CONSEQUENCES OF BODILY FEEDBACK ON STEREOTYPE USE: I APPROACH THEREFORE IT IS FINE VS. I APPROACH THEREFORE I LIKE
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Consequences of bodily feedback on stereotype use: I approach therefore it is fine vs. I approach therefore I like

Impact des indices corporels sur l’utilisation des stéréotypes :
Aspects informationnels et motivationnels

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Abstract
Extending previous work documenting the influence of internal variables on stereotyping, two studies show that approach and avoidance bodily cues influence information processing and stereotype use. In a first experiment, we asked participants either to push downwards (avoidance) or pull upwards (approach) on the surface of a table while working on an impression formation task. Results indicated that approach increased reliance on stereotypes compared to avoidance. These results were replicated in a second experiment with the use of a more subtle manipulation of approach and avoidance bodily cues. In this second study the greater reliance on stereotypes associated with approach bodily cues appeared to be a by-product

Résumé
Deux études montrent que des indices corporels liés à l’approche et l’évitement influencent le traitement de l’information et l’utilisation des stéréotypes. Dans une première expérience, les participants ont dû activer soit le muscle fléchisseur (appui sous la surface d’une table ; approche), soit le muscle extenseur (appui sur la surface d’une table ; évitement) pendant la réalisation d’une tâche de jugement. Les résultats indiquent que l’approche favorise l’utilisation des stéréotypes comparativement à l’évitement. Une deuxième expérience reproduit ces résultats à l’aide d’une manipulation moins explicite des indices corporels. Toutefois, contrairement à l’expérience 1, les données suggèrent que l’utilisa-
There is now a growing amount of research suggesting that our bodily states have a pervasive impact on thought processes (Damasio, 1994; Friedman & Förster, 2000; Martin, Harlow, & Strack, 1992; Raab & Green, 2005; Strack, Martin, & Stepper, 1988; for reviews see Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005; Schwarz & Clore, 2007). These effects have been found in diverse areas of research such as perceptual judgments (e.g., Tucker & Ellis, 1998), memory (e.g., Riskind, 1984), decision making (e.g., Damasio, 1994), persuasion (e.g., Wells & Petty, 1980) and social judgment (e.g., Martin et al., 1992) and suggest that body and mind are closely intertwined and in fact are the same and one thing (Lakoff & Johnson, 1999). To state it briefly, cognition is embodied, in the service of action and related to pragmatic concerns of the individual interacting with his/her environment (Schwarz, 2002; Smith & Semin, 2004). From this perspective, we sought to investigate bodily cues as determinants of stereotyping. This is especially important given that bodily gestures and nonverbal forms of communication are sometimes viewed as expressions of discrimination (Word, Zanna, & Cooper, 1974) and that negative attitudes towards a group are associated with avoidance of its members (Neumann, Hülsenbeck, & Seibt, 2004). Conversely, behaviors reducing the distance toward a person have been viewed as a way to decrease prejudice, for instance by approaching an outgroup member (Allport, 1954; Kawakami, Phillips, Steele, & Dovidio, 2007). In the present research, we examined how simple approach/avoidance bodily cues can impact information processing and affect stereotype use.
Approach/Avoidance Motor Actions and Evaluation

Approach or avoidance actions are considered as the most elemental and fundamental adaptive decisions an organism has to make (Lang, Bradley, & Cuthbert, 1990; Lewin, 1935; Tooby & Cosmides, 1990). In order to interact in an adapted way with our environment, we are continuously appraising it for potential dangers or benefits (Smith & Kirby, 2000). Many theorists agree that the affective meaning of stimuli is extracted automatically, at a very early stage of information processing (Bargh, 1997; Berridge & Winkielman, 2003; LeDoux, 1996; Zajonc, 1980), and initiates adapted motor programs. Positive stimuli trigger approach whereas negative stimuli trigger avoidance. It has been further argued that this evaluation-behavior link is bidirectional. During one’s lifetime, arm flexion has been coupled with bringing closer desired stimuli and arm extension has been coupled with pushing back undesirable or noxious stimuli. As a result, the instantiation of approach/avoidance movements should have an impact on subsequent evaluations or judgments (Cacioppo, Priester, & Berntson, 1993; Neumann, Förster, & Strack, 2003). In a classic demonstration of this idea, Cacioppo and colleagues (1993) had participants rate a set of novel stimuli (i.e., Chinese ideographs) while they were asked either to push downwards on the top of a surface table thereby contracting the extensor muscle (i.e., a behavior associated with avoidance) or to push upwards on the bottom surface of the table thereby contracting the flexor muscle (i.e., a behavior associated with approach). Results indicated that arm position had an impact on subsequent evaluations of the stimuli. Ideographs viewed under the approach movement were liked more than ideographs viewed under the avoidance movement.

Arm Contractions and Information Processing

The research by Cacioppo and colleagues (1993) suggests that bodily cues influence simple evaluations of objects and persons. However, there is evidence that they also influence the way people process incoming information. According to Schwarz and Clore (2007), the impact of bodily states on thought processes
could be accounted for by extending the cognitive tuning account (Schwarz, 1990). In its original version, this model claims that a variety of affective signals such as moods, emotions or external cues inform us about the benign or problematic state of our environment and tune our thought processes in order to respond to this situation. More specifically, a positive affective state or cue (e.g., the state of happiness, a smiling face) signals a safe environment where there is no need to engage in effortful processing. In this case, people spontaneously adopt a more heuristic processing strategy. Conversely, a negative affective state or cue (e.g., the state of sadness, a frowning face) signals a problematic state of the environment. In such conditions, reliance on heuristics could have deleterious consequences and a more effortful, analytic strategy is preferred. Interestingly, this rationale has also been extended to bodily signals of approach/avoidance. Arm flexion which is associated with approaching positive stimuli signals that the situation is benign and, conversely, arm extension associated with avoiding negative stimuli signals a problematic situation. According to this reasoning, arm contractions should therefore elicit differential processing strategies (Schwarz & Clore, 2007). Nevertheless, empirical support for this idea is not clear-cut.

