence was assessed by repeated measures of strength exertion using a hand dynamometer. If the priming manipulation is effective, participants should exert more strength to squeeze the handgrip after trials containing words related to a high intensity of motivation than after exposure to words associated with a low intensity of motivation.

Method

Participants and design

Thirty undergraduate psychology students (20 females) took part in the experiment for course credits. They were native English speakers without any reported hearing problems.

Procedure

When entering into the soundproof room, participants sat in front of a computer and put on headphones. All instructions were provided on a computer screen, but the experimenter stayed until the end of the practice session to ensure that participants correctly understood them. As Rivenez *et al.* (2006) did not find any effects of laterality on priming, all participants were instructed to focus on the channel presented in their right ear and ignore the channel presented in their left ear. The practice session was comprised of six trials. At the beginning of each trial, the name of the category appeared and remained on the screen until the end of the trial. Participants were instructed to press a button as fast as possible each time they heard a word belonging to this category (e.g., hearing 'golf' when 'sport' was displayed). After four trials in the practice session, participants were informed that they would be asked periodically to squeeze a handgrip at the end of some trials. For this reason, the two last trials of the practice session included the strength exertion measure. Two thousand milliseconds after the offset of the audio sequence, participants were asked to squeeze the handgrip with their dominant hand as tightly as possible as long as the word 'squeeze' appeared on the screen (2,000 ms). Then, the participants started the test session. This session included 45 trials divided into nine blocks. Each block included three trials followed by the strength measure, and then two trials without the strength measure. Trials were separated by 2,000 ms. Primes were only inserted in the trials followed by strength measure. The occurrence of the prime words temporally matched the target words in the attended channel. Each block contained primes belonging to one of the three conditions: high-, low-, or no motivation-related words.

Materials

The list of words of the attended channel was composed by 16 spoken words presented at an average rate of two words per second. To avoid attentional switches, there were no gaps between words and we used monosyllabic or quickly pronounced disyllabic words. Words were recorded by a native Canadian English speaker with a monotonous intonation. Eleven semantic categories were used (e.g., sport, vegetable), and one or two target words appeared in each list. When a second target appeared, it was at the last or second last position in the list.

The unattended messages were composed of nonsensical sentences (e.g., 'Request the morning from the issue'). On average, the unattended message included 3.8 sentences (21.6 words) per trial. To avoid attention switches, unattended sentences were recorded without lag in a normal prosody by the same talker. The fundamental frequency was decreased by 40 Hz, and the volume was attenuated by 12 db (see Rivenez *et al.*, 2006). Priming words were naturally embedded at varying positions in the sentences (e.g., 'Witness the tower of that *effort*'). During each trial of the high- or low-motivation conditions, two words related to a high or low intensity of motivation were presented.

The list of words depicting a state of high intensity of motivation was as follows: 'desire, dynamic, effort, alive, energetic, active, joy, enthusiastic, persist, keen, energy, vigorous, performance, vitality, perseverance, improve, motivated, striving', whereas the low-motivation words were as follows: 'annoying, weak, obligation, tired, asleep, exhausted, lassitude, boring, weariness, constrained, sleepy, useless, obliged, spineless, draining, bother, depleted, resigned'. To prevent any distractions, the unattended speech started with a fade in effect 800 ms after the onset of the attended message.

Results and discussion

To eliminate any possibilities of attention shifts towards the unattended channel, we only kept trials in which the targets words of the attended speech were correctly detected (see Appendix S1). Given that response times above 1,500 ms are typically considered as outliers (see Ratcliff, 1993), responses were viewed as correct when the button was pressed up to 1,500 ms after the occurrence of the target word. As such, 18% of the trials were removed from the analysis. A general linear model for repeated measures was performed on the maximal contraction and the total effort exerted by participants on the handgrip-squeezing task (mean force over time). A linear contrast was created to

