Affect and action : contrasting conscious and nonconscious processes

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CHAPTER 4

AUTOMATIC AFFECTIVE EVALUATION DOES NOT AUTOMATICALLY PREDISPOSE FOR ARM FLEXION AND EXTENSION*

Affect may have the function of preparing organisms for action, which is presumably organized in motivational systems, enabling approach (i.e., arm flexion) and avoidance (i.e., arm extension) behavior. Chen and Bargh (1999) suggested, for instance, that affective processing automatically resulted in action tendencies for arm flexion and extension. This position can, however, be disputed because their critical test of automaticity may have been contaminated by conscious affective evaluation. In three experiments, we varied instructions and experimental design to investigate the exact nature of the link between automatic affective evaluation and arm flexion and extension. When faces with emotional expressions were evaluated consciously, similar effects were obtained as in Chen and Bargh. When conscious evaluation was reduced, however, no action tendencies were observed, whereas affective processing of the faces was still evident from affective priming effects. The results suggest that action tendencies for arm flexion and extension are not automatic consequences of automatic affective information processing.

Emotions may have the function of preparing for direct action without explicit deliberation (Darwin, 1872/1998, Lang, Bradley, & Cuthbert, 1990), or any involvement of consciousness. Emotions are seen as responsible for the ability to swiftly perform appropriate actions, particularly in urgent and evolutionary 'old' (i.e., frequently recurring in evolutionary history; LeDoux, 1996; Öhman, 1986) situations. Because affect is a central process in emotion (Ortony & Turner, 1990), processing on the positive/negative dimension may be closely linked to action, for instance, to approach or to avoid stimuli (Chen & Bargh, 1999; Davidson, Ekman, Saron, Senulis, & Friesen, 1990; Neumann & Strack, 2000 a&b). Action tendencies are assumed to be organized in, at least, two different motivational systems that enable approach or avoidance behavior (Bargh, 1997; Cacioppo, Priester, & Berntson, 1993; Lang et al., 1990). Chen and Bargh, for instance, explicitly claimed to have demonstrated the "(...) existence of a direct link between automatic evaluation and approach/

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avoidance behavior (...)" (p.221). Their argument can, however, be disputed since it cannot be ruled out that their effects are due, at least in part, to conscious processing. In three experiments we varied stimuli, instructions and experimental design in order to investigate whether action tendencies for arm flexion and extension are the immediate result of automatic affective information processing and "does not depend on the individual concurrently having the conscious and intentional goal of evaluating the stimuli" (Chen and Bargh, p.221).

In the first experiment of Chen and Bargh (1999, see also Solarz, 1960, for a similar experiment) one group of participants was instructed to push (i.e., arm extension) the response lever away if the stimulus word was negative and to pull (i.e., arm flexion) the lever towards them if the stimulus was positive (i.e., affect-congruent action). The remaining participants received the opposite instruction (i.e., affect-incongruent action). With positive words participants were faster when pulling the lever than when pushing the lever. With negatively valenced words, on the other hand, the lever was pushed faster than pulled. Chen and Bargh concluded that affect-congruent movements were performed faster than affect-incongruent movements. This pattern of results was found even when participants were instructed to push or pull only on mere presentation of the stimuli and respond irrespective of affective meaning (Experiment 2). Chen and Bargh argued that approach and avoidance behavior is linked directly to automatic stimulus evaluation because it apparently does not depend on the conscious goal of affective evaluation. They further argued that "(...) this automatic link between evaluation and behavioral tendency is entirely nonconscious (...)" (p.221).

Chen and Bargh (1999) argue that one important function of automatic affective evaluation is to nonconsciously predispose behavior toward the attitude object. They propose that these findings contrast to the traditional theoretical approach regarding the affect-behavior relationship that conceptualizes the selection of behavioral responses as being under conscious control. This position is further supported by the results of Experiment 3 conducted by Duckworth, Bargh, Garcia, & Chaiken (2002). In this experiment, in which participants also had to push or pull a lever on the mere presence of novel (but affectively valenced) images, similar findings were obtained as in Experiment 2 of Chen and Bargh. Because participants were only instructed to push or pull the lever irrespective of the affective valence of the stimuli (as in Chen and Bargh's Experiment 2), Duckworth et al. conclude, in line with Chen and Bargh, that "(...) the automatic evaluation of novel stimuli has direct and immediate consequences for approach and avoidance behavioral tendencies." (p.518).

According to Chen and Bargh (1999, see also, Bargh, 1997; Cacioppo, Priester, & Berntson, 1993; Duckworth et al., 2002; Wentura, Rothermund, & Bak, 2000) "(...) automatic evaluation (...) is an adaptive back-up system for those times when conscious processing is elsewhere or not focused on the goodness or badness of immediately present stimuli." (p. 217). In a stronger version of their argument they also propose that these automatic influences on behavior are only occasionally overridden by conscious interventions and surely do not depend on these conscious processes. They suggest that automatic evaluation (probably even of novel stimuli, see Duckworth et al., 2002) is, therefore, linked directly to pulling (i.e., arm flexion) and pushing (i.e., arm extension). They further propose that automatic affective evaluation "(...) is linked directly to the basic motivational states of approach and avoidance and, presumably through such motivations, to actional tendencies." (p.222). Though, they do no specify exactly which actions are influenced by these motivational states, this must include arm movements (i.e., arm-flexion and –extension) in view of their use of a lever which has to be pulled or pushed by hand.

The argument for a nonconscious and automatic link between affect and arm movement is further strengthened by experimental evidence suggesting a bi-directional relationship. Affective evaluations of novel and neutral ideographs were, for instance, congruently influenced by isometric arm flexion and extension (Cacioppo et al., 1993). Neutral ideographs were evaluated more positively when participants first flexed their arm, whereas neutral ideographs were evaluated more negatively when participants extended their arm. Emotional words, moreover, were categorized faster as positively or negatively valenced while performing congruent (positive-flexion, negative-extension) arm movements (Neumann & Strack, 2000 a, Experiment 1). Neumann and Strack, furthermore, suggested that not only proprioceptive but also exteroceptive cues of movement might be involved in the evaluations. In their Experiment 2 illusory movement of positively and negatively valenced words made a congruent contribution to the speed of evaluation. Positively valenced words were categorized faster when they seemed to be moving toward participants than when they seemed to move away. Negatively valenced words, on the other hand, were categorized faster when they seemed to move away than when they seemed to move toward the participants. Recently similar evidence was obtained in our laboratory for emotional faces that moved towards or away from the participant (Bonarius, 2002).

The argument of Chen and Bargh (1999) for an entirely automatic and nonconscious affect-behavior link is based primarily on the results of their Experiment 2. It was assumed in this experiment (as in Duckworth's et al., 2002, Experiment 3) that participants who were instructed to respond only to the mere presence of affectively valenced stimuli were not evaluating consciously the affectively valenced stimuli. Because a comparable pattern of results was obtained in Chen and Bargh's second experiment as in their first it was concluded that automatic affective evaluation has fully automatic and direct behavioral consequences. This conclusion may, however, be premature. It can be argued that the results of Chen and Bargh's second experiment (see also Duckworth's et al, 2002, Experiment 3) were due to contamination by accidental conscious affective evaluation by some of the participants. It can be argued that conscious evaluation of the affectively valenced targets was not sufficiently prevented in their Experiment 2 , as well as in Duckworth's et al. (2002) Experiment 3.