In one experiment, Friedman and Förster (2000; Experiment 7) found results supporting this hypothesis. Participants asked to extend their arm (avoidance) while performing a series of problems taken from the Graduate Record Exam solved significantly more problems compared to participants asked to flex their arm (approach). However, using a similar procedure, Riis and Schwarz (2003) found that, compared to approach, avoidance increased the conjunction fallacy (an indicator of heuristic processing) in the Linda problem. Trying to account for this atypical finding, these authors argued that participants in the avoidance condition engaged in a more systematic processing which led them to pay increased attention to the presented information and, thus, judged the target as “looking like” the professional prototype, committing more the conjunction fallacy. However, as Riis and Schwarz acknowledged, their experiments did not include indicators of processing style, therefore their analysis remains speculative.
Arm Contractions and Stereotype Use

Stereotyping is usually expected to be promoted in conditions of reduced processing (e.g., Bodenhausen, Macrae, & Sherman, 1999). Consequently, one can hypothesize that those bodily cues that lead to reduced processing should increase reliance on stereotypes. However, inconsistencies in the effects of bodily feedback on information processing prevent us from drawing strong predictions concerning their impact on stereotype use. Such inconsistencies may stem from the fact that researchers infer processing strategies from a performance on a task or a judgmental outcome rendering their conclusions speculative (see Bless & Schwarz, 1999). For example, in the mood and stereotyping literature, happiness or anger were for a long time associated with increased stereotyping because of a suspected reduced motivation or incapacity to process (Bodenhausen, 1993; Schwarz, 1990). However, studies testing these hypotheses failed to include indicators of information processing (Bodenhausen, Kramer, & Süsser, 1994; Bodenhausen, Sheppard, & Kramer, 1994). As a consequence, conclusions were drawn solely on the basis of differences in judgmental outcomes as a function of the target’s category membership. Therefore, in our studies, particular care was taken to include indicators in order to better assess the impact of arm contractions on information processing. This is especially important because although stereotypic judgments have been frequently equated with heuristic processing (e.g., Bodenhausen et al., 1999), research suggests that stereotype use does not necessarily involve reduced motivation or ability to process information (Bless, 2001). In order to measure the amount of information processing, researchers have used various indicators such as reading times (Forgas, 1995), recall (Krauth-Gruber & Ric, 2000) or recognition (Bless, Bohner, Schwarz, & Strack, 1990). These measures have however been criticized. Reading times have been found hard to interpret because extended reading times can imply either a careful examination or a lack of capacity to process (Bless & Schwarz, 1999). Recall data is generally coded for its global meaning and lacks sensitivity (Krauth-Gruber & Ric, 2000). Therefore, in addition to these measures, we have chosen to rely on a less controversial measure of information processing, i.e. participants’ cognitive responses
(Greenwald, 1968), which is widely used in persuasion settings as an indicator of message elaboration (e.g., Moons & Mackie, 2007). It is based on the idea that the best way to know how participants process information is to evaluate the proportion of thoughts relevant to the issue they have had while performing the task.

In two studies, we explored the impact of bodily cues on stereotype use. As our review of the available data suggests, there is no consensus concerning the effects of these cues on information processing. Therefore, the issue remains open as to the existence of such effects and the possible underlying mechanisms. Nevertheless, a prediction derived from the cognitive tuning account (Schwarz, 2002) would suggest that approach elicits a heuristic strategy and increases stereotype use compared to avoidance which fosters a more systematic processing.

**Experiment 1**

In the first experiment, we manipulated bodily feedback using an arm contraction procedure. This was done for the sake of comparability with past research (Friedman & Förster, 2000; Riis & Schwarz, 2003). Moreover, in order to better assess the mediational role of information processing in the effects of bodily cues on stereotype use, we included indicators of information processing. We used reading times (Forgas & Bower, 1987; Ric, 2004), recall, as well as a thought listing task (Greenwald, 1968; Wegener, Clark, & Petty, 2006). Following our theoretical overview, we expected stronger reliance on stereotypes, as well as reduced processing (i.e., poorer recall; Stroessner & Mackie, 1992; less task-relevant thoughts listed; Wegener *et al.*, 2006; and faster reading times; Forgas & Fiedler, 1996; Ric, 2004) in the approach compared to the avoidance condition.

**Method**

**Participants**

Eighty-one undergraduate psychology students at the Paris Descartes University were recruited on a voluntary basis. They were run individually and randomly assigned to the conditions of a 2 (Arm contraction: approach vs. avoidance) by 2 (Category: organizer vs. engineer) between-participants design.
Procedure

Participants were informed that the study was about impression formation. They were seated in front of a computer screen and received instructions concerning their arm position. The research was said to be concerned with improving work conditions of injured or handicapped persons and for that purpose they would be asked to adopt a particular bodily position simulating these situations (see Strack et al., 1988). Depending on the condition, we asked participants to flex or extend their arms by pulling up the bottom surface (approach) or pushing down the top surface (avoidance) of a table, while keeping their upper arms perpendicular to the floor and their elbows in an upright position (see Cacioppo et al., 1993). After the experimenter assured that the correct position was maintained, participants received instructions for the impression formation task. It was explained that we were interested in how individuals form impressions about strangers. A text (486 words) describing a day in the life of a man was presented on a computer screen, one sentence at a time, at the participant’s own pace. Depending on conditions, the target person was either an organizer in a holiday center (a category stereotypically associated with extraversion) or a computer engineer (a category stereotypically associated with introversion). These categories were selected from a pilot study in which 17 other participants indicated the extent to which a series of 10 categories were associated with extraversion or introversion (1: not at all, 7: totally). Organizers in a holiday center were found to be associated with extraversion ($M = 5.60, SD = 1.27$) but not with introversion ($M = 2.00, SD = 0.86$). Computer engineers were found to be associated with introversion ($M = 4.94, SD = 1.39$) but not with extraversion ($M = 2.35, SD = 0.93$; all means were significantly different from the midpoint of the scale). The text was strongly inspired by material used in other studies exploring the impact of affective cues on stereotyping (see Clore & Colcombe, 2003; Isbell, 2004) and contained an equal number of extraverted and introverted behaviors.\footnote{The impression formation material was kindly communicated to us by Jerry Clore. We express our gratitude to him.} These were taken from a pilot study in which 16 other
participants rated the extent to which a series of 44 behaviors were related to extraversion (1: *not at all*, 9: *totally*) and introversion (1: *not at all*, 9: *totally*). For a particular trait, we selected behaviors that were rated significantly above the midpoint (5) of the scale for the correspondent trait and significantly below the midpoint for the other one. On the basis of this criterion, we selected three extraverted behaviors (e.g., *he started to discuss with him about the latest political issues*) and three introverted behaviors (e.g., *be bad some ideas but did not exposed them during the meeting therefore avoiding to put himself in an embarrassing situation*). The text also included six neutral behaviors (e.g., *be bought the newspaper before going to work*). Thus, the text presented daily activities across contexts in which the target person behaves equally in an introverted manner (e.g., doesn’t say a word in front of many people, is withdrawn from the activity around him, is shy in intimate relationships) as well as in an extraverted manner (e.g., speaking to strangers, having an active part in an ongoing discussion).

