Review

automatic reactions are learnt form experience bargh et al !997.
encountering same object builds strong associations that can later be retrieved automatically when such instances are encountered.
depressed individuals can process negative information about themselves even under high cognitive load. but un-depressed wont be able to process negative thoughts about themselves in a short window of 500ms.
mildly negative and positive words are also responsible for priming even in absence of any evaluative intent.
time and resource scarcity studied done my fazio shows that control is conscious while categorization and characterization is automatic.

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Automaticity in social-cognitive processes

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Over the past several years, the concept of automaticity of higher cognitive processes has permeated nearly all domains of psychological research. In this review, we highlight insights arising from studies in decision-making, moral judgments, close relationships, emotional processes, face perception and social judgment, motivation and goal pursuit, conformity and behavioral contagion, embodied cognition, and the emergence of higher-level automatic processes in early childhood. Taken together, recent work in these domains demonstrates that automaticity does not result exclusively from a process of skill acquisition (in which a process always begins as a conscious and deliberate one, becoming capable of automatic operation only with frequent use) – there are evolved substrates and early childhood learning mechanisms involved as well.

The pervasive role of automaticity in psychological theory and research

If there is one major trend in research on automaticity of the higher mental processes over the past few years, it is that the concept has now permeated nearly all psychological domains. What began 30 years ago with some tentative steps into the notion that some basic social-perceptual processes, such as impression formation and stereotyping, could have efficient and unintentional components (that is, influences that operate outside of one's conscious awareness) [1], has now become a staple and indispensable construct for the explanation and prediction of almost all psychological phenomena. In this concise review of a burgeoning literature we seek to present the highlights and some representative studies in (i) behavior contagion and conformity, (ii) face perception and social judgment, (iii) embodiment, or the automatic influence of concrete physical states and experiences on abstract psychological and interpersonal processes, (iv) emotion regulation, (v) moral judgments, (vi) motivation and goal pursuit, (vii) the emergence of higher-level automatic processes in early childhood, (viii) decision making, and (ix) relationship formation and maintenance (Table 1).

In keeping with our intended focus on the new, emerging domains of automaticity research, we did not include here the most recent developments in the longest-standing domain of social automaticity research, that of attitudes and prejudice in adults (see [2]); instead we devote attention to the new emerging research on attitudes and prejudice in very young children (see the section on development).

The second major trend in automaticity research has been the growing recognition that not all higher-level automatic processes are put in place via a process of skill acquisition (e.g., [3]), in which a mental process starts out as conscious and effortful and only with frequent and consistent practice and experience becomes efficient and automatic. Early childhood studies and research on embodied influences have shown how innate processes and those acquired in very early childhood (such as concepts about the physical world and physical experiences) can exert an automatic, nonconscious influence on the higher mental processes, without starting out as a conscious process (see [4]).

Several forms of automatic influence are driven by effortless perceptual activity regarding the outside world, such as behavioral contagion or conformity effects triggered by the perception of others' behavior and immediate impressions of others based on their facial features or expressions alone, whereas others are driven by automatic sensory perception and the perception of internal states as in embodied cognition and emotional influences, including emotional influences on moral judgment. These can be thought of as 'preconscious' automatic phenomena [1], because they are generated from effortless sensory or perceptual activity and then serve as implicit, unappreciated inputs into conscious and deliberate processes. A major development over the past decade and especially the past 5 years has been the inclusion of motivational and goal pursuit processes into this category of preconsciously automatic processes. Research has shown that goal pursuits can become activated (primed) by relevant situational features; they then operate outside of conscious awareness and guidance. Other forms of automaticity are consequences of prior conscious and intentional thought, such as unconscious components in consciously intended decision-making processes and those that support one's conscious commitment to a relationship partner; these can be considered as 'postconscious' or (better still) 'goal-dependent' forms of higher-level automatic processes (see [1]; also [5]).

We will present representative recent studies of automatic influences on such higher order phenomena as social

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Table 1. Domains of automaticity research

Type of automaticity	Domains
Preconscious automaticity: Generated from effortless sensory or perceptual activity to then serve as implicit, unappreciated inputs into conscious and deliberate processes, or directly activate higher mental processes such as goal pursuit and social behavior	Behavior contagion and conformity (see text)
	Consumer behavior [160]
	Developmental: early childhood (see text)
	Embodiment (see text)
	Emotion regulation (see text)
	Evolutionary influences [161]
	Face perception and social judgment (see text)
	Health psychology [162]
	Implicit attitude influences [163]
	Moral judgments (see text)
	Motivation and goal pursuit (see text)
	Stereotyping and prejudice [2]
Postconscious (goal-dependent) automaticity: Dependent on prior or concurrent conscious and intentional thought	Attention and motor performance [164]
	Cognitive skill acquisition [165,166]
	Decision-making (see text)
	Relationship formation and maintenance (see text)

behavior, self-regulation, moral judgments, close relationships, and decision making, organized in terms of whether these require only the presence of the triggering sensory or perceptual experience (preconscious) or are dependent on the additional context of an active motivational state (goal-dependent) for their operation. As will be seen, occasionally the sensory or perceptual experiences can be carry-over reactions from one context to the next, as in embodiment or moral judgment research, in which emotional disgust or guilt reactions influence subsequent information processing and behavioral responses. We will focus on the underlying mechanism or source of the automaticity effect, sometimes evolved or hard-wired, sometimes from early experience (including absorption of cultural beliefs in the very young), as well as the traditionally researched source of automaticity from skill acquisition. We draw the general conclusion that each new field that includes a consideration of automatic processes in accounting for their central phenomena is profiting by increased power of its models in accounting for heretofore unexplained variance. For example, a consideration of automatic, nonconscious influences has proven a boon to understanding the causes of counterproductive unhealthy behaviors and formerly unexplained sources of romantic attraction.

Preconscious automaticity

Behavior contagion and conformity

Past research on the automatic link between social perception and behavior established that the mere perception of the physical behavior of others [6], as well as the automatic activation of the more abstract category memberships (e.g., racial, gender, role-related) that occurs passively in the course of person perception, results in increased tendencies to behave in the same way oneself (i.e., the 'perception-behavior link'; [7]). In this way, the same stimuli that in the normal course of social perception activate mental representations of different categories of people and (at a more micro level) what they are currently doing also naturally increase the likelihood that one will behave the same way oneself. Recent reviews of this behavior-priming literature (e.g., [8]) have concluded that this is now a well-established finding, such that contemporary research has moved on to questions of limits, constraints, and moderators of the basic effect (Figure 1). Other research now focuses on the potential social consequences of natural imitation and mimicry tendencies.