The instruction in Chen and Bargh's Experiment 2 to react to the presence of target stimuli (which disappeared on response) did not necessarily exclude all conscious affective evaluation. At least some participants, probably, noticed that the targets were affectively valenced and searched for a reason for their presence. A similar argument, for instance, was used by Bargh, Chaiken, Raymond, & Hymes (1996, but see Klauer & Musch, In press) in the justification of their third experiment. Participants were instructed in three experiments to pronounce affectively valenced target adjectives as quickly as they could. These target adjectives were preceded by affectively valenced primes (i.e., sequential priming paradigm) and pronunciation latency was used as the critical dependent variable here. Basically, in all three experiments shorter latencies (i.e., affective priming) were obtained in congruent (i.e., positive-positive, negative-negative prime-target combinations) than in incongruent (i.e., positive-negative, negative positive prime-target combinations) affective trials. In these experiments it was shown that affective priming may not depend on conscious evaluation by the participants but in their justification of Experiment 3 they remarked that

> it is not unreasonable to suppose that repeatedly seeing and pronouncing adjectives (...) could passively prime the concepts of good and bad, or an evaluative processing goal. It is also possible that subjects consciously notice the valenced nature of the target stimuli and infer that the experiment has something to do with evaluation. (p.117).

Although, in the second experiment of Chen and Bargh participants were instructed to respond (and not pronounce) to affectively valenced adjectives (and in Duckworth et al., 2002, Experiment 3, to affectively valenced images), we assume that we can apply the same arguments to this experiment. In sum, it seems that we cannot exclude the possibility that in Chen and Bargh's Experiment 2 and Duckworth's et al (2002) Experiment 3 at least some of the participants consciously evaluated the affectively valenced targets. The conclusion that affect and behavior are linked fully automatically and do not depend on (some) conscious affective evaluation may, therefore, be premature.

The question studied here is whether the link between automatic affective information processing and arm flexion and extension (see below) is automatic and entirely nonconscious as proposed by Chen and Bargh (1999) or is also mediated by more conscious affective evaluation processes. We would like to add that we do not question automatic affective information processing per se but the assumed automatic follow-up link with pushing and pulling. We dispute, therefore, the general claim made by Chen and Bargh (1999) that "in a break from the traditional model [in which affect can be activated automatically but the response is under conscious control] (...) the behavioral component of the equation can be automatic as well." (p.215). Before we can investigate this equation, however, it seems important to define what is meant by Chen and Bargh by an automatic link.

Chen and Bargh (1999) proposed that if an effect is "(...) not requiring any deliberate conscious processing (...) we can conclude that automatic evaluation of stimuli in turn automatically predisposes approach and avoidance reactions to them." (p.218). Although this position with regard to automatic versus controlled processing deviates sharply from, for instance, Shiffrin and Schneider (1977; see also Allport, 1989) it seems fair to follow Chen and Bargh's definition (see also Bargh, 1994) in our study. Conscious processing goals were, therefore, varied through instruction and experimental design. To maximize our chances of finding behavioral follow-up effects of automatic affective evaluation we used facial expressions of emotion instead of words. Emotional faces, which are more likely to be processed automatically due to their evolutionary preparation (Öhman, 1986), may constitute more powerful affective stimuli than emotion words. In Experiment 1 participants were explicitly instructed to categorize faces (i.e., facial expressions of emotion) with the help of a button-stand, so that participants were forced to flex (as in pulling) or extend (as in pushing) their arm. In Experiment 2 participants were instructed to categorize the same stimuli as in Experiment 1, but now on a non-affective (i.e., gender) dimension. In the third experiment, the same stimuli were used as in the foregoing experiments but this time as primes in a sequential priming task that is typically used to study automatic information processing (Fazio, Sanbonmatsu, Powell, & Kardes, 1986). It was expected that, if arm flexion and extension are the automatic and immediate result of automatic affective evaluation, basically the same affective influence on arm flexion and extension should be found in all three experiments. If, on the other hand, non-automatic affective evaluation is a prerequisite for affect-specific behavior, no effect on arm flexion and extension is expected in at least the last two experiments.

Experiment 1

First, we need to show that the findings of Chen and Bargh (1999, Experiment 1) and Solarz (1960) can be generalized to the nonverbal domain. We thus tried to conceptually replicate their findings with a different type of affective stimuli (i.e., positively and negatively valenced facial expressions of emotion) which presumably are processed more automatically (Öhman, 1986) than words. Recent evidence from neuroimaging studies, for instance, suggests that even nonconscious perception of angry faces evokes an amygdala response through subcortical pathways (Morris, Öhman, Dolan, 1998; Morris, Öhman, Dolan, 1999). Similar to Solarz, but in contrast to Chen and Bargh, instruction (i.e., arm flexion with positive or arm flexion with negatively valenced targets) was varied within participants instead of between participants. Only female participants were included in the experiments because Solarz found that the effects were larger for female than for male participants and this would thus improve our chances of finding the expected effect.

The experimental apparatus was somewhat different from Chen and Bargh (1999), and also from Solarz (1960). Instead of a vertical lever (Chen & Bargh) or a horizontal lever (Solarz) that had to be pushed (by means of arm flexion) or pulled (by means of arm extension) participants were instructed to press buttons on a vertical stand (see below). In this fashion responding with the button-stand corresponds to arm flexion and extension in Cacioppo et al. (1993). According to Chen and Bargh "Cacioppo, Priester, and Berntson (1993) have demonstrated a link between evaluation and motor responses but in the reverse direction from that of our hypothesis." (p.217). Chen and Bargh suggest, therefore, in line with our reasoning (see, for instance, also Förster & Strack, 1996) a conceptual similarity between arm flexion and arm extension and lever movement. If we would obtain a similar pattern of results as Chen and Bargh, Duckworth et al. (2002) and Solarz this would further support this conceptual similarity.

Participants were instructed to move their right hand from a home button (placed in the middle of the stand) to a response button below or above on the stand. As they pressed one out of two response buttons with the top or bottom side of their hand, they did not turn their hand when responding. Two different dependent measures (as in Solarz) could be obtained in this manner: the initiation time or release-time (RT) of the home button and the movement time (MT) needed for reaching and pushing the response button. RT constitutes an index of central processes and reflects stimulus evaluation, response selection, programming the execution of motor movements, and is relatively independent of MT which reflects the magnitude of the neuro-muscular response (Fitts, 1954). RT increases, for instance, as a function of the amount of stimulus information (Sternberg, 1966), or with the number of target alternatives (Brainard, Irby, Fitts, & Alluisi, 1962). MT, in contrast, is relatively unaffected by these parameters, but is affected by the distance towards the target and size of the target-location (Fitts, & Peterson, 1964). The influence of affect on latency times should, primarily, be found in RT (see Solarz, 1960), rather than in MT.