**Dependent variables**

*Impression.* Participants gave their impressions of the target on a series of traits related to the introversion/extraversion dimension. These were taken from a pilot study in which 16 other participants were asked to rate the extent to which a series of traits (*n* = 167) were associated with extraversion (1: *not at all*, 9: *totally*) and with introversion (1: *not at all*, 9: *totally*). For the main study, we selected six traits, *warm, social, restless, noisy, talkative, extraverted* that were associated with extraversion (*Ms* = 7.75, 7.50, 7.32, 7.00, 8.18, 8.84 and *SDs* = 0.58, 1.36, 1.70, 1.93, 0.83, 0.57, respectively) but were not associated with introversion (*Ms* = 3.44, 3.87, 3.12, 2.81, 2.75, 1.38 and *SDs* = 1.93, 1.31, 1.99, 1.87, 1.73, 1.12) and six traits, *mild, reserved, cold, withdrawn, introverted and lonely* associated with introversion (*Ms* = 6.46, 6.54, 7.07, 7.88, 8.05, 7.63 and *SDs* = 2.25, 1.46, 1.19, 1.82, 2.16, 1.58) but not with extraversion (*Ms* = 4.20, 3.87, 2.53, 1.82, 2.35, 2.62 and *SDs* = 1.43, 1.31, 1.50, 1.32, 2.39, 2.00, respectively).

*Affective state.* Participants first rated their current mood state (1: *bad*, 7: *good*), in order to capture diffuse affective reactions (Neumann & Strack, 2000a). Then, we measured participants’
conscious emotional reactions by asking them to indicate on a 9-point scale (1: not at all, 9: extremely) how sad, melancholic, depressed, happy, joyful, pleased, irritated, angry, annoyed, in anguish, anxious, worried they were feeling at the moment.

**Measures of information processing**

*Reading time.* The time participants spent reading the text was measured by the computer.

*Recall.* After they had completed the judgment task, participants were given a surprise recall task in which they had 2 minutes to recall the elements of the text on a sheet of paper provided by the experimenter.

*Thought listing task.* At the end of the experiment, participants were asked to list whatever had passed through their mind during the task (for similar instructions, see Bless et al., 1990).

*Post-experimental questionnaire.* In a post-experimental questionnaire, we asked participants to rate on a 7-point scale (1: not at all, 7: extremely) the subjective pleasantness (“How pleasant was the arm position for you?”) and effortfulness (“How effortful was it to maintain the arm position?”) of the arm position. We also addressed participants’ motivation (“How motivated were you to do the task?”) and liking (“How much did you enjoy the task?”) of the task. We then used a funneled debriefing procedure (see Thompson, Roman, Moskowitz, Chaiken, & Bargh, 1994) that tapped any possible suspicions about the experimental procedure and asked participants to generate hypotheses concerning the study. None of the participants evoked anything about the impact of arm positions on stereotype use. Finally, participants were debriefed, thanked and dismissed.

**Results**

Data from two participants were dropped because they failed to maintain the ascribed arm position during the task. It is worth noting that the two arm positions did not differ in terms of discomfort or fatigue ($F_s < 1.60$).
Affective state

Mood. This variable revealed no significant effect ($F$s < 1).

Emotion. A Principal Component Analysis (PCA) with a Varimax rotation on ratings on the emotion adjectives revealed 4 factors accounting for 80% of the variance. These factors corresponded to our four basic emotions (anger, fear, happiness, sadness) with the related emotion adjectives obtaining high factor loadings on them (> .65). Then, emotion adjectives were averaged to form indexes of self-reported sadness, anger, fear, and happiness. Data were submitted to a 2 (Arm position: approach vs. avoidance) × 2 (Category: organizer vs. computer engineer) × 4 (Scale type: sadness vs. anger vs. fear vs. happiness) mixed-model ANOVA with repeated measures on the last factor. The analysis revealed a main effect of scale type, $F (3, 225) = 62.69, p < .001$. Participants reported being happier ($M = 3.55, SD = 1.16$) than angry ($M = 1.11, SD = 1.45$), fearful ($M = 1.49, SD = 1.63$) or sad ($M = 1.26, SD = 1.41$), all $F$s > 70 and all $p$s < .001. Moreover, the difference between self-reported fear and anger was significant, $F (1, 75) = 4.61, p < .05$. No other effect reached significance (all $F$s < 1.47 with $p$s > .22).