Regarding moderators and mechanisms, the social consequences of behavior contagion appear to be mediated by its effect on self-construal. This was first demonstrated by Hull and colleagues [9] across five studies in which stereotypes, emotional faces, and achievement-related primes were presented either subliminally or supraliminally. Implicit elderly-stereotype primes caused participants subsequently to walk more slowly (Studies 1 and 2), replicating the original elderly stereotype priming effect on behavior [10], but this effect was found only for dispositionally high self-conscious, not low self-conscious, individuals. In other experiments, subliminal achievement primes produced improved task performance compared to a control group (Study 3) and subliminal angry faces significantly increased blood pressure compared to a subliminal relaxation prime (Studies 4 and 5), but again, only for high self-conscious participants. In harmony with these findings, manipulations of self-focused attention also moderate behavior priming effects: DeMarree and Loersch [11] manipulated attentional focus to the self versus to other aspects of the current environment and found that aggressive behavior could be primed only when attention was focused on oneself. Focusing attention on someone else instead allows priming effects on the perception of that person (e.g., that they are more aggressive in nature), but not on self-perception, and the reverse is true when attention is self-focused. Emerging research findings are consistently showing that primed constructs are most impactful on behavior when they are integrated into one's current or 'working' self-concept and considered to be self-descriptive [12].

Relatedly, priming responses appear to be 'full body' responses in that the identical priming event (e.g., synonyms of 'achievement') can influence perception, behavior, as well as goal pursuit, depending merely on which dependent measure the researcher happens to be collecting. In other words, the prime manipulation in any single study sets all of these effects into motion simultaneously, as if a complex 'role' or 'persona' is being activated instead of

mimicry and imitation

context dependent

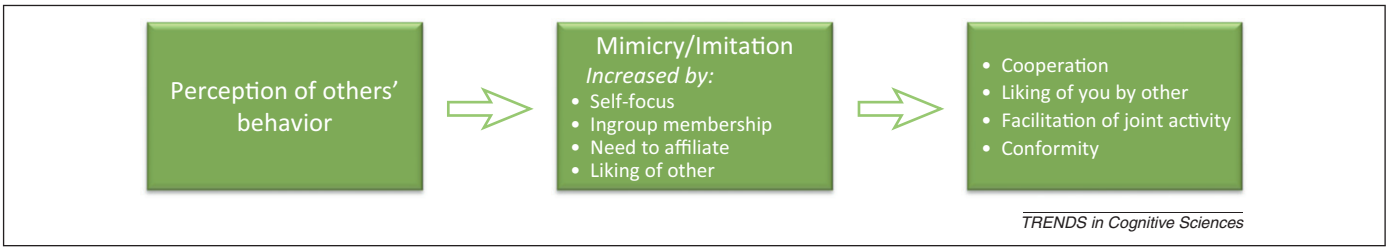

Figure 1. Mechanisms of behavior contagion and conformity.

process-specific (e.g., perceptual or behavioral) constructs alone [13,14]. Thus, not only does priming with elderly-related stimuli cause a participant to walk more slowly (behavioral effect), but it also affects the participants' perceptions of the environment in stereotype-consistent ways: estimating a hill to be steeper and the distance across a grassy field to be longer compared to the estimates made by a control group [15]. It is as if the active self-concepts of the experimental group participants took on the role or persona of an elderly person.

Related to the mediating role of the self-concept in automatic behavior priming effects, behavioral tendencies produced by social perception also seem to be constrained by positive or at least non-negative feelings towards the perceived target. Thus, in another replication of the elderly-walking-slow priming effect [16], the effect was obtained mainly for those who reported liking elderly people and not for those who reported disliking the elderly. Subsequent research has similarly shown that natural mimicry tendencies do not apply when the other person is a member of an outgroup (see [17]). And, although being mimicked by another person typically creates feelings of bonding ([6], Study 2) and social warmth (as well as physical warmth; see section on embodiment), being mimicked by an outgroup member has the opposite effect and actually 'leaves one cold' [18]. Imitation and mimicry may thus be the default mechanism, occurring with new acquaintances, as well as members of one's social groups, but disappears or even reverses in the presence of outgroup members.

Assuming that most people have a favorable view of themselves, these two lines of evidence – that the self-concept and also positive feelings towards the target are necessary ingredients for mimicry and behavior contagion effects – suggest that positive affect plays an important gatekeeping role in allowing perceptual activation to flow automatically to overt behavioral tendencies. Supporting this conclusion is the finding by Leighton and colleagues [19] that boosting prosocial feelings in general causes a subsequent increase in automatic imitation tendencies, which also suggests that the relation between mimicry and the positivity of social attitudes is bidirectional.

With respect to consequences, Chartrand and Bargh [6] originally found that being mimicked by a stranger created feelings of bonding and liking towards the stranger, serving as a kind of 'social glue'. More recent research has shown that mimicry can also increase interpersonal harmony when it is automatically elicited by feelings of social exclusion [20]. Having recently been excluded by participants in a joint activity automatically increases tendencies to mimic others in a subsequent situation, which again has the effect of increasing liking and feelings of closeness between the interactants. Mimicry also has the positive consequence of enhancing individuals' ability to succeed in joint-action tasks by honing their perceptual sensitivity to others' motions [21].

A particularly intense form of mimicry is when two or more individuals engage in the same behavior not in sequence, but at the same time. Such synchronized behavior is argued by Wiltermuth and Heath [22] to foster group cohesion and cooperation, and for this reason has been a historically important component of group rituals (e.g., marching armies; standing, sitting, kneeling, singing at the same time in religious services) for millennia. Further, the degree of interpersonal behavioral synchrony that people exhibit predicts their subsequent degree of affiliative behavior [23].

Clearly, automatic mimicry and behavior contagion tendencies are powerful sources of conformity tendencies within society. The automaticity of conformity effects helps us understand social issues, such as how anti-social behavior (e.g., copy-cat crimes) may spread in societal contexts; it also suggests solutions for preventing it. Simply seeing evidence that social norm violations have been committed in the recent past – such as when viewing graffiti scrawled on city walls or litter on the streets – leads to the general spreading of disorder and crime. In a set of field experiments, Keizer and colleagues [24] found that people were more likely to behave in unscrupulous ways, such as littering, stealing, or disobeying posted signs, in contexts where there was evidence of past disorder (e.g., graffiti, litter). Behavior priming thus has real social consequences and can occur even in the absence of the original actors and the actual behavior being mimicked – when only vestiges of the relevant behavior remain.