It was expected in line with Chen and Bargh (1999), Duckworth et al. (2002), and Solarz (1960) that in affect-congruent conditions (positively valenced faces with arm flexion and negatively valenced faces with arm extension) latencies would be shorter than in affect-incongruent conditions (positively valenced faces with arm extension and negatively valenced faces with arm flexion).

Method

Participants. Forty-eight first-year female psychology students (average age 21.3 year, *SD*=4.23) from the University of Amsterdam participated in the experiment for course credit. All participants had normal or corrected-to-normal vision, were right-handed and signed informed consent. The experiment was announced as "Judgment of emotional pictures".

Design. The evaluation task had a 2 (Affect-congruency: affect-congruent, vs. affect-incongruent) x 2 (Target-valence: positive vs. negative emotional expressions) x 2 (Target-gender: female vs. male model) within-participants factorial design.

Two different reaction times were measured: the initiation time after stimulus onset of releasing the home button (RT), and the movement time (MT) needed for reaching the response button. Reaction times that deviated more than 2.5 SD from the average of the instruction condition (i.e., congruent or incongruent button) were excluded from the analysis. If RT data were excluded, corresponding MT data were also excluded and vice versa. Incorrect responses were also excluded from the reaction time analyses. The maximum number of outliers and incorrect responses was set at four per instruction condition per participant. If more than four outliers and incorrect responses were recorded per participant, out of a total of twenty responses, the mean RT or MT was replaced by the overall mean RT or MT (over all participants) in that instruction condition. The number of incorrect responses also served as a dependent variable.

Material and apparatus. Forty pictures with emotional expressions from Ekman and Friesen (1976) and Matsumoto and Ekman (1988) served as targets. Both the happy and the angry expression were taken from the same model. The set of targets was subdivided in two fixed series (A and B) that contained both 10 happy and 10 angry expressions of different models. Ten of these pictures were taken from female and ten were taken from male models. Each series contained, therefore, 5 happy expressions of female models, 5 happy expressions of male models, 5 angry expressions of female models, and 5 angry expressions of male models. Each picture was projected on a milk-colored screen with a vertical visual angle of 14 degrees and a horizontal visual angle of 10.7 degrees.

Twenty-four participants started with an affect-congruent (i.e., positive evaluations with pushing the upper button and negative evaluations with pushing the lower button) instruction block of trials (series A for twelve participants and series B for the other twelve participants). Subsequently, an affect-incongruent (i.e., positive evaluations with pushing the lower button and negative evaluations with pushing the upper button) block of trials (series B for twelve participants and series A for the other twelve participants) followed after an unrelated evaluation task (not using the button stand) that served to ease transition from congruent to incongruent instruction or vice versa. To calibrate novel Japanese ideographs for use in other experiments they were rated by the participants as positively or negatively valenced. The other twenty-four participants followed the reversed order of instruction blocks.

The stimuli were projected from the back on the screen by means of a three-way projection tachistoscope with three digital data projectors (Hitachi CPX 955) that were fitted each with a ferro-electric liquid crystal shutter (Displaytech LV2500-AC). Each data-projector as well as the three shutters were controlled by the application 'Beam' (inhouse software) with a Pentium II 400 MHz computer. Each series was preceded by six practice trials that contained pictures not included in both experimental series. Each trial started with the projection of a black fixation point for

400 ms that was placed in a mask. This mask consisted of a screen of random lines and shadows that was used to prevent leaking of light from the targets through the shutters. Targets were projected for 100 ms.

Responses could be given by means of three one-button boxes that were fixed to a vertical stand. Participants were seated to the left of the stand and operated it with their right hand. The home-button (fixed in the middle) had to be pushed loosely with the back of the right hand as long as no response was given (resting position). The height of this button was set for each participant individually, so that the angle between the arm and upper-arm was 110 degrees for all participants in the resting position. In this way both muscles (biceps and triceps) were equally tensed when holding the home button pressed. The response-buttons were positioned above and below the home button (at a distance of 10.3 cm). In this way participants could simply flex or extend their arm in responding without any need for precise aiming at the response-buttons.

Procedure. Participants were instructed to evaluate (i.e., positively or negatively) facial expressions. They received either an affect-congruent or an affect-incongruent instruction. An affect-congruent instruction entailed the pressing of the lower button with negatively valenced faces, and of the upper button with positive faces. With the affect-incongruent instruction the reference to the response buttons was reversed. All possible references in the instructions to "movement" or "congruence" versus "incongruence", "approach-behavior" or "avoidance-behavior", or for that matter "flexion" and "extension" were prevented. Before the first block of experimental trials, six practice trials were presented. After finishing the first block of trials, a second task was presented. Forty-eight ideographs had to be rated on an affective dimension with a different response box positioned on a table in front of the participant. Subsequently, the second block of trials was presented which was also preceded by six practice trials. The experiment was concluded by an exit-interview in which participants were asked about their strategies and ideas about the experiment.

Results

Participants subjectively reported to be well able to evaluate the affective meaning of the pictures. No average reaction times were replaced by overall means. Twenty-two outliers (2.3%) were excluded from analysis from the affect-congruent condition and twenty-five (2.6%) from the affect-incongruent condition. There were less incorrect responses with affect-congruent instructions (1.9%) than with affect-incongruent (3.1%) instructions. This difference proved to be reliable in a paired two-tailed t-test ($t(47)=2.5$, $p<0.05$).

Table 1. *Mean (SD) reaction times for the home button (RT) in Experiment 1.*

	Congruent	Incongruent
Positive		
Male	505.6	540.9
	(76.3)	(106.6)
Female	511.5	539.3
	(80.1)	(110.4)
Negative		
Male	479.9	525.8
	(74.6)	(103.5)
Female	532.8	565.1
	(88.7)	(94.3)

Participants were overall faster to release the home (RT) button ($F(1,47)=14.1$, $p<0.001$) in affect-congruent ($M=507.5$, $SD=81.7$ ms) than in affect-incongruent ($M=542.8$, $SD=104$ ms) conditions as was evidenced by a main effect of instruction in a 2 (Affect-congruency) x 2 (Target-valence) x 2 (Target-gender) ANOVA. The (female) participants released the home button also faster for male ($M=513.1$, $SD=93.6$ ms) than for female ($M=537.2$, $SD=95.2$ ms) target faces, but this main effect ($F(1,47)=25.8$, $p<0.0001$) was qualified by a two-way interaction between target-gender and affective valence ($F(1,47)=33.0$, $p<0.0001$). For positive female faces RT was shorter, with both flexion and extension, ($M=525.4$, $SD=96.9$ ms) than for negative (M=548.9, SD=92.5 ms) female faces, as was evidenced by Tukey's HSD post-hoc test ($V(47)$=4.4, p<0.05), whereas for positive male faces RT was longer (M=523.3, SD=93.9 ms) than for negative (M=502.9, SD=92.6 ms) male faces ($V(47)$=3.8, p<0.05) (see also Table 1). No further main or interaction effects were significant in this analysis.