Impressions

Again, we performed a PCA on the extraversion and introversion traits ratings to ensure that they refer to a common extraversion/introversion dimension. The first factor, accounting for 25% of the variance, was interpreted as representing the extraversion/introversion dimension. Negative factor loadings were associated with extraversion, social ($- .36$), talkative ($- .74$), warm ($- .32$), extraverted ($- .74$), noisy ($- .66$) and restless ($- .72$) whereas positive factor loadings were associated with introversion, mild ($+.41$), introverted ($+.43$), lonely ($+.22$), and reserved ($+.26$). Two traits (cold, withdrawn) with very low factor loadings ($+.01$ and $- .01$ respectively) were discarded. Then, an extraversion index was computed with the remaining traits by averaging the scores on the extraversion traits and the reversed scores on the introversion traits. This index was then submitted to a 2 (Arm position: approach vs. avoidance) by 2 (Category: organizer vs. computer engineer) ANOVA. The expected Arm Position × Category interaction approached significance, $F (1, 75) = 3.64$,
p < .06 (see Figure 1). In the approach condition, the organizer was rated as more extraverted ($M = 5.20, SD = .98$) than the engineer ($M = 4.45, SD = .99$), $F(1, 75) = 5.31, p < .02$. In the avoidance condition, this effect was non-significant ($F < 1$).

![Figure 1: Mean extraversion judgments as a function of target’s category and arm position (Experiment 1). Vertical bars represent standard errors.]

**Information processing**

**Reading time.** An ANOVA revealed a marginally significant effect of arm position, $F(1, 75) = 3.76, p < .056$, such that participants in the approach condition spent less time reading the text ($M = 148$ sec, $SD = 36$) than their counterparts in the avoidance condition ($M = 165$ sec, $SD = 37$).

**Recall.** Information recalled by the participants was coded 1 for correct recall and 0 for incorrect recall by two independent judges who reached a high degree of agreement (92%, disagreements were solved through discussion). Proportions of correctly recalled information were submitted to a 2 (Arm position: approach vs. avoidance) by 2 (Category: organizer vs. computer engineer) by 3 (Type of information: neutral vs. extraverted vs. introverted) mixed-model ANOVA with repeated measures on the last factor. The analysis revealed a main effect of type of information, $F(2, 150) = 12.94, p < .01$. Participants recalled less introverted ($M = .26, SD = .21$) than neutral ($M = .35, SD = .11$) and extraverted ($M = .41, SD = .23$) behaviors. The Arm position $\times$ Information type interaction was significant, $F(2, 150) = 7.19, p < .01$. Participants in the approach condition recalled more neutral behaviors ($M = .39, SD = .10$) than participants in the
avoidance condition ($M = .32, SD = .12), F (1, 75) = 6.23, p < .02.
Conversely, they recalled less introverted ($M = .19, SD = .18)
behaviors than participants in the avoidance condition ($M = .33,$
$SD = .21), F (1, 75) = 11.65, p < .01.

Thought listing task. The valence of the thoughts listed by the
participants and their relevance to the task were coded by two
independent judges, who again reached a high degree of
consensus (90%). Disagreements were again resolved through
discussion. Data were submitted to a 2 (Arm position: approach
vs. avoidance) × 2 (Category: organizer vs. computer engineer)
× 2 (Relevance: relevant vs. irrelevant) × 2 (Valence: positive vs.
negative) mixed-model ANOVA with repeated measures on the
last two factors. The analysis yielded a main effect of valence,
$F (1, 75) = 35.42, p < .001.$ Overall, participants listed more negative
($M = 1.03, SD = 1.55$) than positive ($M = .28, SD = .70$)
thoughts. The effect of relevance was also significant, $F (1, 75)
= 4.56, p < .04.$ Participants listed more relevant ($M = .83,$
$SD = 1.41$) than irrelevant ($M = .48, SD = .81$) thoughts. The Arm
position × Relevance interaction reached significance, $F (1, 75)
= 8.49, p < .01.$ Participants in the avoidance condition listed
more relevant thoughts ($M = 1.14, SD = 1.60$) than did particip-
ants in the approach condition ($M = .50, SD = .85$), $F (1, 75)$
$= 6.38, p < .02.$ However, participants in both conditions listed a
comparable number of irrelevant thoughts ($p > .10$).

Motivation
The analysis did not yield any significant effect ($F < 1$).

Mediational analysis
So far, we have found that approach increased stereotype use and
decreased the number of relevant thoughts listed by the partici-
pants compared to avoidance. Thus, in a further step, we tested
the idea that stereotype use in the avoidance condition was the
result of shallow processing. Subject-generated cognitive
responses were considered as our thought index of task elabora-
tion (Petty, Cacioppo, & Heesacker, 1981). A more careful
examination of the information would result in an increase of
relevant thoughts towards the target and thus reduce stereo-
typing. In order to explore this possibility, we performed a mediated moderation analysis following Muller, Judd, and Yzerbyt (2005). In a first equation, we regressed extraversion judgments on arm position, category and their interaction. Consistent with the ANOVA, the Arm position × Category interaction was marginally significant, $B = 0.21, t (75) = 1.91, p < .06$. Then, our thought index was regressed on arm position, category and their interaction. There was only a main effect of arm position, $B = -0.64, t (75) = -2.53, p < .02$, with participants in the avoidance condition generating more relevant thoughts than participants in the approach condition. Finally, extraversion judgment was regressed on arm position, category, thought, and all higher-order interactions. In this model, the Thought × Category did not reach significance, $B = 0.07, t (75) = 1.37, p > .16$, and the Arm Movement × Category interaction remained significant, $B = 0.26, t (75) = 2.23, p < .03$. At the outcome, the amount of relevant thoughts (information processing) does not seem to mediate the impact of arm position on stereotype use.