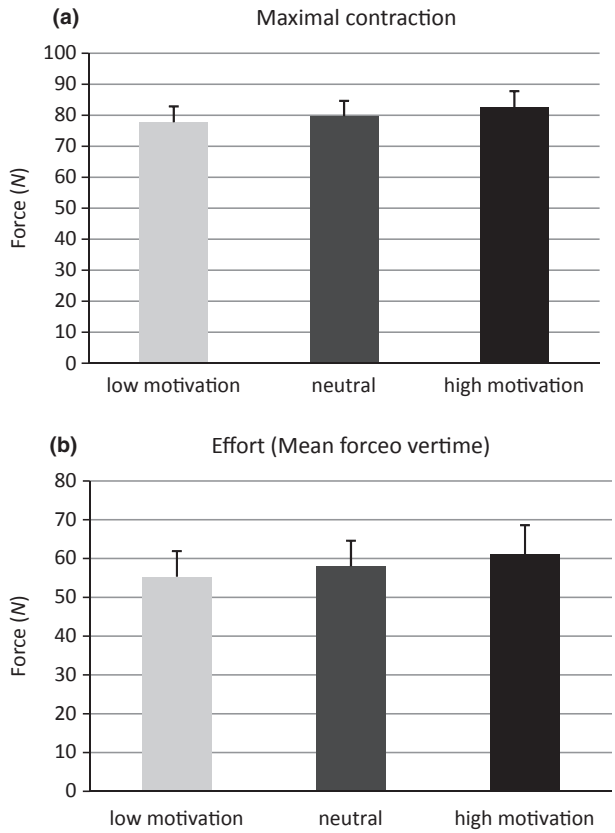

Figure 1. Effect of the type of motivation priming on maximal contraction (a) and total effort exerted (b) in the squeezing task of Study 1. *Note.* Error bars represent the standard errors.

represent the priming hypothesis (low-intensity motivation = −1; neutral = 0; high-intensity motivation = 1). This linear contrast significantly predicted maximal contraction $F(1, 29) = 4.484$, $p < .05$, $\eta^2 = .134$ and total effort $F(1, 29) = 5.285$, $p < .05$, $\eta^2 = .154$. Post-hoc comparisons indicated that participants exposed to high-motivation words displayed a greater maximal force and exerted more effort than those primed with low-motivation words, $t(29) = -2.301$, $p < .05$ and $t(29) = -2.117$, $p < .05$, respectively. The Figure 1 illustrates this pattern of results.

These results suggest that the presence of low-motivation words in the unattended speech reduced effort, whereas the presence of high-motivation words increased effort in the handgrip-squeezing task. As effort is related to motivational intensity (Brehm & Self, 1989), this study offers support for the idea that individuals' motivation can be primed by unattended auditory cues.

STUDY 2

Whereas Study 1 reliably demonstrated the possibility to prime motivation through unattended speech using a standard paradigm, Study 2 intended to replicate this finding in a more realistic setting of unattended speech processing. As such, while participants focused on a demanding task, they were exposed to the speech of a person who was highly motivated and enjoyed doing an activity (i.e., IM) in the background. The volume of the conversation was determined in a pilot study (see Appendix S1) to make it intelligible without attracting participants' attention. Specifically, no participants of the pilot study noticed the background at the chosen intensity while they were doing the demanding task, but a substantial part of the content could be understood while they were asked to focus on the background speech.

As it has been shown that individuals make automatic inferences about others' motives (Hassin, Aarts, & Ferguson, 2005), we presumed that participants could extract motivational information from the unattended speech and that, in turn, this information could serve as a prime to affect participants' subsequent behaviours. The effect of the priming was observed on a word-fragment completion task. To verify that the priming manipulation was effective, a list of fragments that could be completed with words-related IM was included. We expected that participants primed with IM, compared with participants in the control condition, would have this construct more accessible in working memory (see Higgins, 1996), which would make them more likely to complete these ambiguous fragments with IM-related words compared with control participants. To test whether the unattended conversation had a motivational effect, we monitored performance to complete neutral fragments, and the persistence at solving a last unsolvable fragment. As IM has been associated with performance and perseverance (e.g., Radel *et al.*, 2009), we expected that participants primed with IM would display greater levels of performance to solve the neutral fragments, and a greater persistence before giving up on an unsolvable item than control participants.