Table 2. *Mean (SD) movement times (MT) in Experiment 1.*

	Congruent	Incongruent
Positive		
Male	177.8	181.5
	(62.9)	(65.5)
Female	166.5	161.8
	(58.5)	(57.4)
Negative		
Positive	166.8	172.8
	(63.4)	(54.4)
Negative	169.2	184.1
	(56.3)	(95.8)

In MT (see Table 2) no effect of affect-congruency was found ($F(1,47)$<1, n.s.). The two-way interaction ($F(1,47)$=8.8, p<0.005) between target-gender and affective valence was, however, also found in MT. The arm was moved faster (i.e., in both flexion and extension) with negatively valenced male faces (M=169.8, SD=58.8 ms) than with positively valenced male faces (M=179.7, SD=63.9 ms), whereas, with negatively valenced female faces MT was longer (M=176.6, SD=78.6 ms) than with positively valenced female faces (M=164.2, SD=57.7 ms). Both differences in affective valence within target-gender were, however, not significant ($V(47)$=1.9, n.s.; $V(47)$=2.3, n.s., respectively) according to Tukey's HSD post-hoc test. No further main or interaction effects were found in this analysis.

Discussion

Faster (with respect to RT) and less incorrect responses were produced with affect-congruent than with affect-incongruent responses. These results show that effects similar to those of Chen and Bargh (1999), Duckworth et al. (2002, Experiment 3), and Solarz (1960) can be obtained with our experimental set-up. Moreover, our results extend their results, respectively, from affective words and affectively valenced but novel images to affectively valenced facial expressions. No attempt was made to mask the affective nature of the task (the experiment was announced as an affective evaluation task). No conclusion can be drawn yet, therefore, about the type of affect arm flexion/extension relationship and whether it depends on conscious processing goals. Strictly speaking, these results cannot be generalized to male participants, but Solarz' results suggest that similar effects can also be found in males, albeit in a diminished form.

An interesting, but unexpected aspect of our results was the interaction between model gender and affective valence with these female participants. They reacted faster overall (i.e., irrespective of flexion and extension) to negatively valenced male than to positively valenced male target faces in both RT and MT. This is in line with the finding of Chen and Bargh (1999) that responses were faster for negatively valenced words than for positively valenced words. Chen and Bargh interpreted this as further evidence for a greater automatic vigilance for, or sensitivity toward, negatively valenced information (Pratto & John, 1991; Taylor, 1991). For female targets this pattern of results was, in contrast, reversed. Although we should be careful with the interpretation of these unexpected results, it seems that gender as a social identity is an important parameter for early vigilance and monitoring of the environment for potential danger and should be considered in further studies of the automatic vigilance hypothesis (Pratto & John, 1991).

In the second experiment of Chen and Bargh (1999) and the third experiment of Duckworth et al. (2002) participants were instructed to push or pull a lever whenever they detected the target stimulus (respectively, words and images). In these experiments too support was found for a relation between affect and arm movement, which may be part of a more general link between automatic affective information processing and action tendencies. Participants were, however, instructed to respond (i.e., arm flexion or extension) to clearly visible affectively valenced words and images. As already argued, it could not be excluded that some participants evaluated the affectively valenced words or images consciously (see for a similar conception Bargh, et al., 1996). At least part of the participants, probably, searched a reason for the presence of the affective stimuli. The difference between affect-congruent and affect-incongruent conditions, moreover, seems smaller in Chen and Bargh's Experiment 2 than in Experiment 1. In our Experiment 2, we replaced the affective evaluation of Experiment 1 by a non-affective judgment of the target faces, and thus attempted to divert attention from the affective features of the targets. This instruction may be more effective in preventing accidental conscious affective evaluation than the instruction to react to the mere presence of the target stimulus in the absence of any judgment with respect to the stimulus. It can be argued, however, that such an instruction could interfere with the immediate behavioral consequences of automatic affective stimulus evaluation. According to Chen and Bargh, however, automatic affective stimulus evaluation with direct behavioral consequences makes good adaptive sense "(...) because it is able to occur when conscious goal-directed thought is elsewhere or when attentional resources are short in supply." (p.221).

Experiment 2

The second experiment was completely similar in experimental set-up, design and affective stimuli to Experiment 1, except for the instruction. In this fashion participants were instructed to categorize faces as either being male or female. It is often assumed that affect can be processed automatically and without conscious processing (see Bargh et al., 1996; Dimberg, Thunberg, & Elmehed, 2000; Draine & Greenwald, 1998; Duckworth et al., 2002, Bargh, Garcia, & Chaiken, 2002; Murphy & Zajonc, 1993; Chapter 2; Chapter 3). With this gender-categorization instruction affective processing can be induced that does not depend necessarily on conscious processes (Morris, Friston, Büchel, Frith, Young, Calder, & Dolan, 1998), although, some conscious processing of affect cannot be excluded. In comparison to the second experiment of Chen and Bargh (1999), however, conscious processing of affect seems at least hindered more extensively with this instruction whereas automatic affective information processing can take place simultaneously. The contrast of this instruction with that of Experiment 1 is typically used to study " the functional dissociation between pathways for the conscious explicit appraisal of facial expressions (...) and pathways for automatic implicit processing of salient facial expressions (...)" (Critchley et al., 2000, p.102). If the influence of affect on arm flexion and extension is automatic and does not heavily depend on conscious affective evaluation, the same pattern of results should be expected as in Experiment 1. If, on the other hand, conscious affective evaluation is required for the initiation of action tendencies for arm flexion and extension (but not for the affective information processing), this pattern of results should not be present.

Method

Participants. Forty-eight first-year female psychology students (average age 20.9 year, $SD=1.24$) from the University of Amsterdam participated in the experiment for course credit. All participants had normal or corrected-to-normal vision, were right-handed and signed informed consent. The experiment was announced as "Gender judgment of faces".

Design. The judgment task had a 2 (Target-gender: female vs. male model) x 2 (Target-valence: positive vs. negative emotional expression) x 2 (Affect-congruency: affect-congruent- vs. affect-incongruent) within-participants factorial design. Initiation time (RT), movement time (MT), and percentage incorrect responses were again measured. The same exclusion criteria for reaction times were used as in Experiment 1.

Material and apparatus. Only changes with respect to the first experiment will be discussed here. Affect-congruent trials were mixed with affect-incongruent trials by including in both blocks of trials angry as well as happy facial expressions of both sexes. Twenty-four participants started with series A, whereas the remaining participants started with series B.

Procedure. Participants were instructed to judge face gender (i.e., male or female). It was mentioned that the faces showed expressions but that these were irrelevant to the experimental task. The experiment again consisted of two different instruction blocks, but this time the instruction specified the relation between upper or lower button and model gender.