Face perception and social judgment

A powerful form of preconscious automaticity for the impressions and other important judgments we make about other people concerns the immediate appraisal of faces. Early studies on this topic found that rapid judgments of a person's competence, based solely on facial appearance and with faces presented for merely milliseconds, successfully predict the outcome of elections in which those target people were candidates [25,26]. More generally, judgments of specific traits based on facial appearance occur very rapidly, with brief presentations of faces leading to spontaneous inferences about the trustworthiness and competence of the target person [27,28]. Evidence also shows that people are able to automatically infer the preferences of others from spontaneous facial expressions [29]. An important question for further research is whether or not these automatic inferences are

Accuracy of this judgment is questionable!

accurate – an especially important question given the apparent automaticity and strong confidence we have in our judgments of others based on their faces alone. Emerging research indicates that, overall, people tend to rely too much on appearance when making these trait and other judgments, assigning facial appearance too much weight in subsequent decisions about the person than is merited [30,31].

Embodiment

One of the major new areas of automaticity research has been on embodied emotion and cognition (e.g., [32]), in particular the strong associations between metaphorically related physical and psychological concepts [33,34], such that activation automatically spreads from concepts activated by physical experiences to their metaphorically-related social and psychological concepts. For example, physical sensations of surface hardness prime more abstract notions of difficulty, physical heaviness activates notions of seriousness [35], and briefly holding a warm cup of coffee produces feelings of social warmth (generosity, trust; [36]), and other physical warmth experiences can be used to satisfy needs for social warmth [37].

The physical experiences also produce behavioral effects in line with the associated abstract content; for example, people compromise more in price negotiations when sitting on soft versus hard chairs [35] and prefer to wash their hands more after remembering a past guilty behavior, as though they were 'washing away their sins' [38]. Indeed, hand washing can 'wipe away' psychological states: physical cleaning experiences have been found to wipe away post-decision dissonance and priming effects of the recent past [39,40]. For example, hand washing altered risk-taking strategies by wiping away the influence of good and bad luck experiences (reducing risk-taking behavior in the former and increasing it in the latter; [41]); the slate clearing effects of cleansing are indiscriminate and impact even desirable states. Social variables such as relative power seem to be mapped onto spatial dimensions as well: target people presented at the top of a display are rated as more powerful than those who happen to be presented lower down [42].

The automatic associations between metaphorically-related physical and psychological concepts appear to be bi-directional. For example, physical warmth experiences produce feelings of social warmth, such that people feel closer to each other on a variety of dependent measures [43]; in turn, manipulations of social warmth and closeness, such as discovering one has similar attitudes and values as the target person, cause participants to estimate the room temperature as higher [44].

'Power posing' is another emerging topic in embodiment research. Not only does power posing, or the incidental adoption of open and expansive bodily positioning, produce psychological and behavior changes such as increased feelings of power and risk tolerance, but it also produces neuroendocrine changes by increasing testosterone (the dominance hormone) and decreasing cortisol (the stress hormone; [45]). Accordingly, high-power posers show increased confidence in decision-making, as well as a preference for decision-consistent information [46].

Demonstrations of metaphorical or embodied cognition effects have become so widespread in the literature that recent reviews of the domain (e.g., [47]) are now calling for more 'second generation' research that identifies boundary conditions (e.g., [48]), mediators (e.g., [49]), action-relevant contexts (e.g., [50]), and individual differences (e.g., [51]). It has become clear that more than one mechanism is probably involved in producing these effects (Table 2). Some appear to be semantic in nature (e.g., the physical concept of 'hardness' accrues additional meanings over time such as 'difficulty'), whereas others – the more pan-cultural ones, such as physical and social warmth and coldness (see [52]) – may be hard-wired [49]. For example, experiences of social exclusion (social coldness) literally reduce bodily temperature (physical coldness; [53]). Another likely mechanism is early learning: Mandler [54] has argued that physical concepts serve as the bridge for the pre-verbal child to acquisition of language (such that the later-forming abstract concepts are scaffolded or built onto the pre-existing physical correlates), and, as the seminal attachment theorist John Bowlby argued [55], in infancy feelings of social closeness (trust, affection) are naturally conflated with physical closeness (e.g., being held close during breast-feeding).

Theoretically, scaffolding theory [56], in harmony with Mandler's [54] original work on early concept formation, posits that early sensorimotor experience (e.g., distance cues, temperature, cleanliness) serves as a mental foundation for later, more abstract, constructs, producing strong associative connections that persist in influence throughout the lifespan. In addition, innate and evolved motives and processes can serve as the foundation for later-developing abstract concepts and processes, in keeping with the basic brain-developmental principle of 'neural re-use' [57]. Thus, more abstract social and psychological processes are argued to make use of pre-existing circuits and systems if at all possible. For example, Eisenberger *et al.* [58] found that the social pain and distress caused by rejection experiences activates the same brain regions involved in the experience of physical pain.

Table 2. Three potential mechanisms for embodiment effects

Origin	Theoretical mechanism	Sample evidence
Phylogenetic	Evolved associative connections	Anatomical connection in insula between social warmth/coldness and physical warmth/coldness [49], combined with pan-cultural emphasis of dimension in outgroup stereotypes [52]
Ontogenetic	Early perceptual and sensory experience of the physical world	Psychological distance derived from spatial and temporal distance experiences [78]
Semantic	Acquired associations and metaphors	Culture-specific metaphors: for example, a ''bright'' smile [167], and ''rigidity'' activated by experiences of physical hardness [35]

At the metaphorical level, disease-avoidance mechanisms, which evolved to protect against contagious disease threats, have been found to overgeneralize to contribute to social outgroup prejudice. Huang *et al.* [59] found that negative attitudes towards immigrants decreased after the participant (i) washed their hands or (ii) received an inoculation against the H1N1 virus. It is as if satisfying the motive of protection against disease (invasion of the body against viruses) also satisfied the more abstract social (and metaphorically related) goal of protecting one's culture against 'invasion' by immigrants.

Emotion regulation

Recent research has shown that successful emotion regulation, long thought to be a strictly effortful and deliberative process, can occur without the necessity of conscious control [60–63]. In these studies, the goal to regulate emotions is primed outside of the participant's awareness through presentation of regulation-goal-related words, and is then found to operate nonconsciously to produce the same effects as deliberate, explicit regulation instructions from the experimenter.

Mauss and colleagues [62] primed emotion control (vs emotion expression) in this way by exposing participants to words related to those categories (e.g., 'restrained' for emotion control and 'boiled' for emotion expression) in a sentence unscrambling task, before participants were given an anger induction experience. The researchers found that participants who had been primed with concepts relating to emotion control reported experiencing significantly less anger than participants primed with emotion expression. Williams *et al.* [63] similarly primed participants with a reappraisal goal (e.g., transform, change) and showed that on a stressful task, those participants gave evidence of lower cardiovascular emotional reactivity, measured as a change in heart rate from baseline, compared to nonprime control group participants. Moreover, the success of the nonconscious reappraisal manipulation was equivalent to that in a separate condition in which participants were given explicit instructions to reappraise the stressful stimuli.