**Discussion**

Results from Experiment 1 indicate that arm contractions have an impact on information processing and on stereotype use. Using a now classical induction of arm contraction (Cacioppo et al., 1993), we found that participants’ impressions in the approach condition were more influenced by the target’s category membership (i.e. they judged the organizer as more extraverted than the engineer) compared to participants in the avoidance condition. Thus, bodily feedback associated with approach (arm flexion) seems to increase stereotype use compared to bodily feedback associated with avoidance (arm extension). These findings could be explained in terms of differences in information processing. Importantly, measures of information processing revealed that participants in the avoidance condition spent somewhat more time reading the person description and listed more relevant thoughts compared to participants in the approach condition. However, a mediational analysis conducted with our thought index failed to confirm that stereotype use is the outcome of differences in information processing induced by arm contraction. We did not find support for the idea that the
effects of bodily cues on judgment is mediated by depth of processing, at least in this experiment. Furthermore, recall did not yield the predicted pattern of results. This might be due to the coding of the information recalled in terms of its global meaning that could result in a lack of sensitivity of this measure that washes out between-group differences.

Globally, these results parallel those of mood on stereotyping (e.g., Bodenhausen, Kramer, & Süsser, 1994) and extend previous work that studied the impact of bodily cues on information processing (Friedman & Förster, 2000; Riis & Schwarz, 2003) to the stereotyping domain. They suggest that bodily cues affect information processing and fit well with predictions of the cognitive tuning account (Schwarz, 2002). However, although we found some indications that arm position influences information processing, as measured by reading times and thought listing, we did not find evidence that the differences in the amount of processing induced by arm contractions mediate their impact on stereotype use. One possibility could be that the effects on stereotype use and on information processing are independent. Such a claim could be seen as consistent with recent models according to which affective or bodily cues could inform the individual about the appropriateness of his/her reliance on scripts or stereotypes (Bless, 2001), the validity of one’s current mental content, or his/her inclinations about the task (Briñol & Petty, 2003; Clore, Wyer, et al., 2001). This issue will be developed further in the General Discussion section.

At this point, we would like to address some methodological issues. One could question the procedure of experiments that have activated approach or avoidance with the use of arm contractions. In these experiments, participants are typically asked to either pull upward vs. push downward on the surface of a table while performing a task. These two arm positions differ with respect to dimensions other than approach/avoidance. In the literature, arm extension is typically rated as more pleasant or less effortful than arm flexion (Förster & Strack, 1998; Friedman & Förster, 2002; Riis & Schwarz, 2003). It could therefore be argued that pulling upwards on the table imposes a greater cogni-

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2. Another mediational analysis using reading times (that are correlated with the number of positive relevant thoughts, \( r = .31, p < .05 \)) as a mediator did not reveal significant results.
tive load on participants than pushing downwards, and this may explain why participants in the arm flexion condition rely more on stereotypes and engage in a less careful processing of incoming information. Moreover, one may suspect that this manipulation produces a rather unusual situation that could alter participants’ perception of the task and draws participant’s attention to the self (Lambie & Marcel, 2002). Our post-experimental questionnaire revealed that participants were indeed constantly aware of their arm and they report having been intrigued by the assigned position. For these reasons, we conducted a second experiment in which we sought to examine the impact of less intrusive approach/avoidance bodily cues.

Experiment 2

Manipulations of approach/avoidance motor actions typically involve arm contractions against the surface of a table (Cacioppo et al., 1993), a lever or a joystick (Chen & Bargh, 1999), perceived movements toward or away from the person on a screen (Neumann & Strack, 2000b) or a modified keyboard (Vaes, Paladino, Castelli, Leyens, & Giovanazzi, 2003). In this second experiment, we used a modified keyboard procedure that has produced reliable approach/avoidance effects (Alexopoulos & Ric, 2007). The main advantage of this procedure is that approach/avoidance movements are performed with respect to a horizontal axis which precludes approach movements to be perceived as more effortful (due to the fact that approach is associated with a specific key on a keyboard rather than a position below the surface of a table) and minimizes self-awareness because participants are simply instructed to press different keys on a keyboard in order to perform the task, as in many standard psychological experiments.

Method

Participants

Sixty-four undergraduate psychology students at Paris Descartes University were recruited on a voluntary basis. They were run individually and assigned randomly to a 2 (Arm movement:
approach vs. avoidance) by 2 (Category: organizer vs. engineer) between-participants design.

**Procedure**

The procedure was basically the same as in Experiment 1. Only the approach/avoidance manipulation was different. Instead of an isometric tension on the surface of a table, we used a modified keyboard to simulate approach and avoidance movements. A keyboard was placed close to the participants at an angle of 45° with respect to the monitors’ axis. Participants had to press a central key while reading the sentence that appeared on the screen and, once finished, they were instructed to press one of the two external keys (equidistant from the center of the screen) to display the next sentence. Depending on conditions, participants were told to press either a distant key requiring arm extension (i.e., avoidance) or a closer key requiring arm flexion (i.e., approach) in order to go on with the task. This procedure allows us to manipulate the execution of the correspondent arm movement in a more ecological manner than arm contractions below or above the surface of a table.

**Results**

Importantly, during the post-experimental interview none of the participants evoked a potential influence of arm movements. Also, the two arm movements did not differ in terms of discomfort or fatigue ($F_{s} < 1.28$).

**Affective state**

*Mood.* No effect reached significance (all $F_{s} < 1.23$).  
*Emotion.* Again, we performed a PCA on ratings on the emotion adjectives. After a Varimax rotation, the analysis yielded 4 factors accounting for 79% of the variance. These factors corresponded to our four basic emotions (*anger*, *fear*, *happiness*, *sadness*) with the corresponding emotion adjectives obtaining high factor loadings (>0.65). Then, the scores from the different scales were averaged for each affective state and data were submitted to a 2 (Arm movement: approach vs. avoidance) $\times$ 2 (Category: organizer vs. computer engineer) $\times$ 4 (Scale type: sadness vs. anger
vs. fear vs. happiness) mixed-model ANOVA with repeated measures on the last factor. The analysis revealed again only a main effect of scale type, $F(3, 180) = 57.42, p < .001$. Participants report being happier ($M = 3.51, SD = 1.27$) than angry ($M = .92, SD = 1.24$), fearful ($M = 1.82, SD = 1.61$) or sad ($M = 1.00, SD = 1.21$), all $ps < .01$.