Upper and lower buttons alternatively corresponded to 'male' and 'female' responses in the two instruction blocks. All possible references in the instructions to "movement" or "congruence" versus "incongruence", "approach-behavior" or "avoidance-behavior", or for that matter "flexion" and "extension" were prevented. Before the first block, six practice trials were presented. After finishing the first block, a second task (i.e., ideograph evaluation) was again performed to ease transition between instruction conditions. Subsequently, the second block of trials was presented which was also preceded by six practice trials. The experiment was again concluded by an exit-interview.

Results

Participants reported to be well able to evaluate the gender of the faces and almost all participants reported to have also noticed the emotional expressions. The average for one participant was replaced by the overall average in that condition because more than four outliers and incorrect responses were identified in this participant's affect-incongruent responses. Overall, twenty-two outliers (2.3%) were excluded from the analysis of the affect-congruent trials and twenty-five (2.6%) from the affect-incongruent trials. Slightly more incorrect responses were made with affect-incongruent responses (4.3%) than with affect-congruent responses (4.2%). According to a paired t-test ($t(47)<1$, n.s.), this difference was, however, not significant.

No clear effect (see Table 3) of affect-congruency was obtained in RT (congruent: M=507.2, SD=79.6 ms; incongruent M=504.6, SD=77.8 ms), as was evidenced by the absence of a main effect ($F(1,47)<1$) in the 2 (Target-gender) x 2 (Target-valence) x 2 (Affect-congruency) ANOVA. The home button was, however, released faster (irrespective of affect-congruency) for positive female targets (M=493.9, SD=75.1 ms) than for negative female targets (M=516.3, SD=88.9 ms), as was revealed by Tukey's HSD post-hoc test ($V(47)=4.2$, $p<0.05$) for the interaction between model-gender and affective valence ($F(1,47)=23.3$, $p<0.0001$). No significant difference ($V(47)=2.6$, n.s.) between negative male faces (M=499.8, SD=71 ms) and positive male faces (M=513.6, SD=77.2 ms) was, however, obtained. This two-way interaction resembles the pattern of results, at least for the female facial expressions, obtained in Experiment 1. This suggests that, although affective valence appears to have been processed, it had no clear effect on affect-congruency. No further main or interaction effects were significant in this analysis.

Table 3. *Mean (SD) reaction times for the home button (RT) in Experiment 2.*

	Congruent	Incongruent
Positive		
Male	512.5	514.7
	(75.9)	(79.3)
Female	489.7	498
	(80.2)	(70.3)
Negative		
Positive	506.2	493.4
	(69.4)	(72.8)
Negative	520.4	512.2
	(90.8)	(87.8)

No main effect ($F(1,47)<1$, n.s) of affect-congruency (congruent: M=162.0, SD=64.5 ms; incongruent M=157.3, SD=57.0 ms) was obtained (see Table 4) in MT in the 2 (Target-gender) x 2 (Target-valence) x 2 (Affect-congruency) ANOVA. There was, however, an interaction between affect-congruency and affective valence ($F(1,47)=5.1$, $p<0.05$) which indicated that for negative stimuli affect-congruent movements (M=157.9, SD=62.4 ms) were performed faster than affect-incongruent movements (M=162.6, SD=62.6 ms), but that this pattern reversed for positive stimuli (congruent: M=166.1, SD=66.6 ms; incongruent: M=152.1, SD=50.6 ms). Both differences were, however, not significant according to Tukey's HSD post-hoc tests ($V(47)<1$, n.s.; $V(47)=2.4$, n.s., respectively). The interaction may result from the relative ease of performing arm extension relative to arm flexion. Participants also moved their arm faster ($F(1,47)=6.4$, $p<0.05$) with male targets (M=155.9, SD=56.6) than with female targets (M=163.4, SD=64.7). No further main or interaction effects occurred in this analysis.

Table 4. *Mean (SD) movement times (MT) in Experiment 2.*

	Congruent	Incongruent
Positive		
Male	163.1	149.2
	(70.1)	(49.8)
Female	169.1	155.0
	(63.5)	(51.7)
Negative		
Positive	148.6	163.0
	(44.0)	(59.1)
Negative	167.3	162.3
	(75.9)	(66.5)

Discussion

No influence was found of affect on arm flexion and extension when attention was diverted away from the affective valence by the instruction to evaluate target gender, although, almost all participants reported to have noticed the affective content of the targets. The alternative explanation of an overall absence of affective processing is further made implausible by the finding of a similar interaction as in Experiment 1 between affective valence and target gender in RT. Smiling female faces were categorized faster than angry female faces, whereas, however, no reliable difference was found between the categorization of happy and angry male facial expressions. It thus seems that affect was noticed and processed, at least partially, but that full attention towards affective evaluation is required (as in Experiment 1) to evoke any influence of affect on arm flexion and extension. If this conclusion can be extended to Experiment 2 of Chen and Bargh (1999) and Duckworth's et al. (2002) Experiment 3, the congruency effects there may have been due to contamination by participants' conscious processing the affective content of the stimuli in the absence of another attention consuming task. Before we can draw such a conclusion replication of these results seems warranted in an alternative paradigm (with arm flexion and extension) that would allow simultaneously dissociation of automatic affective evaluation effects from automatic influences of affect on arm flexion and extension.

In the sequential priming procedure (Neely, 1977), a prime stimulus is presented first and subsequently followed (after a Stimulus Onset Asynchrony: SOA) by a target stimulus that has to be judged on a shared dimension. Fazio, Sanbonmatsu, Powell, and Kardes (1986; see also: Bargh, Chaiken, Govender, & Pratto, 1992), for instance, found that affective evaluations were faster when prime and target words (presented with a SOA of 300 ms) had a congruent valence (e.g., 'puppy' and 'wonderful') than when prime and target words had an incongruent valence ('puppy' and 'disgusting'). Chen and Bargh (1999) argued with respect to this paradigm

> because the duration of the attitude object prime was too short to permit any conscious set or expectancy concerning the valence of the upcoming adjective (...), any influence of the attitude object prime on latency to classify the target as good or bad could only occur if the attitude object had automatically activated the attitude associated with it in memory."(p.216).

This affective priming effect is now well established for valenced words (Bargh, Chaiken, Govender, & Pratto, 1992; Hermans, De Houwer, & Eelen, 1994), for valenced pictures (Banse, 2001; Fazio, Jackson, Dunton, & Williams, 1995; Hermans et al., 1994), and even completely novel words and sounds (Duckworth et al., 2002). The sequential priming paradigm seems suitable to test for the dissociation between automatic affective evaluation and automatic action tendencies for arm flexion and extension. This is because overall latency times (i.e., affect-congruent versus affect-incongruent latencies) can be differentiated in affect specific arm flexion and extension latencies (see Experiment 3).