Method

Participants

Sixty-eight French undergraduate students (33 females) participated on a voluntary basis and were randomly assigned to one of the two groups (IM priming vs. control condition).

Procedure

When participants arrived, they sat in front of a computer located at the back of a 5-m-long room. They completed a 9-min. memorization task consisting of 36 trials. Participants first saw an abstract picture and then had to determine whether a second picture was the same or different. Between the two pictures, participants were asked to add or subtract two-digit numbers. Immediately after the memorization task, participants completed a word-fragment completion task (see Roediger, Weldon, Stadler, & Riegler, 1992), which consists of creating words by adding letters to incomplete words as fast as possible. No constraints on possible completions were imposed, and each fragment had between three and six possible solutions. The thirteen solvable fragments were presented in a randomized order. For seven of the fragments, participants could find a word referring to IM (e.g., pleasure, interest). None of these words were present in the script of the conversation. For the six other words, possible answers were not related to IM. Another fragment displayed at the end of the task had no solution and no time limitation. Participants could therefore continue as long as they wished. Then, the experimenter ran participants through the same funnelled debriefing as used in the pilot study to examine participants' awareness of the priming. Finally, participants completed a test checking their auditory capacity.

Experimental manipulation

One minute after the beginning of the memorization task, an auditory background was played slightly above the auditory threshold via an invisible loudspeaker located beside the front door. Following the example of many visual priming experiments that exposed control groups to meaningless stimuli, such as non-words (e.g., Aarts *et al.*, 2005) or abstract pictures (e.g., Gillath, Mikulincer, Birnbaum, & Shaver, 2008), a conversation was made unintelligible using a backward transformation for the control group. This avoided the activation of unwanted constructs. At the same time, the general shape and intensity of the signal was preserved; the voice, tone, and pace of the speaker were similar with and without this transformation (Wood & Cowan, 1995). While the conversation remained unintelligible up to the end in the control condition, the conversation became intelligible after 7 min and lasted one more minute in the priming condition. The intelligible part of the conversation was about a male student who told his friend (a female student) about a very interesting activity he just did. This conversation was created in accordance with the definition of IM, which postulates that an intrinsically motivated behaviour is characterized by enjoyment and satisfaction (Deci, 1975).

Dependent variables

Accessibility for IM

The number of times participants found the word related to IM in the seven fragments was counted to assess the level of accessibility of the IM construct.

Motivated behaviours

Motivated behaviours displayed during the word-fragment completion task were assessed by two performance measures and by a perseverance measure. The performance measures were the total number of correct responses given for the six neutral fragments

Table 1. Main statistics of the dependent variables according to the priming conditions in Study 2

	Priming conditions				
	Priming		Control		
	M	*SD*	*M*	*SD*	*t*(55)
IM accessibility: Number of IM-related words completed	2.64	1.37	1.93	1.28	2.03*
Performance 1: Number of neutral fragments completed	5.61	0.57	5.26	0.80	1.86^{t}
Performance 2: Mean response time to complete neutral fragments (ms)	10,313	2,309	11,799	2,366	−2.40*
Perseverance on the unsolvable fragment (ms)	48,455	12,119	42,525	9,980	2.02*

Note. $^{t}p < .07$; $*p < .05$.

and the average response time for these same words. The perseverance measure was indicated by the time spent attempting to solve the unsolvable fragment.