Moral judgments

When left unregulated, automatic emotional reactions play a significant role in moral reasoning. Although traditional theories of human morality have long emphasized the role of conscious, controlled processes in moral reasoning and judgment, recent research has highlighted more automatic influences on moral cognition (e.g., [64]). One of the most prominent advances concerns the role that the emotion of disgust plays in moral reasoning, a link proposed several times in the past decade but solidified only recently by empirical findings (see [65,66]). For example, even children as young as 5 years of age refer to moral transgressions as 'disgusting' [67]. Feelings of moral disgust, such as when one is the target of unfairness in an economic game, lead to the involuntary activation of the same facial muscles used in the expression of physical disgust [68]. Inducing feelings of disgust, either through a bitter taste [69] or a disgusting smell or messy work area [70], automatically (without the participants' awareness of this influence) increases the severity of a wide variety of moral judgments. Moreover, both trait [71] and state [72] disgust sensitivity are associated with more negative implicit attitudes toward homosexuals. These findings demonstrate that disgust reactions are powerful influences on moral cognition outside of people's awareness or control.

In light of such findings, theorists have proposed that morality may be innate [73], or wired into the mind [74] as a 'Universal Moral Grammar' [75], and empirical findings have revealed that rule-based moral judgments (e.g., that harming others is morally wrong) are governed by automatic cognitive processes. For example, manipulations of cognitive load [76] and time constraints, both of which impair controlled but not automatic processes, have been found to decrease utilitarian moral judgments (i.e., those that maximize benefits and minimize costs for affected individuals), but not rule-based judgments [77]. Cognitive load also reduces concern for the moral domains of authority, loyalty, and purity, which suggests that these might require controlled processes, but not for harm or fairness, which suggests that these may be more automatic.

In addition to research demonstrating that some components of moral cognition are more intuitive and automatic, other research demonstrates that, even when moral judgments result from controlled processes, they can be influenced automatically – without awareness or intention – by factors that are logically irrelevant to the judgment. For example, a moral transgression occurring a year in the future is experienced as more immoral than that same act said to occur tomorrow, and, similarly, a morally good act occurring a year in the future seems more virtuous [78]. In addition to imagining an actual event occurring in the near or far future, mere incidental priming of temporal distance leads participants to report that they will act more altruistically and judge the selfish behavior of others more harshly [79].

Motivation and goal pursuit

One of the more active automaticity research areas has been that on nonconscious goal pursuit. Building on earlier theoretical ideas that goal representations could be activated directly by environmental features (i.e., primed), just as for any other mental representation [80,81], and then operate in pursuit of the desired end-state outside of the person's awareness [82], the recent research has fleshed out how goals and motivations can operate in the absence of conscious guidance. In doing so, this research has greatly advanced our knowledge about the mechanisms of motivation in general, because nonconscious goal pursuit has been shown to be highly similar to conscious modes of goal pursuit, both in the outcomes produced, as well as how they are produced.

The original studies [82,83] found that primed, nonconscious goals produced the same outcomes – not only behavioral, but cognitive (e.g., memory structures) and motivational (e.g., resumption of interrupted tasks; [84]) as well – and did so using the same subgoals and brain regions as during conscious pursuit of the same goal [85,86]. These observations led to the prediction that unconscious goal pursuit must make use of the same executive functions and working memory resources as used in

conscious goal pursuit, in order to selectively attend to some features of the environment over others and then transform those to suit the current needs of the task [87]. Subsequent research has documented and validated this prediction. Hassin and colleagues [88,89] showed that a nonconsciously operating achievement goal serves to increase working memory capacity on the serial reaction time task and also to significantly improve performance on the Wisconsin Card Sorting Task, both standard measures of executive functioning. Across six experiments, Marien and colleagues [90] subliminally primed a variety of goals (e.g., socializing, academic performance) and found that they all took attentional capacity (executive processing resources) away from an ongoing conscious task (e.g., proofreading). In a major review of this literature, Dijksterhuis and Aarts [91] concluded that unconscious goal pursuit makes use of attention and executive processes in furtherance of the goal, just as conscious goal pursuit does, but in the absence of conscious awareness of the pursuit.

Many studies have shown that one way in which nonconscious goal pursuit furthers goal attainment is by changing the valence or positivity of environmental stimuli, making goal-facilitating objects (including people who are helpful in one's attainment of the goal) more positively evaluated. Because this positive evaluation is linked with stronger approach motivations [92], it naturally increases approach motivational tendencies towards those goal-facilitating objects and people [93,94]. For example, Fitzsimons and Fischbach [95] found that, when the achievement goal is primed, participants report that they like their study friends more than their party friends, but when the socializing goal is primed, they now like their party friends more. However, although such changes in evaluation may further the pursuit of the current goal, they may not be in the long-term best interest of the individual [96]. Hill and Durante [97] found that the nonconscious activation of the mating goal causes women to view the health consequences of tanning booths and dangerous diet pills as less negative and personally threatening, leading them to report, while that goal was active, stronger intentions to use them.

Nonconscious goal pursuits also map onto the reward structure of the environment in an automatic manner. Extensive research by Aarts, Custers, Holland and their colleagues has shown that evaluative conditioning of positive affect (unrelated semantically to the goal) to the goal representations increases both the probability that goal will be pursued, over other possible goal pursuits, and the amount of effort that will be expended in pursuit of that goal [98,99]. The role of positive affect in increasing probability of nonconscious goal pursuit would seem to be related to the repeated finding that subliminal priming of product brand names does not increase consumption of that product unless the person is currently in a related need state (e.g., tired, for an energy pill supplement; see [100–102]). The need state thus works to increase the reward value of the product. The effect of pairing positive affect with a goal is also pronounced in the case of self-symbols or stimuli related (often merely incidentally) to the individual's identity or self-concept [99]. This may help to explain the 'name letter effect', in which people are more likely to pursue careers and move to locations that incidentally share letters (especially initials) of their name (e.g., [103]), or other aspects of identity, such as birthdays. For example, Walton and colleagues [104] found that high school students obtain higher mathematics class scores at the end of the school year if they have read about a mathematics prize-winning student at another school who happens to share their birthday.

Just as the probability of nonconscious goal activation increases with the reward or incentive structure of the environment (as sensed by the amount of positive affect associated with the goal representation), so does the strength of the goal map onto one's success at pursuing it [105,106]. Following the priming of the achievement goal, for instance, 'success' at an easy anagram filler task increases both positive mood and how hard participants work on a subsequent verbal task; 'failure' on a hard (impossible) filler anagram task has the opposite effects. Success also increases the positivity of automatic attitudes towards the goal, whereas failure decreases them [107]. All of these effects serve to automatically perpetuate the goal into future situations by increasing the probability of pursuing goals that produce rewards that one is likely to be successful at attaining and decreasing goals that are low in relative reward value and which one is less likely to obtain, either because of deficits in personal ability or because environmental situations somehow prevent attempts at the goal [108].