Although conscious evaluation appears necessary for finding action tendencies for arm flexion and extension, only the explicit task-context of affective evaluation may be sufficient for this purpose. Klinger, Burton, and Pitts (2000) argued, for instance, that (nonconscious) activation of response tendencies is heavily dependent on conscious task demands. Klinger et al. demonstrated that affective priming by affectively valenced words occurred only with evaluation (i.e., positive, negative) of affective target words (Experiment 1). When a lexical decision had to be made (Experiment 2), however, the affective priming effect disappeared. Prime words influenced judgments on target words only when primes and targets were compatible with regard to the response dimension. In other words, attention to the relevant dimension (i.e., affect) may be a prerequisite even for the activation of automatic response tendencies. With gender judgment action tendencies for arm flexion and extension may, thus, have been absent because attention was focused on a non-affective dimension. Because in the sequential affective priming paradigm targets can be evaluated on an affective dimension this alternative explanation could not be raised for the results obtained in such a paradigm. In Experiment 3 we studied the influence of affective stimuli (serving as primes in a sequential priming task) that were not consciously evaluated, but were presented in the context of explicit evaluation of affective target stimuli.

Experiment 3

The same type of facial stimuli as in Experiment 1 and Experiment 2 now served as primes, instead of as targets. Different affective scenes (e.g., sunny beaches, garbage dumps) served as targets. The SOA between prime and target was chosen at 100 ms, on the one hand, to resemble target presentation time of Experiment 1 and Experiment 2, and, on the other hand, to ensure automatic influences of the prime stimuli. It was expected that if affective information processing results automatically in action tendencies influences of prime faces on arm flexion and extension should be obtained. If, however, this influence is non-automatically mediated, no effect of the faces on arm flexion and extension latencies should be obtained. Second, it was expected that an effect of target valence on flexion and extension (i.e., as in Experiment 1) would be found. Third, an affective priming effect should be obtained. That is, when valence of target and trial correspond (i.e., positive-positive, negative-negative combinations) responses should be faster and more accurate than when they do not correspond (i.e., positive-negative, negative-positive combinations) (see Bargh et al., 1992; Fazio et al., 1986; Fazio et al., 1995; Hermans et al., 1994). This opens up the possibility of finding evidence for affective processing of the (prime) faces in the absence of action tendencies for arm flexion and extension.

Method

Participants. Forty-eight first-year female psychology students (average age 20.9 year, SD=2.6) from the University of Amsterdam participated in the experiment for course credit. All participants had normal or corrected-to-normal vision, were right-handed and signed informed consent. The experiment was announced as "Categorization of affective stimuli".

Design. The judgment task had a 2 (Target-affect-congruency: affect-congruent vs. affect-incongruent) x 2 (Target-valence: positive vs. negative pictures) x 2 (Prime-valence: positive vs. negative emotional expressions) within-participants factorial design.

Material and apparatus. Only changes with regard to Experiment 1 and Experiment 2 will be discussed here. Forty-eight pictures with emotional expressions from Ekman and Friesen (1976), Matsumoto and Ekman (1988) and Martinez and Benavente (1998) served as primes. The happy and angry expressions were taken from the same model. The set of primes was subdivided in two series (A and B) that each contained twelve happy and twelve angry expressions from twenty-four different models. Twelve of these pictures were taken from female and twelve were taken from male models. Forty-eight pictures (no faces) from Lang, Öhman, and Vaitl (1988) served as targets. Twenty-four pictures were rated mildly positive, and twenty-four were rated mildly negative by American women (Lang, Bradley, & Cuthbert, 1995). Targets were combined with each series (A and B) in such a way that six positive targets were combined with three happy male and three happy female expressions, six positive targets were combined with three angry male and three angry female expressions. Six negative targets were combined with three angry male and three angry female expressions, and six negative targets were combined with three happy male and three happy female expressions. Four different couplings of primes and targets were prepared for each series (A and B). These couplings were rotated over the participants. The order of trails was randomized for each participant, separately.

Each series was preceded by six practice trials that contained pictures (primes and targets) not included in the experimental material. Each trial started with the projection of a black fixation point for 400 ms that was placed in a mask. Primes were, subsequently, projected for 100 ms and were directly followed by the target pictures which were projected for 150 ms.

Procedure. Participants were instructed to evaluate the valenced targets. It was mentioned that facial expressions would precede these targets, but it was emphasized that the targets had to be rated. They received either a target-affect-congruent (press the lower button with negatively valenced targets, press the upper button with positively valenced targets), or a target-affect-incongruent instruction (press the upper button with negatively, and the lower button with positively valenced targets). All reference to "congruence" or "incongruence", "approach-behavior" or "avoidance-behavior", or for that matter "flexion" and "extension" was avoided. After finishing the first block, the same intervening task was performed,as in Experiments 1 and 2. Subsequently, the second block of trials was presented again preceded by six practice trials. The experiment was concluded by an exit-interview.

Results

Participants reported to be well able to evaluate the affective valence of the targets. Overall thirty-three outliers (2.9%) were excluded from the analysis of the target-affect-congruent conditions and twenty-seven (2.3%) from the target-affect-incongruent conditions. Slightly more incorrect responses were made in the incongruent conditions (4.7%) than in the congruent conditions (4.0%). According to a paired t-test ($t(47)<1$), however, this difference was not significant.

Participants released the home button overall faster in target-affect-congruent (M=685.4, SD=93.3 ms) than in target-affect-incongruent (M=712.1, SD=97.8 ms) conditions (see Table 5 & Figure 1), as was evidenced by the main effect ($F(1,47)=12.2$, $p<0.01$) of target-affect-congruency in the 2 (Target-affect-congruency) x 2 (Target-valence) x 2 (Prime-valence) ANOVA on RT. If prime and target had a corresponding valence, moreover, participants were faster (Pos-pos, M=679.8, SD=94.9 ms; Neg-neg, M=692.4, SD=95.7 ms, respectively) than when prime and target valence differed (Pos-neg, M=710.8, SD=99.9; Neg-pos, M=712, SD=92.7, respectively), as was evidenced by the two-way interaction between target and prime valence ($F(1,47)=28.1$, $p<0.0001$). No further main or interaction effects were significant in the analysis of RT.

Table 5. *Mean (SD) reaction times (RT) for the home button arranged for target-affect-congruency in Experiment 3.*

	Congruent		Incongruent	
	Pos. prime	Neg. prime	Pos. prime	Neg. prime
Positive target	668.3	701.9	691.2	719.7
	(95.9)	(95.3)	(93.4)	(104.5)
Negative target	694	677.3	730	707.5
	(92.2)	(88.6)	(90.7)	(100.9)

Table 6. *Mean (SD) movement times (MT) arranged for target-affect-congruency in Experiment 3.*

	Congruent		Incongruent	
	Pos. prime	Neg. prime	Pos. prime	Neg. prime
Positive target	226.2	221.7	223.9	257.0
	(81.2)	(87.3)	(62.6)	(102.5)
Negative target	243.0	211.8	228.4	256.5
	(88.1)	(74.1)	(84.3)	(105.9)

For MT (see Table 6) a similar main effect of target-affect-congruency ($F(1,47)=5.1$, $p<0.05$) was found (congruent, M=225.7, SD=83.0 ms; incongruent, M=241.4, SD=91.1 ms). This effect seems to be largely due, however, to the movements with negatively valenced targets (congruent positive, M=234.6, SD=84.7 ms, congruent negative, M=216.8, SD=80.7 ms incongruent positive, M=226.1, SD=73.9 ms, incongruent negative, M=256.8, SD=103.7 ms). Post-hoc analyses of the two-way interaction between target-affect-congruency and target-valence (F(1,47)=15.6, p<0.001) revealed that the difference between target-affect-congruent conditions is significant only for negatively valenced targets (V(47)=4.6, p<0.05), but not for positively valenced targets (V(47)<1). The same two-way interaction (F(1,47)=4.2, p<0.05) between prime-valence and target-valence indicating an affective priming effect was obtained as with RT (Pos-pos, M=225.0, SD=72.1 ms; Neg-neg, M=234.2, SD=93.7 ms; Pos-neg, M=235.7, SD=86.1 ms, Neg-pos, M=239.4, SD=96.4 ms). No further main or interaction effects proved significant in this analysis for MT.