**Impressions**

Again, we performed a PCA on the extraversion and introversion traits ratings to ensure that they refer to a common extraversion/introversion dimension. The first factor, accounting for 30% of the variance, was interpreted as representing the extraversion/introversion dimension. Negative factor loadings were associated with extraversion, *social* ($-.66$), *talkative* ($-.53$), *warm* ($-.31$), *extraverted* ($-.57$), whereas positive factor loadings were associated with introversion, *withdrawn* (.70), *cold* (.67), *introverted* (.63), and *lonely* (.72). Four traits (*restless, noisy, mild, and reserved*) with very low factor loadings (.04, .12, .13 and.13 respectively) were discarded. Then, an extraversion index was computed with the remaining traits, by averaging the scores on the extraversion traits and the reversed scores on the introversion traits and was submitted to a 2 (Arm position: approach vs. avoidance) by 2 (Category: organizer vs. computer engineer) ANOVA. The analysis yielded a main effect of target’s category, $F(1, 60) = 11.88, p < .02$, such that the organizer is judged more extraverted ($M = 5.77, SD = 1.17$) than the engineer ($M = 4.78, SD = 1.18$). The expected Arm movement x Category interaction was marginally significant, $F(1, 60) = 3.31, p < .07$ (see Figure 2).

![Mean extraversion judgments as a function of target’s category and arm movement (Experiment 2). Vertical bars represent standard errors.](image-url)
In the approach condition, the organizer was rated as more extraverted ($M = 5.97, SD = .92$) than the engineer ($M = 4.44, SD = 1.35$), $F (1, 60) = 13.50, p < .01$. In the avoidance condition, there was no category effect, $F < 1.35$.

**Information processing**

**Reading time.** The analysis revealed no significant effect.

**Recall.** Given the high consensus in the first experiment, recalled information was coded by one of the two judges who served previously. The analysis revealed only a main effect of type of information, $F (2, 120) = 15.65, p < .001$. Participants recalled more extraverted ($M = .44, SD = .27$) than neutral ($M = .26, SD = .11$) or introverted ($M = .24, SD = .22$) behaviors.

**Thought listing task.** Given the high consensus in the first experiment, valence and relevance of the thoughts listed by the participants were coded by one of the two judges who served previously. Data were submitted to a 2 (Arm movement: approach vs. avoidance) × 2 (Category: organizer vs. computer engineer) × 2 (Relevance: relevant vs. irrelevant) × 2 (Valence: positive vs. negative) mixed-model ANOVA with repeated measures on the last two factors. The analysis yielded a main effect of relevance, $F (1, 60) = 7.34, p < .01$. Participants listed more task-relevant ($M = 1.46, SD = 1.90$) than task-irrelevant ($M = .91, SD = .64$) thoughts. The effect of valence was significant, $F (1, 60) = 5.11, p < .03$. Participants listed more negative ($M = 1.33, SD = 1.41$) than positive ($M = 1.04, SD = 1.10$) thoughts. The Arm movement × Relevance interaction was marginally significant (see Figure 3), $F (1, 60) = 3.18, p < .08$. A closer look at this interaction revealed that participants in the approach condition listed somewhat more task-relevant thoughts ($M = 1.70, SD = 1.54$) than participants in the avoidance condition ($M = 1.22, SD = 1.37$), this difference being marginally significant $F (1, 60) = 2.63, p < .10$, and less task-irrelevant thoughts ($M = .78, SD = .88$) than participants in the avoidance condition ($M = 1.03, SD = 1.09$) although this difference did not reach significance, $p > .25$. 
**Motivation**

Interestingly, participants in the approach condition declared being more motivated to invest efforts in the task ($M = 5.16$, $SD = .77$) than their counterparts in the avoidance condition ($M = 4.60$, $SD = 1.36$), $F (1, 60) = 4.13$, $p < .05$. No other effect reached significance. Note that this measure was correlated with the number of relevant thoughts listed ($r = .30$, $p < .05$).

**Mediational analyses**

As in Experiment 1, in a first equation, we regressed extraversion judgments on arm position, category and their interaction. Consistent with the ANOVA, the Arm movement × Category interaction was marginally significant, $B = -1.06$, $t (60) = -1.82$, $p < .07$. When our thought index was regressed on arm movement, category and their interaction, there was only a marginally significant effect of arm movement, $B = 0.96$, $t (60) = 1.62$, $p < .10$, with participants in the approach condition generating more relevant thoughts than participants in the avoidance condition. Finally, in the third regression model, extraversion judgment was regressed on arm position, category, thought, and all resulting interactions between these factors. In this model, the Thought × Category did not reach significance, $B = 0.15$, $t (60) = 1.25$, $p < .21$, and the Arm Movement × Category interaction remained marginally significant, $B = -1.13$, $t (60) = -1.95$, $p < .06$. At the outcome, our thoughts index does not seem to mediate the interaction between arm position and category on extraversion judgment of the target.
Given the fact that relevant thoughts and motivation to engage in the task were correlated, we sought to determine whether this variable mediated stereotype use. In order to test this assumption, we again conducted a mediated moderation analysis. When motivation was regressed on arm movement, category and their interaction, there was a main effect of arm movement, $B = 0.57$, $t(60) = 2.03, p < .05$, with participants in the approach condition declaring being more motivated than participants in the avoidance condition. Finally, extraversion judgment was regressed on arm movement, category, motivation, and all resulting interactions between these factors. In this model, the Motivation × Category was marginally significant, $B = -0.50$, $t(60) = -1.94, p < .06$, and the Arm Movement × Category interaction was no longer significant, $B = -0.75$, $t(60) = -1.26, p > .22$. Thus, the effects of arm movement on stereotype use seem to be mediated by self-reported investment in the task.