The lack of awareness of pursuing nonconsciously operating goals has important consequences for the individual's understanding of what he or she was doing. Bargh *et al.* [82] found that immediately following a task, participants who had been unconsciously pursuing the goal of cooperation could not report, at better than chance levels, how much they had just cooperated, whereas participants who had been consciously pursuing the cooperation goal were able to accurately report on their degree of cooperation. Bar-Anan and colleagues [109] showed in four experiments that participants misattribute their behaviors that were driven by nonconscious goals to other plausible, consciously accessible reasons. For example, following priming of the mating goal, male participants were more likely to choose to work with a female tutor on Topic A than a male tutor on Topic B, but later explained their choice in terms of greater interest in that topic (which had been randomly paired with either the male or female tutor). These erroneous self-understandings were shown to have long-term behavioral consequences, as well. In another study, participants primed with a helping goal were more likely to choose to play a version of a trivia game in which they would be able to give help to another participant. This 'help' version was randomly described as either 'easy' or 'challenging'; if it had been described as 'challenging', the participant was subsequently more likely to choose reading material about how to pursue personal challenges over other available reading material.

As with other active behavior-producing concepts, nonconsciously activated goal representations are subject to contagion and projection effects (see next section). People naturally understand and perceive other people's behavior in terms of their current purposes, that is, the goals they

Table 3. Automatic processes observed in infancy/early childhood

Domain	Summary of findings
Objects	Infants (i.e., before 12 months) understand that objects, but not substances, are solid (i.e., they cannot occupy the same space at the same time) and cohesive (i.e., they persist as single entities; [168]).
Numbers	Infants appear to possess one core system for representing small quantities as individual objects and a second system for representing quantities as approximate numerical values [169].
Space	Infants show sensitivity to distance, angles, and direction, and can utilize both egocentric and allocentric frames of reference to navigate their spatial environment [170].
Agents	Infants organize the actions of agents in terms of those agents' goals [120].
Social evaluation	Infants prefer prosocial to antisocial agents [171].
False beliefs	Children younger than 4 years fail to verbally express knowledge of an agent's false belief, yet infants demonstrate false-belief understanding on looking-time and other implicit measures [172,173].
Priming	Priming can induce social behavior in toddlers and young children, such as helping in 18-month-olds [124] and affiliative imitation following social exclusion in 5-year-olds [125].
Implicit attitudes	By 12 months of age infants can distinguish faces by gender and race [174], and by 5 years of age children demonstrate implicit racial attitudes that that are identical to those of adults [131].

are trying to accomplish ([110]; also [111]). The increase in accessibility produced by this perceptual activity makes it more likely that the perceiver will adopt and pursue that goal him- or herself ('goal contagion'; [112]). Moreover, the increase in goal accessibility for a goal that the individual is currently pursuing is more likely to be used to interpret and understand the relevant behavior of others ('goal projection'; [113]). Subsequent research by Loersch and colleagues [114] and Leander and colleagues [115] demonstrated some important limits to such goal contagion effects: (i) they occur more strongly when perceiving members of one's social in-groups than out-groups, and (ii) they are less likely to occur if they conflict with one of the person's fundamental motives, such as autonomy and self-regard.

Development: automatic and unconscious processes in early childhood

Some of the most fascinating developments in automaticity relate to the cognition and behavior of infants and young children (Table 3). An emerging perspective in cognitive science proposes that, rather than beginning life with a 'blank slate', infants enter the world possessing innate cognitive systems prepared to represent objects, actions, number, space [116], and social partners [117]. The literature has swelled with empirical findings demonstrating that infants less than 1 year of age show a sophisticated understanding of object persistence [118], number and basic arithmetic operations [119], as well as other properties of the physical world. However, perhaps the most remarkable findings concern infants' understanding of the social world.

For example, infants understand that agents, but not objects, pursue goals [120] and infants will even selectively reproduce the goals of actions they observe [121]. (Converging evidence in adults supports the primacy of automatic and developmentally early goal inferences; see the section on motivation and goal pursuit above.) Infants as young as 6 months show the capacity for social evaluation, choosing to interact with a prosocial character over an antisocial character [122], and infants as young as 3 months of age look longer at a prosocial than a control character [123]. These findings suggest that, even before their first birthday, infants possess the cognitive machinery necessary to begin making sense of the physical and social world around them.

Further evidence for the automatic nature of these processes has been demonstrated in a series of priming studies in infants and young children. In a pioneering study, Over and Carpenter [124] showed 18-month-old infants photographs of common household objects. These photos included a small priming picture, presented unobtrusively in the corner, that depicted either a prosocial scene (two dolls facing each other) or a neutral scene (two dolls facing apart). A second experimenter then entered the room and accidentally dropped a handful of sticks. Infants who had viewed the photos with the prosocial prime were three times more likely to spontaneously help the second experimenter, compared to those who viewed the neutral photos. A further study [125] primed 5-year-old children with ostracism by showing the children videos of two animated geometric shapes on a computer screen that appeared to 'exclude' a third shape from a game, and found that children primed with ostracism subsequently engaged in compensatory affiliative behavior (as do adults after the same manipulation; e.g., [126]) by imitating an experimenter in an unrelated task following the prime.

The Over and Carpenter demonstrations are particularly striking as the children themselves were not excluded – in fact, the prime did not include real people at all, but only doll figurines and even mere abstract shapes moving on a screen. These results suggest that young children, prior to having any protracted periods of experience in the social world, possess rich mental representations of sophisticated social behaviors that can be activated automatically by features of their environments, as through experimental priming manipulations.

Another recent advance in developmental automaticity research concerns a veritable explosion of research on the implicit intergroup attitudes of children. Decades of research have revealed that children express a strong explicit preference for their ingroup that peaks at 7 years of age, but declines shortly thereafter, at approximately the same time that children begin to realize that such preferential attitudes violate societal norms [127]. Thus, researchers have begun to explore children's implicit attitudes by modifying the Implicit Association Test (IAT; [128]) for use with children as young as 5 years of age. The results from these studies are striking: by age five, children from groups with high social status are consistently found to possess high levels of implicit pro-ingroup bias, including

American White children [129], British White children [130], and Japanese children living in Japan [131]. In contrast, on this test children from groups with low social status show relatively less pro-ingroup bias and in some cases even show pro-outgroup bias (see [132]).