Results and discussion

Participants' performance on the first task was high ($M = 76\%$, $SD = 8\%$ of correct answers). To eliminate possibilities of attention switches during the task, we removed participants who displayed the lowest scores (nine participants below 1 standard deviation). In addition, two others were eliminated because of hearing impairments, so the final sample comprised 28 participants in the IM condition and 29 participants in the control condition. As shown by the responses given in the debriefing, all remaining participants did not detect the prime, suggesting that it was unattended.

An omnibus test including the measures of IM accessibility, performance, and perseverance was first performed to determine the multivariate effect of the priming condition. Results indicated that the priming condition was effective, $F(3, 53) = 2.611$, $p < .05$, $\eta^2 = .167$. Table 1 reports the descriptive statistics and the univariate effect for each dependent variable. As one can see, IM accessibility was higher for the group primed with IM than for the control group. In addition, the group primed with IM tended to perform better than the control group as revealed by a marginally significant effect on the total neutral fragments completed and a significant effect on the response times for these fragments. Finally, a significant effect was found for perseverance, indicating that participants primed with the IM-related conversation persevered longer than control participants.

In sum, not only did the unattended conversation of an intrinsically motivated person activate its corresponding representation in working memory but it also shaped participants' motivational state accordingly upon the completion of the subsequent cognitive task.

GENERAL DISCUSSION

This study aimed to test whether one's motivation can be influenced by unattended speech. In two studies, we provided support for such an effect. Using a dichotic-listening

paradigm and a within-subject design, Study 1 demonstrated that participants' strength exertion was greater when the unattended speech contained words related to a high motivational intensity than when it contained low-motivation words. In Study 2, we replicated the effect by activating IM, which has great relevance in many different contexts such as education (Reeve, 2009) or work (Gagné & Deci, 2005). Using a more realistic priming manipulation in which a barely audible conversation was played while participants were focused on a demanding task, we observed that the motivational priming also affected participants' subsequent behaviours. Specifically, participants primed with a conversation depicting IM performed better and persisted longer in the subsequent task than those who were only exposed to a similar but unintelligible auditory signal. These findings suggest that this effect represent a real-life influence because most of the auditory inputs of one's living environment are actually filtered out because of the limited capacity of higher level processing.

The main contribution of our findings pertains to the research on automatic processing of motivation. Few decades ago, the conventional view assuming that one's motivational state resulted from a conscious reflection has been increasingly challenged by many studies reporting motivation priming outside awareness (e.g., Aarts *et al.*, 2008; Pessiglione *et al.*, 2007). But if it is now well established that motivation can be primed without consciousness using subliminal primes, the fact that motivation can be activated when attention is not directed to the prime has yet to be examined. Our findings filled this gap by showing that motivational primes embedded in unattended speech can influence subsequent motivational state. Although our results appear consistent with recent findings showing that priming effects can be found outside of attention (e.g., Rolke, Heil, Streb, & Hennighausen, 2001; van den Bussche *et al.*, 2010), they also contrast with the pivotal role given to attention in motivational processes (Badgaiyan, 2000; Dijksterhuis & Aarts, 2010). More specifically, Dijksterhuis and Aarts (2010) indicated that if consciousness is not necessary for pursuing goals, attention would be essential to this process. While there is some support for their proposition, the present data suggest that attention would not be always necessary, at least not at the initial stage of the process when a specific motivational state is triggered. Although motivation could be activated outside of the focus of attention, it is still possible that attention would play a crucial role in the following stages, as attention would come to facilitate goals attainment by orienting individuals towards stimuli relevant to the activated goal (e.g., Aarts, Dijksterhuis, & De Vries, 2001; Radel & Clément-Guillotin, 2012). In sum, it is possible that attention is only needed for goal pursuit and not for goal activation. In addition, if attention is not necessary to activate motivation, it is very likely that attention would modulate the magnitude of the priming effect. As shown by Kiefer and Brendel (2006), attended stimuli may engender a greater activation than unattended ones.