**Discussion**

Our results show again that bodily cues influence stereotype use. Importantly, we replicated findings of Experiment 1 with the use of a different manipulation. Participants asked to flex their arm towards them (approach) in order to go through a person description made more stereotypic judgments compared to participants asked to extend their arm (avoidance). These effects are compatible with the cognitive tuning account (Schwarz, 2002) and, once again, parallel those of mood on stereotyping (Bodenhausen, Kramer, & Süsser, 1994). Noteworthy, these results were replicated with an arm contraction manipulation that minimizes self-awareness or cognitive load. However, results on indicators of information processing revealed a somewhat different picture than in Experiment 1 and suggest that participants in the approach condition were more

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3. A mediation hypothesis implies a causal model whereby an independent variable causes a mediator which, in its turn, causes a dependent variable. Therefore, ideally, the mediator measurement should temporally precede the outcome variable (Sobel, 1990). However, a reverse causal model, in our case, implies that increased stereotype use caused an increase in motivation to perform the task. This, to our opinion, is unlikely within classic person perception models (Fiske & Neuberg, 1990). In future research, we plan to measure the mediator before the outcome variable in order to provide a more stringent test of our hypotheses.
motivated to process information than their counterparts in the avoidance condition. The former listed more task-relevant thoughts than the latter. Also, they declared being more motivated to invest efforts in the task. As in Experiment 1, our mediational analyses including thought listing were inconclusive. Again, this suggests that these effects may be independent. However, results indicated that the more motivated to engage in the task were the participants, the more stereotypic were their judgments. Below, we outline the potential mechanisms that could explain such findings.

General Discussion

Globally, this set of studies shows that bodily cues have a pervasive influence on thought processes. Extending previous research, we showed that motor signals associated with approach or avoidance influence stereotype use. In Experiment 1, using a now classic manipulation of arm contraction (Cacioppo et al., 1993), we found that participants asked to flex their arm by pulling up the bottom of the table surface (approach) relied more on social categories in their impressions compared to participants asked to extend their arm by pushing down on the top of a table surface (avoidance). Moreover, they spent less time reading the person description compared to participants in the avoidance condition. Additionally, in the avoidance condition participants listed more task-relevant thoughts than in the approach condition. These findings are in agreement with the cognitive tuning model (Schwarz, 2002) claiming that affective cues signal the state of our current environment and tune up the processing strategies to meet the situational requirements. However, a mediational analysis failed to show that stereotype use is the result of the observed differences in the amount of processing as would be predicted by this model. In the following section, we review several alternative explanations concerning the impact of bodily cues on stereotype use.

Firstly, one possibility could be that bodily cues are experienced as evaluations about the content of thought. In this case, bodily cues may signal the appropriateness of one’s reliance on general knowledge structures such as schemas or stereotypes (Bless,
or the confidence in the validity of one’s current thoughts (Briñol & Petty, 2003; see also Clore & Colcombe, 2003). For example, in a persuasion study, Briñol and Petty (2003) found that participants who nodded were more persuaded by a message than participants who shook their head when the arguments were strong (and thus generating favorable thoughts) whereas the reverse happened when the arguments were weak (and thus generating unfavorable thoughts). In an impression formation task, the most accessible knowledge would probably be the stereotype. In this case, arm flexion (approach) would encourage participants to use the stereotype whereas arm extension (avoidance) would probably inhibit its use. This self-validation hypothesis explains rather elegantly our findings concerning stereotype use. Additionally, within this framework the validation of pre-existing knowledge such as the stereotype can influence the subsequent amount or nature of information processing (e.g., Briñol, Petty, Valle, Rucker, & Becerra, 2007).

Following this rationale, we could speculate that in Experiment 1, bodily cues influence the amount of thought by validating prior knowledge structures: Isometric flexion or approach could validate the stereotype and in this case no further processing would be required whereas isometric extension or avoidance would lead participants to feel less confident about the stereotype and thus generate more thoughts about the target (Bless, 2001; Briñol et al., 2007). In Experiment 2, participants in the approach condition relied more on the person’s category in their judgments compared to participants in the avoidance condition. However, in contrast with Experiment 1, data on the thought listing task suggest that participants in the approach condition processed information more thoroughly than participants in the avoidance condition. Moreover, the former declared being more motivated to realize the task than the latter and our mediation analysis revealed that the more participants were motivated to perform the task, the more they used the stereotypes in their judgments. This finding is also opposite to the predictions of the cognitive tuning account (Schwarz, 2002). One way to reconcile it with this theoretical framework is to reinterpret our experimental conditions according to the performed arm movement. In the approach condition, participants had to flex their arm to reach a closer
button in order to go through the task. However, they subsequently were engaged in arm extension to return to the central key when the next information was displayed on the screen. The same rationale can be applied for the avoidance condition where participants had to subsequently perform an arm flexion to return to the central key. Following this reasoning, data on motivation to engage in the task fit well with the cognitive tuning account (Schwarz, 1990). However, it can hardly account for the fact that participants in this newly defined avoidance condition (the previous approach condition) use the target’s category in their impressions because according to this model a negative cue prevents individuals from using heuristics (see Martin & Clore, 2001). Now, from a self-validation perspective (Briñol et al., 2007), we could speculate that in Experiment 2 approach led participants to validate the stereotype and the higher amounts of relevant thoughts could be due, for example, to the participants’ efforts to try to solve the discrepancies of the target’s behavior and to confirm the activated category. Interestingly, within this model, thought content is not a mediator but rather a consequence of stereotype use. This would help explain the absence of mediation by our thought index. However, this self-validation account remains silent concerning the differences in motivation found in Experiment 2. And most importantly, it cannot account for the observed reversal of the effects of arm manipulation on information processing or the outcome of our mediational analysis that included task motivation.

Globally, none of the models reviewed so far (i.e., cognitive tuning, self-validation) can account satisfactorily for our complete data set. And an alternative explanation, in terms of mood for example, seems unlikely. Across the two experiments, we did not find any evidence that bodily cues altered participants’ affective state.