These findings of young children's implicit attitudes mirror those of adults, who show the same status asymmetry on the IAT [133]. Notably, however, not a single study mentioned above found an age-related change over time – across all age-groups tested, children show the same level of bias on the IAT as adults. Thus, although explicit social group attitudes change over time to become more egalitarian in appearance, implicit social group attitudes favoring one's ingroup emerge at very young ages and persist thereafter through the lifespan.

Interim summary

Recent research on preconscious forms of automatic influence have validated and extended previous demonstrations of direct environmental effects on social perception, social behavior, and motivation and goal pursuits. The older lines of research have become more refined and nuanced, with consistent and converging evidence of important mediators and moderators, such as the role of the active self-concept in producing behavior priming effects. Underlying mechanisms, such as the role played by executive processes and working memory in unconscious goal pursuit, have helped greatly to demystify the theoretically generated, but nonetheless surprising, early demonstrations; and emerging research findings that even very young children show adult-like evaluative, priming, and motivational effects is shedding light on the evolutionary origins of many automatic processes.

Moreover, new and powerful preconscious inputs into subsequent conscious thought, judgments, and experiences have been identified, such as the compelling effects of facial appearance on our judgments of others, even for very important decisions such as whom we select to be our elected representatives in government; and the role played by perceptual experiences of the physical world and our own physical sensations influence our higher mental processes through their associative connections to analogous abstract representations and motivations.

Goal-dependent automaticity

Goal-dependent or postconscious automaticity (see [1]) concerns skills and efficient thought processes that require the goal or intention to engage in them, but, once put in motion, operate very well with minimal attentional guidance. Motor skills, such as those involved in driving a car or typing a manuscript, can operate, after considerable practice, almost entirely without conscious guidance, but they do not occur without the initial conscious intention to engage in them. Recently, the idea that consciously formed goals set the stage for subsequent automatic processes, operating in the service of those goals, but themselves not requiring any further intention or conscious guidance, has been extended into the domains of complex decision-making processes and of close relationship formation and maintenance. In both cases, there is emerging evidence that the automatic, unconscious components of the process have an evolutionary basis.

Decision-making

Traditionally, human decision-making processes have been considered a bastion of exclusively conscious and deliberate thought. It is one of the last domains of psychological research to be examined for automatic and unconscious components. However, based in part on concurrent advances in unconscious motivation research (see above), Dijksterhuis and Nordgren [134] proposed 'Unconscious thought theory' (UTT) and provided initial supporting evidence for the claim that decisions made unconsciously are superior in quality to those made consciously. This provocative claim elicited a series of empirical protests from judgment and decision-making researchers, both methodological and empirical (see [135] for a review; also [136,137]). Over the past 5 years since the UTT proposal, the dust has settled somewhat and some early conclusions about the efficacy, if not the outright superiority, of unconscious decision-making seem merited.

Briefly, UTT holds that, after a first period of conscious thought in which the judgment relevant information is acquired (such as the relative merits of different products or apartments, across several dimensions, such as price and quality) and conscious intention is formed to make the best decision (this is why UTT is a form of goal-dependent automaticity), a period of deliberation using unconscious thought (while conscious thought is directed elsewhere) produces better quality judgments than does an equally long period of conscious deliberation. Theoretical reasons for this prediction include the greater efficiency of unconscious thought and the tendency of conscious thought to unequally weigh some dimensions over others, because of the limited focus of conscious thought at any one time.

Although space precludes a complete review of the theory and the resultant empirical evidence, a recent review of the available evidence [135] led to the conclusion that, when multiply relevant dimensions are in play and the available comparative information is relatively simple (i.e., this apartment is bigger than that one, this product has a longer warranty than the other one), a period of unconscious thought consistently produces decisions at least as good as an equal period of conscious thought. Even detractors of the theory consistently obtained this outcome. Their complaint was instead that the claim of superiority of unconscious over conscious thought was not supported in their studies.

However, in some studies superiority of unconscious thought was obtained and in precisely those domains that were likely to have been important over evolutionary time, prior to the advent of conscious thought processes. Ham and colleagues [138–140] showed consistent superiority of unconscious over conscious deliberation in three judgment domains: guilt (participants were given a complex legal case and asked for judgments as to who was guilty), utilitarian morality (approving of harmful actions that nonetheless produced the best consequences), and fairness (in complex job application procedures). Not coincidentally, these happen to be the same domains for which evolutionary theorists have argued that people possess innate

(unconsciously operating) processing mechanisms, such as cheater detection in social exchange settings [141] and the intuitive-prosecutor mindset to react against transgressions of social norms [142].

A welcome development has been second-generation theory and research which advances beyond the either-or question of 'which one is better?' to an examination of the conditions and circumstances in which one is better than the other. In what situations and for what types of decisions would periods of unconscious thought produce better outcomes than deliberate thought? Recently, Nordgren and colleagues [143] proposed a compromise position, arguing that a combination of both conscious and unconscious thought processes would solve complex problems better than either type by itself. Conscious thought was argued to be superior for components of the decision-making process that involved following rules, whereas unconscious thought was superior for those phases involving the aggregation or weighting of the various decision-relevant dimensions. Moreover, they suggested that the best decisions would occur when the period of unconscious thought follows the period of conscious deliberation.

Close relationships

Traditionally, research on close relationships has focused on conscious and deliberate processes that are available to introspection and reportable to the experimenter – for example, what people explicitly report as the important factors in their degree of attraction to another person. More recently, however, research has included a consideration of possible automatic or unconscious influences on relationship formation, maintenance, and dissolution.

Much of the recent research on automatic processes in close relationships has focused on automatic methods by which one maintains one's close relationships. When in a committed romantic relationship, individuals tend to automatically behave in a manner geared toward maintaining that relationship, even without any conscious awareness of how their behavior is doing so. For instance, Maner and colleagues [144] found that when one is in a relationship, but not when one is single, one gives members of the opposite sex less early-stage attention, which has the effect of reducing that person's potential threat to one's current relationship. Whereas men who were not currently in a committed relationship devoted more early-stage attention to attractive others [145] and also displayed higher levels of testosterone in their presence [146], those male participants who were currently in a committed relationship unconsciously responded instead with relative inattention to attractive opposite-sex targets [147].

Of course, men do not consciously pick up on fertility cues, knowing which women are currently at the peak fertility phase of their monthly cycle, but unconsciously they do regulate their behavior such that single men unconsciously approach and committed men unconsciously avoid fertile women. Men currently in a committed relationship rated a female confederate as least attractive when she happened to be highly fertile [147], contra to the ratings by single men of the same woman. In addition, when there is stress in a relationship, committed individuals tend to unconsciously upregulate interpersonal trust as a maintenance strategy. Participants' relationship stress was manipulated by instructions to imagine that their partner was going abroad for an extended period of time. Subsequently, in an unrelated context, their degree of interpersonal trust was measured either in a trust game (played against an anonymous stranger) or by having participants rate the trustworthiness of unknown faces. Greater relationship stress automatically increased interpersonal trust tendencies [148].