In summary, our findings indicate that, beyond subliminal perception (weak stimuli), motivation can also be activated through pre-conscious perception (unattended perceptible stimuli). The next step would be to investigate if motivation can still be primed using unattended weak stimuli. Although Dehaene *et al.* (2006) predicted that such situations would not engender sufficient activations to elicit priming effects, this question still needs to be tested.

Finally, these findings provide an important contribution to the literature on unattended speech processing. The studies reporting a semantic processing of unattended stimuli have been sparse (e.g., Eich, 1984; Moray, 1959), and most of them could not rule out attentional switches as an alternative explanation (see Holender, 1986).

As we took many precautions to prevent attentional switches (e.g., continuous speech at low volume) and disregarded low performances on the main task, our studies are certainly not affected by this bias. Nevertheless, as performance in the main task is an indirect measure of the locus of attention, it would be interesting to go a step further and find ways to monitor participants' attention online. In spite of this limitation, our findings seem to offer support for Groeger's (1988) claim that the meaning of the ongoing inputs can be fully extracted by unattended speech processing.

References

Aarts, H., Chartrand, T. H., Custers, R., Danner, U., Dik, G., Jefferis, V. E., & Cheng, C. M. (2005). Social stereotypes and automatic goal pursuit. *Social Cognition*, *23*, 465–490.

Aarts, H., Custers, R., & Marien, H. (2008). Preparing and motivating behavior outside of awareness. *Science*, *319*, 1639.

Aarts, H., Dijksterhuis, A., & De Vries, D. (2001). On the psychology of drinking: Being thirsty and perceptually ready. *British Journal of Psychology*, *92*, 631–642.

Badgaiyan, R. D. (2000). Executive control, willed actions, and nonconscious processing. *Humain Brain Mapping*, *9*, 38–41.

Bahrami, B., Lavie, N., & Rees, G. (2007). Attentional load modulates responses of human primary visual cortex to invisible stimuli. *Current Biology*, *17*, 509–513.

Bargh, J., & Chartrand, T. (2000). The mind in the middle: A practical guide to priming and automaticity research. In H. T. Reis & C. M. Judd (Eds.), *Handbook of research methods in social and personality psychology* (pp. 253–285). New York, NY: Cambridge University Press.

Brehm, J. W., & Self, E. A. (1989). The Intensity of motivation. *Annual Review of Psychology*, *40*, 109–131.

Cherry, E. C. (1953). Some experiments on the recognition of speech, with one and two ears. *Journal of the Acoustical Society of America*, *25*, 975–979.

Custers, R., & Aarts, H. (2010). The unconscious will: How the pursuit of goals operates outside of conscious awareness. *Science*, *329*, 47–50.

Deci, E. L. (1975). *Intrinsic motivation*. New York: Plenum Press.

Dehaene, S., Changeux, J., Naccache, L., Sackur, J., & Sergent, C. (2006). Conscious, preconscious, and subliminal processing: A testable taxonomy. *Trends in Cognitive Sciences*, *10*, 204–211.

Dijksterhuis, A., & Aarts, H. (2010). Goals, attention, and (un)consciousness. *Annual Review of Psychology*, *16*, 467–490.

Dupoux, E., Kouider, S., & Mehler, J. (2003). Lexical access without attention? Exploration using dichotic priming. *Journal of Experimental Psychology: Human Perception and Performance*, *29*, 172–184.

Eich, E. (1984). Memory for unattended events: Remembering with and without awareness. *Memory & Cognition*, *12*, 105–111.

Gagné, M., & Deci, E. L. (2005). Self-determination theory and work motivation. *Journal of Organizational Behavior*, *26*, 331–362.

Gillath, O., Mikulincer, M., Birnbaum, G., & Shaver, P. R. (2008). When sex primes love: Subliminal sexual priming motivates relational goal pursuit. *Personality and Social Psychology Bulletin*, *34*, 1057–1069.