Another theoretical account that could help explain our findings is to conceptualize approach and avoidance as motivational states rather than evaluations (Elliot, Maier, Moller, Friedman, & Meinhardt, 2007; Ric, 2004). For example, a recent account proposed by Ric (2004) holds that implicit affective information triggers approach/avoidance tendencies that can spill over to stimuli/situations/events that are encountered next (see also Elliot, 2006). In this model, implicit positive information triggers
approach that fosters exploration and interest towards stimuli whereas implicit negative information triggers avoidance that leads to the rejection of stimuli. Thus, implicit affective cues should induce differential investment on a subsequent task. A growing number of studies support this idea. Elliot and colleagues (2007) recently showed that implicit cues related to danger (e.g., the color red) triggers avoidance that impedes performance on a subsequent task (e.g., an IQ test), or leads individuals to choose easier tasks afterwards. In a similar vein, the processing of implicit positive, approach-related cues bolster performance on a subsequent task. Bargh and colleagues (2001) found that participants implicitly primed with success-related words outperformed those of a control group (i.e. primed with neutral words) on a word-search puzzle task. Custers and Aarts (2005) also showed that individuals worked harder on tasks implicitly linked to positive cues.

In sum, there seems to be some evidence that implicitly triggered approach or avoidance tendencies have motivational consequences on information processing. Globally, the idea that approach enhances exploration and motivation whereas avoidance fosters rejection and disengagement is intuitively appealing, and has important adaptive implications involving reproduction and survival (Zajonc, 1980). Interestingly, this line of research suggests that the approach/avoidance motivational system can operate implicitly, outside the individuals’ conscious awareness (Elliot et al., 2007; Ric, 2004). If our analysis is correct, it could account for the differences found in motivation to engage in the task. The fact that we found this effect only in the second experiment could be due, in this case, to the more implicit nature of our bodily cues manipulation.

Now, how could we explain that an increase in motivation to engage in the task fosters stereotype use? A possible answer to this question may stem from an analysis of our impression formation material. In impression formation studies, researchers usually present descriptions that are open to multiple interpretations. For example, in Srull and Wyer’s (1979) classic study, bedside manner, sense of humor, punctuality, etc., are all attributes that could be inferred from a patient’s description of their doctor. However, in our experiment, the participants were not asked to rate the doctor on any specific attribute. Instead, they were simply asked to write a description of their doctor. It is possible that the increase in motivation to engage in the task led the participants to use stereotypes to fill in the gaps in their descriptions. This would be consistent with the idea that stereotypes serve to simplify complex social information by providing a framework for organizing and interpreting social interactions. In conclusion, the present study provides evidence for the idea that bodily cues can influence motivation and stereotype use, and suggests that further research is needed to explore the mechanisms underlying these effects.

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4. Interestingly, the hypothesis that approach increases motivation to process whereas avoidance decreases it has also been formulated by champions of the cognitive tuning account such as Jens Förster and Ron Friedman (Förster, Friedman, Özelsel, & Denzler, 2006; p. 143), but these researchers discarded it due to an absence of effect on self-report scales.
Donald’s refusal “to pay his rent until the landlord repaints his apartment” is ambiguous with respect to hostility. In our case, the description of the target person presents both extraverted and introverted behaviors. Extraversion is an extreme trait (Higgins & Bargh, 1987) and the extraversion/introversion dimension is perceived as a central dimension in personality psychology that is often represented by a continuum with mutually exclusive ends (Eysenck, 1991). Thus, the target description provided to the participants may have been perceived as extremely ambiguous or even self-contradictory as on one occasion, the target person was warm and had an active part in an ongoing conversation, whereas on another occasion, the person was shy and avoided interpersonal contact. Therefore, this could have led motivated participants to use the persons’ category in order to form a coherent impression of the person (Jussim, 1991). The stereotype might have been used as a diagnostic piece of information, what Wegener and colleagues (2006) termed thoughtful stereotyping. Accordingly, other research has shown that stereotyping can be a resource consuming strategy (Yzerbyt, Coull, & Rocher, 1999) or that motivated participants make use of relevant heuristic cues (Moons & Mackie, 2007).

At the outcome, this explanation could shed some light to the fact that we found evidence that stereotyping may stem from different routes within the same experimental setting (Wegener et al., 2006). In Experiment 1, bodily cues provided by arm contractions are salient because of the constant muscle activation phenomenology (Clore, 1992) and may be experienced as a feedback about the validity of the stereotype (Bless, 2001; Briñol & Petty, 2003; Clore & Colcombe, 2003). In this case, stereotype use is not mediated by differences in information processing but by self-validation processes. However, a less intrusive induction of approach/avoidance cues as the one used in Experiment 2 could have implicitly elicited differential motivation to process information, with participants in the approach condition elaborating more on the presented behaviors and using the stereotype in order to form a more valid impression of a target showing contradictory behaviors. These motivational effects could have been overridden by our more explicit manipulation of bodily cues in Experiment 1. This, still speculative, rationale is in agreement with Ric (2004) who argued that consciousness of the affective...
cues is an important determinant in the production of these effects on judgment. Future research should define more precisely the boundary conditions of the effects of bodily cues on stereotype use by directly manipulating the implicit vs. explicit nature of the cues and show that, on an implicit level, bodily cues influence stereotype use by altering the motivation to process whereas on an explicit level, they provide feedback about one’s reliance on such knowledge. Importantly, this view complements the cognitive tuning account or the self-validation hypothesis by suggesting that affective and bodily cues not only convey meaning about our thoughts or the situation but, in some conditions, have more direct consequences on attraction or withdrawal motivation.

In sum, the present set of studies shows that arm flexion and arm extension positions (Experiment 1) or movements (Experiment 2) provide approach and avoidance feedback that influences information processing. Previous research has documented the impact of approach/avoidance signals on creativity and analytical problem solving (Friedman & Förster, 2000), as well as on the conjunction fallacy (Riis & Schwarz, 2003). We extend this work by showing that different manipulations of bodily feedback of approach or avoidance have also an impact on person perception and stereotype use. Importantly, we showed in contrast with the work by Kawakami and colleagues (2007) that approach can increase stereotype use. This counterintuitive finding has important implications for the prevention of prejudice and discrimination. When certain conditions are met, close distance can have deleterious consequences and can exacerbate prejudice.

References