Automatic processes also play a significant role in relationship quality judgments and relationship dissolution decisions. Deliberative (conscious) thought no doubt plays a large role in the decision of whether or not to end a relationship (e.g., [149]), but recent research has indicated that implicit affect associated with one's partner also directly predicts relationship satisfaction and indirectly predicts likelihood of breakup 4 months after the implicit measurement was taken [150]. In one study, participants' implicit partner affect was first measured as an implicit bias for the initials in one's partner's name, similar to the name-letter effect [103,151], in which positivity towards one's own initials is found to be an index of implicit self-esteem (e.g., [152]). Participants rated how aesthetically pleasing was each letter of the alphabet, with implicit partner affect operationalized as the extent to which the initials of one's partner's name received higher ratings than the other letters in the alphabet. Four months later, this measure of implicit partner affect was found to be positively correlated with relationship satisfaction (but not commitment), which was in turn correlated with the likelihood of still being in the relationship.

Concluding remarks

The concept of automaticity has attained a status commensurate with conscious or controlled information processing, such that both forms of processing now receive research scrutiny and incorporation into models of nearly all psychological phenomena (Box 1). Across the various research domains reviewed above, two main developments have taken place over the past 5 years or so. First, no longer is automaticity assumed to result exclusively from a process of skill acquisition, in which a process always begins as a conscious and deliberate one, and only with experience becomes capable of automatic operation. Second, as pointed out many years ago by Shiffrin [153], any process of sufficient complexity to be of interest to social psychologists involves a complex interplay between both controlled (conscious) and automatic processes.

Extensive conscious and intentional use of a process or concept is no longer the only observed means to an automatic end. The developmental research clearly shows that, even before their first birthday, infants possess the cognitive machinery necessary to begin making sense of the physical and social world around them, casting doubt on the necessity of skill acquisition for at least certain processes, such as social evaluation and the motivation to help and cooperate with others. The embodiment research also shows that the many of the abstract social and psychological concepts and processes used in adulthood grow naturally out of very early learning of the physical environment, resulting in strong associative connections that exert their

Box 1. Questions for future research

- What are the automatic, unconscious motives operating in very young children, other than the already-demonstrated helping and affiliation motives?
- In addition to studying adult-like automatic processes in very young children, could such processes be found in non-human primates, as well?
- Do automatic processes involve different neural underpinnings than the same processes when engaged in consciously? Could such comparative neuroscience research shed light on the brain regions or circuits underlying consciousness?
- How do these various automatic processes influence each other? Do some, such as unconscious goal pursuit, dominate others, such as behavior contagion, when they suggest conflicting responses?
- How are the various automatic effects reviewed in this article influenced and moderated by ongoing conscious states and processes?
- Can a person prime him- or herself? Does conscious awareness of the priming attempt interfere with it or would it be possible to prime oneself to perform better, feel happier, be friendlier?
- What are the underlying mechanisms that produce embodiment effects on social judgment, social behavior, and social goal pursuits, and what are the limits and constraining conditions on those effects?
- Why do we draw so many implicit inferences about a person from his or her face, with so much agreement across perceivers in those inferences, and also have so much confidence in their accuracy, when facial appearance does not actually seem to be very diagnostic of those inferred traits or abilities?
- Are there automatic components and influences in other aspects or stages of close relationships, such as in reconciliation and dissolution ('make-up' and 'break-up')?
- How do automatic processes influence health-related behavior? Can health-supportive automatic behavioral influences be developed to help improve mental as well as physical health?

influence throughout the rest of one's life without the involvement of any conscious or effortful practice of these metaphoric connections. Similarly, innate emotional (e.g., disgust) and motivational (survival and safety, reproduction) processes are found to exert unconscious and automatic influences on social judgments and behavior. Thus, if there is one take home message in the automaticity research of the past decade, it is that skill acquisition is not the only route to automaticity.

The initial analysis of automaticity into preconscious and postconscious varieties [1] was meant to highlight the interplay between conscious and unconscious processes: preconscious forms serve as unfelt automatic input into controlled processes, such as decisions and behavioral choices, whereas postconscious forms are automatic, unintended consequences of conscious thought processes. Major recent reviews of the causal role of conscious processes [154] and recent integrations of the conscious self-regulation and the unconscious priming literatures [155] have similarly concluded that unconscious processes cause conscious ones, which in turn put further unconscious processes into motion. As Baumeister and Masicampo [154] concluded, unconscious processes are the main triggers of social behavior, but conscious processes play an important causal role as well, capable of changing and redirecting the unconscious behavioral or judgmental impulse (for compelling demonstrations of this interplay see [156]). For example, the most recent research is showing that subliminal priming effects disappear when participants are led to (consciously) make external attributions for the priming content [157], and thus the extent to which people effortfully attribute their thoughts to internal or external causes moderates automatic priming effects.

The recognition of the mutual importance of conscious and unconscious processes in the production of higher order cognition and complex interpersonal behavior has also shed light on the free will debate, at least within psychology. It has become clearer now that psychologists and philosophers have different things in mind when they use the term 'free will'. For philosophy, the term refers to one's conscious will as an original, uncaused cause; in psychology, by contrast, the issue for 100 years now (see [158]) has been instead that of the causal role of conscious thought. When psychologists have talked about free will, historically they have been concerned with the question of whether conscious thought participates at all in the causal chain from the environment (and unconscious processes) to responses such as judgments and behavior – independently of whether these conscious thoughts are themselves caused by environmental stimuli and preconsciously automatic processes (as, of course, from a scientific perspective they must be) or not (as held by the metaphysical notion of original causation in philosophy; see [159]). Based on the psychological definition at least, the empirical evidence is clear that free will does exist [154,156]. Conscious thought is causal and it often puts automatic processes into play; similarly, automatic processes regularly cause and influence conscious thought processes. These two fundamental forms of human information processing work together, hand in glove, and indeed one would not be able to function without the support and guidance of the other.