Groeger, J. A. (1988). Qualitatively different effects of undetected and unindentified auditory primes. *Quarterly Journal of Experimental Psychology*, *40*, 323–339.

Hassin, R., Aarts, H., & Ferguson, M. J. (2005). Automatic goal inferences. *Journal of Experimental Social Psychology*, *41*, 129–140.

Higgins, E. T. (1996). Knowledge activation: Accessibility, applicability and salience. In E. T. Higgins & A. W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (pp. 133–168). New York, NY: The Guilford Press.

Holender, D. (1986). Semantic activation without conscious identification in dichotic listening, parafoveal vision, and visual masking: A survey and appraisal. *Behavioral and Brain Sciences*, *9*, 1–66.

Kiefer, M., & Brendel, D. (2006). Attentional modulation of unconscious "automatic" processes: Evidence from event-related potentials in a masked priming paradigm. *Journal of Cognitive Neuroscience*, *18*, 184–198.

Koch, C., & Tsuchiya, N. (2006). Attention and consciousness: Two distinct brain processes. *Trends in Cognitive Sciences*, *11*, 16–22.

Macmillan, N. A., & Creelman, C. D. (1991). *Detection theory: A user's guide*. New York: Cambridge University Press.

Moors, A., & De Houwer, J. (2006). Automaticity: A theoretical and conceptual analysis. *Psychological Bulletin*, *132*, 297–326.

Moray, N. (1959). Attention in dichotic listening: Affective cues and the influence of instructions. *Quaterly Journal of Experimental Psychology*, *11*, 56–60.

Pessiglione, M., Schmidt, L., Draganski, B., Kalisch, R., Lau, H., Dolan, R. J., & Frith, C. D. (2007). How the brain translates money into force: A neuroimaging study of subliminal motivation. *Science*, *316*, 904–906.

Radel, R., & Clément-Guillotin, C. (2012). Evidence of motivational influences in early visual perception: Hunger modulates conscious access. *Psychological Science*, *23*, 232–234.

Radel, R., Sarrazin, P., & Pelletier, L. (2009). Evidence of subliminally primed motivational orientations: The effects of unconscious motivational processes on the performance of a new motor task. *Journal of Sport and Exercise Psychology*, *31*, 657–674.

Ratcliff, R. (1993). Methods for dealing with reaction times outliers. *Psychological Bulletin*, *114*, 510–532.

Reeve, J. (2009). Why teachers adopt a controlling motivating style toward students and how they can become more autonomy supportive. *Educational Psychologist*, *44*, 159–178.

Rivenez, M., Darwin, C. J., & Guillaume, A. (2006). Processing unattended speech. *Journal of the Acoustical Society of America*, *119*, 4027–4040.

Roediger, H. L., Weldon, M. S., Stadler, M. L., & Riegler, G. L. (1992). Direct comparison of two implicit memory tests: Word fragment and word stem completion. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *18*, 1251–1269.

Rolke, B., Heil, M., Streb, J., & Hennighausen, E. (2001). Missed prime words within the attentional blink evoke an N400 semantic priming effect. *Psychophysiology*, *38*, 165–174.

Snodgrass, M., Bernat, E., & Shevrin, H. (2004). Unconscious perception: A model-based approach to method and evidence. *Perception and Psychophysics*, *66*, 846–867.

Van den Bussche, E., Hughes, G., Van Humbeeck, N., & Reynvoet, B. (2010). The relation between consciousness and attention: An empirical study using the priming paradigm. *Consciousness and Cognition*, *19*, 86–97.

Wood, N., & Cowan, N. (1995). The cocktail party phenomenon revisited: Attention and memory in the classic selective listening procedure of Cherry (1953). *Journal of Experimental Psychology: General*, *14*, 243–262.

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Supporting Information

The following supporting information may be found in the online edition of the article:

Appendix S1. Description of pilot studies in Microsoft Word format.