Table 7. *Mean (SD) reaction times (RT) for the home button arranged for prime-affect-congruency in Experiment 3.*

	Congruent		Incongruent	
	Pos. prime	Neg. prime	Pos. prime	Neg. prime
Positive target	668.3	719.7	691.2	701.9
	(95.9)	(104.5)	(93.4)	(95.3)
Negative target	730	677.3	694	707.5
	(90.7)	(88.6)	(92.2)	(100.9)

The influence of prime valence on arm movement was also analyzed in 2 (Prime-affect-congruency) x 2 (Target-valence) x 2 (Prime-valence) ANOVAs on RT and MT. No influence was found (see Figure 1) of prime-affect-congruency (F(1,47)<1, n.s.) for RT (congruent: M=698.8, SD=98 ms; incongruent: M=698.7, SD=95 ms). The only new effect involving prime-affect-congruency was a three-way interaction for RT (see Table 7) between prime-affect-congruency, prime-valence, and target-valence (F(1,47)=12.2, p<0.01). This interaction is probably due to the fact that in prime-affect-incongruent conditions initial facilitation by the corresponding valences of prime and target was offset by the required incongruent movements. In the prime-affect-congruent conditions, in contrast, movement and valence correspondence of primes and targets supported each other. No further main or interaction effects were significant in this analysis.

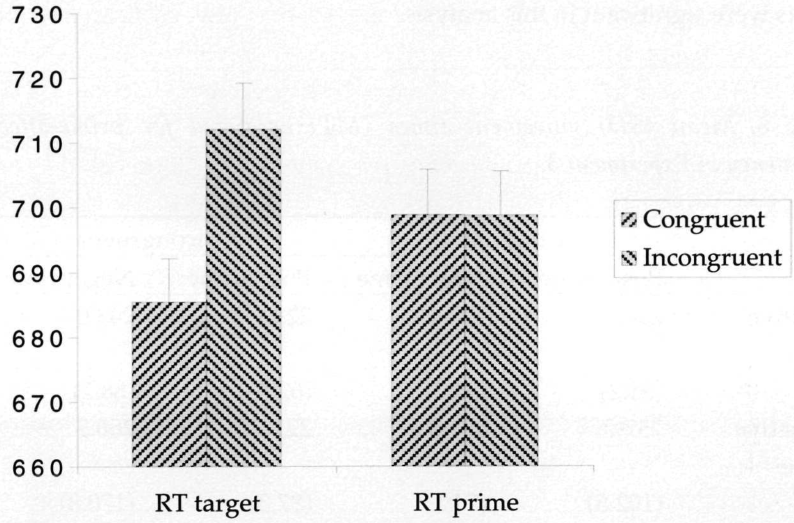

Figure 1. *Reaction times (SE) in target-affect-congruent versus target-affect-incongruent, and prime-affect-congruent versus prime-affect-incongruent conditions, in response to affectively valenced targets.*

For MT also no influence of prime-affect-congruency was found (congruent, M=230.8, SD=87.1 ms; incongruent, M=236.3, SD=87.8 ms) on arm movement (F1,47)=1, n.s.). As with RT, a two-way interaction ($F(1,47)=4.2$, $p<0.05$) was found in MT between affective prime valence and target valence (Pos-pos, M=225.0, SD=72.1 ms; Pos-neg, M=239.4, SD=96.4 ms; Neg-pos, M=235.7, SD=86.1 ms; Neg-neg, M=234.2, SD=93.7 ms). Also a two-way interaction was found between prime-affect-congruency and prime-valence ($F(1,47)=15.6$, $p<0.001$) which indicates that for negatively valenced primes congruent movements (M=220.1, SD=79.4 ms) were performed faster than incongruent movements (M=249.8, SD=79.4 ms) and that for positively valenced primes the reverse pattern of results was found (congruent: M=227.3, SD=82.4 ms; incongruent: M=233.4, SD=76.6 ms). According to Tukey's HSD post-hoc test this difference was not significant for negative primes (V(47)=3.4, n.s.), nor for positive primes (V(47)=2.2, n.s.). Both two-way interactions were qualified, moreover, in the same way as for RT by a three-way interaction ($F(1,47)=5.1$, $p<0.05$) between prime-affect-congruency, prime-valence, and target-valence (see Table 8). No further main or interaction effects were significant in this analysis.

Table 8. *Mean (SD) movement times (MT) arranged for prime-affect-congruency in Experiment 3.*

	Congruent		Incongruent	
	Pos. prime	Neg. prime	Pos. prime	Neg. prime
Positive target	226.2	228.4	223.9	243.0
	(81.2)	(84.3)	(62.6)	(88.1)
Negative target	257.0	211.8	221.7	256.5
	(102.5)	(74.1)	(87.3)	(170.8)

General Discusssion

For both reaction time measures in Experiment 3 faster responses were obtained with affect-congruent than with affect-incongruent responses to the valenced targets (i.e., affective scenes). Also a sequential affective priming effect (Fazio et al., 1995; Hermans et al., 1994) occurred in the overall (i.e., irrespective of flexion or extension) responses to affectively valenced pictures. The latter effect constitutes strong evidence that the affective valence of the primes was actually processed and probably was processed automatically according to the reasoning of Bargh (Bargh et al., 1992, see also Fazio et al., 1986). This dissociation strongly suggests that only the former is automatic. Also when attention was drawn to non-affective features of valenced targets (Experiment 2), no influence of affect on action tendency was found, in spite of some evidence that affect was actually processed. The link between automatic affective information processing and the initiation of action tendencies, at least when operationalized by arm flexion and extension, seems not necessarily nonconscious and automatic as defined by Chen and Bargh (1999), even when such processing was facilitated by the choice of affective stimuli (i.e., facial expressions of emotion, Öhman, 1986).

The experimental set-up of our experiments was different from Solarz's (1960), and Chen and Bargh's (1999, and Duckworth's et al., 2002, Experiment 3) and we need to be careful in drawing strong conclusions. On the one hand, one cannot completely rule out the possibility that due to these differences in experimental set-up, the automatic link between automatic affective evaluation and action tendencies for arm flexion and extension was absent. On the other hand, the similarity in patterns of results between our Experiments 1 and 3 (only for the targets), Solarz's results, Chen and Bargh's results and Duckworth's et al. Experiment 3 strongly suggest that similar conceptual mechanisms were measured. If one accepts this argument, our conclusion that action tendencies for arm flexion and extension does not result automatically from automatic affective information processing is warranted. In line with this remark of caution it should also be noted that our results were obtained with female participants only, and with facial expressions of emotion, and affectively valenced scenes as target stimuli. We have not yet obtained similar effects with word stimuli. However, there is no a priori reason to suspect that different results would be obtained with words.

Action tendencies for arm flexion and extension apparently do not result automatically from automatic affective information processing but there is evidently a link. Cacioppo et al. (1993) suggest (see also Neumann & Strack, 2000 a&b) that this link entails probably a form of higher order Pavlovian conditioning. Arm flexion is usually closely coupled in time (due to countless repetitions during an individual's lifetime) with the consumption of desired goods, whereas arm extension is temporally mostly coupled in time with the onset of unconditioned aversive stimuli. This explanation seems not limited to arm flexion and extension but applies also, according to Förster and Strack (1996), to, for instance, head movements and affective information processing. They found that participants who were induced to nod while encoding affectively valenced words in a recognition task were more likely to recognize positive words, whereas participants who were induced to shake their heads were more likely to recognize negative words. It should be noted, that Cacioppo et al. sought an explanation for their attitudinal effects of arm-movements and effects, whereas Chen and Bargh (1999), Duckworth et al. (2002) and Solarz (1960) measured differences in latency times due to affective information processing. Nonetheless, the suggested explanation by Cacioppo et al. for the link between positive affect and arm flexion and negative affect and arm extension seems to apply to both directions (see also Chen and Bargh) but should be investigated further.

Chen and Bargh (1999) acknowledge that although they assume a fully automatic link between affect and lever pulling (i.e, arm flexion) and pushing (i.e, extension) this link can be overruled accidentally by, for instance, contextual factors. They propose that "(...) it may be possible to generate quite different effects within the same paradigm." (p.222). This argument seems to be underlined by Clore and Ortony (2000). They argue on the basis of a unpublished experiment by Brendl that "(...) when arm flexion can be interpreted as withdrawing one's hand from an object (...), and when arm extension can be interpreted as reaching for the object (...)" (p. 51) the opposite pattern of results (i.e., incongruent facilitation or congruent inhibition) can be obtained. They propose "hence, it is the situated meaning of flexion and extension that is critical; the affective appraisals are manifested in the motivational realm as the desired end states of approaching or avoiding stimuli, rather than simply as triggers for distance-modulating behaviors (muscular flexion or extension) (Neumann & Strack, 1998) [published: Neumann & Strack, 2000 a]." (Clore & Ortony, p.51).

The theoretical points of view of Chen and Bargh (1999) and Clore and Ortony (2000) differ in the importance of automatic information processing. Whereas Chen and Bargh propose automatic affective evaluation as an adaptive back-up system with behavioral effects that (in the strong version of their argument) "(...) are the status quo and are only occasionally overridden by conscious intervention" (p.217), Clore and Ortony made no allowances for them, whatsoever. Clore and Ortony emphasized in contrast deliberation and conscious control in the affect-behavior link. Our results, primarily, seem to contradict the theoretical position of Chen and Bargh (1999) that automatic affective information processing could result automatically in action tendencies involving arm flexion and extension. We have established no direct evidence, however, for Clore and Ortony's hypothesis that it is the situated meaning, for instance, of arm flexion and extension that is important for the link between affect and action. Participants in our experiments were simply not aware of the situated meaning of arm flexion and extension. It seems rather plausible though that if action tendencies for arm flexion and extension depend on conscious appraisals, the situated meaning and context for these movements would be incorporated in these processes.

Action tendencies for arm flexion and extension do not necessarily represent all sort of action tendencies related to affect. Simple generalizations of our conclusions to other behavioral consequences of affect should, therefore, be avoided. It could be argued that our conclusions apply to action tendencies for all behavior that is associated chronically (i.e., conditioned during lifetime, as proposed by Cacioppo et al., 1993, but see also Förster & Strack, 1996) with affective information processing (e.g. body bending, head nodding and shaking). Other behavior, such as facial muscle movement, for instance, has probably besides a deliberate also an automatic link with affect, as may be derived from the long tradition of facial research within the domain of emotions (Darwin, 1872/1998; Ekman & Friesen, 1971). In fact, we previously obtained evidence that affective influences on facial muscles (corrugator and zygomaticus muscles) could be larger with suboptimal (i.e., less conscious) than optimal (i.e., fully conscious) presentation (Chapter 2; see also Dimberg, Thunberg, & Elmehed, 2000). Besides this automatic link between affect and (covert) facial expressions, there is also evidence for an influence of, for instance, social context on facial expressions (e.g., Hess, Banse, & Kappas, 1995). A fully automatic affect-behavior link (that can be modulated) can, thus, not be excluded for all bodily movements, but does not seem to involve arm flexion and extension.

If the link between affective information processing and arm flexion and extension behavior could have been considered entirely automatic, the latter would have constituted an implicit measure of affect. Implicit dependent measures of affect are of interest mainly because they can reflect affective states without accompanying consciousness. Due to the fact that consciousness sometimes inhibits (Murphy & Zajonc, 1993; Chapter 2; Chapter 3), or may even distort (Phaf & Wolters, 1997) affective processing, the availability of an implicit measure would be very helpful to gain further insight in the nonconscious (core) processes underlying emotions. Arm flexion and extension does not appear useful, however, as a pure implicit measure of affect. Arm flexion and extension as an affective response remains implicit in the weaker sense that participants are not fully aware of the link between affect and arm flexion and extension (as, for instance, between happiness and smiling), even when this response is caused by explicit deliberation. In this manner, arm flexion and extension may still be useful to establish dissociations between consciously mediated, but implicit, affective responses and consciously reported affective judgments (e.g., preference judgments). An example may be provided by Experiment 2 of Chen and Bargh (1999) or Duckworth's et al (2002) Experiment 3. Although participants were only instructed to push or pull the lever on mere stimulus presentation, they appeared to have evaluated the valenced targets consciously. Congruent movements were performed faster than incongruent movements in the absence of an explicit affective judgment task. This alone already represents a dissociation between implicit and explicit measures, but it is still possible that corresponding explicit judgments could be made. When further conscious processing inhibits or distorts these judgments, arm flexion and extension may still be useful for tapping affect.

The link between affect and arm flexion and extension appears to be largely dependent on deliberative and conscious information processing. This does not necessarily mean that all types of action tendencies are due to conscious affective evaluation. Initial activation of facial muscles, for instance, does not appear to depend necessarily on stimulus awareness in some conditions (Dimberg, Thunberg, & Elmehed, 2000; Chapter 2). Also the startle response (Lang et al., 1990) is, probably, linked immediately to affect and is widely used as an implicit measure of affect (e.g., in animal research). Only with respect to action tendencies concerning arm flexion and extension we propose a dependence on conscious appraisals here and further research will be needed to investigate the specific nature of this dependence for other types of action (e.g., head nodding and shaking, postural movements).