References

1 Bargh, J.A. (1989) Conditional automaticity: varieties of automatic influence on social perception and cognition. In *Unintended Thought* (Uleman, J. and Bargh, J.A., eds), pp. 3–51, Guilford
2 Nosek, B.A. *et al.* (2011) Implicit social cognition: from measures to mechanisms. *Trends Cogn. Sci.* 15, 152–159
3 Shiffrin, R.M. and Schneider, W. (1977) Controlled and automatic human information processing: II. Perceptual learning, automatic attending, and a general theory. *Psychol. Rev.* 84, 127–190
4 Bargh, J.A. and Morsella, E. (2008) The unconscious mind. *Perspect. Psychol. Sci.* 3, 73–79
5 Wegner, D.M. and Bargh, J.A. (1998) Control and automaticity in social life. In *The Handbook of Social Psychology* (Gilbert, D.T. *et al.*, eds), pp. 446–496, McGraw-Hill
6 Chartrand, T.L. and Bargh, J.A. (1999) The chameleon effect: The perception-behavior link and social interaction. *J. Pers. Soc. Psychol.* 76, 893–910
7 Dijksterhuis, A. and Bargh, J.A. (2001) The perception-behavior expressway: automatic effects of social perception on social behavior. *Adv. Exp. Soc. Psychol.* 33, 1–40
8 Wheeler, S.C. and DeMarree, K.G. (2009) Multiple mechanisms of prime-to-behavior effects. *Soc. Pers. Psychol. Compass* 3, 566–581
9 Hull, J.G. *et al.* (2002) The nonconsciousness of self-consciousness. *J. Pers. Soc. Psychol.* 83, 406–424
10 Bargh, J.A. *et al.* (1996) Automaticity of social behavior: direct effect of trait construct and sterotype activation on action. *J. Pers. Soc. Psychol.* 71, 230–244
11 DeMarree, K.G. and Loersch, C. (2009) Who am I and who are you? Priming and the influence of self versus other focused attention. *J. Exp. Soc. Psychol.* 45, 440–443
12 Wheeler, S.C. *et al.* (2007) Understanding the role of the self in prime to behavior effects: the Active-Self Account. *Pers. Soc. Psychol. Rev.* 11, 234–261

13 Bargh, J.A. (2006) What have we been priming all these years? On the development, mechanisms, and ecology of nonconscious social behavior. *Eur. J. Soc. Psychol.* 36, 147–168
14 Loersch, C. and Payne, B.K. (2011) The situated inference model: an integrative account of the effects of primes on perception, behavior, and motivation. *Perspect. Psychol. Sci.* 6, 234–252
15 Chambon, M. (2009) Embodied perception with others' bodies in mind: stereotype priming influence on the perception of spatial environment. *J. Exp. Soc. Psychol.* 45, 283–287
16 Cesario, J. *et al.* (2006) Automatic social behavior as motivated preparation to interact. *J. Pers. Soc. Psychol.* 90, 893–910
17 Chartrand, T.L. and Lakin, J. (2013) The antecedents and consequences of human behavioral mimicry. *Annu. Rev. Psychol.* http://dx.doi.org/10.1146/annurev-psych-113011-143754
18 Leander, N.P. *et al.* (2012) You give me the chills: embodied reactions to inappropriate amounts of behavioral mimicry. *Psychol. Sci.* 23, 772–779
19 Leighton, J. *et al.* (2010) Social attitudes modulate automatic imitation. *J. Exp. Soc. Psychol.* 46, 905–910
20 Lakin, J.L. *et al.* (2008) I am too just like you: nonconscious mimicry as an automatic behavioral response to social exclusion. *Psychol. Sci.* 19, 816–822
21 Valdesolo, P. *et al.* (2010) The rhythm of joint action: Synchrony promotes cooperative ability. *J. Exp. Soc. Psychol.* 46, 693–695
22 Wiltermuth, S.C. and Heath, C. (2009) Synchrony and cooperation. *Psychol. Sci.* 20, 1–5
23 Hove, M.J. and Risen, J.L. (2009) It's all in the timing: Interpersonal synchrony increases affiliation. *Soc. Cogn.* 27, 949–961
24 Keizer, K. *et al.* (2008) The spreading of disorder. *Science* 12, 1681–1685
25 Ballew, C.C. and Todorov, A. (2007) Predicting political elections from rapid and unreflective face judgments. *Proc. Natl. Acad. Sci. U.S.A.* 104, 17948–17953
26 Todorov, A. *et al.* (2005) Inferences of competence from faces predict election outcomes. *Science* 308, 1623–1626
27 Todorov, A. *et al.* (2009) Evaluating faces on trustworthiness after minimal time exposure. *Soc. Cogn.* 27, 813–833
28 Willis, J. and Todorov, A. (2006) First impressions: Making up your mind after 100ms exposure to a face. *Psychol. Sci.* 17, 592–598
29 North, M.S. *et al.* (2010) Inferring the preferences of others from spontaneous, low-emotional facial expressions. *J. Exp. Soc. Psychol.* 46, 1109–1113
30 Olivola, C.Y. and Todorov, A. (2010) Fooled by first impressions? Reexamining the diagnostic value of appearance-based inferences. *J. Exp. Soc. Psychol.* 46, 315–324
31 Zebrowitz, L.A. and Montepare, J.M. Faces and first impressions. In *Handbook of Personality and Social Psychology: Attitudes and Social Cognition* (Borgida, G. and Bargh, J.A., eds), American Psychological Association (in press)
32 Barsalou, L.W. (2008) Grounded cognition. *Annu. Rev. Psychol.* 59, 617–645
33 Lakoff, G. and Johnson, M. (1980) *Metaphors We Live By*, University of Chicago Press
34 Landau, M.J. *et al.* (2010) A metaphor-enriched social cognition. *Psychol. Bull.* 136, 1045–1067
35 Ackerman, J.M. *et al.* (2010) Incidental haptic sensations influence social judgments and decisions. *Science* 328, 1712–1715
36 Williams, L.E. and Bargh, J.A. (2008) Experiencing physical warmth promotes interpersonal warmth. *Science* 322, 606–607
37 Bargh, J.A. and Shalev, I. (2012) The substitutability of physical and social warmth in daily life. *Emotion* 12, 154–162
38 Zhong, C.B. and Liljenquist, K. (2006) Washing away your sins: threatened morality and physical cleansing. *Science* 313, 1451–1452
39 Lee, S.W.S. and Schwarz, N. (2010) Washing away postdecisional dissonance. *Science* 328, 709
40 Lee, S.W.S. and Schwarz, N. (2011) Wiping the slate clean: psychological consequences of physical cleansing. *Curr. Dir. Psychol. Sci.* 20, 307–311
41 Xu, A.J. *et al.* (2012) Washing away your (good or bad) luck: physical cleansing affects risk-taking behavior. *J. Exp. Psychol. Gen.* 141, 26–30
42 Schubert, T.W. (2005) Your highness: vertical positions as perceptual symbols of power. *J. Pers. Soc. Psychol.* 89, 1–21
43 IJzerman, H. and Semin, G.R. (2009) The thermometer of social relations: mapping social proximity on temperature. *Psychol. Sci.* 10, 1214–1220
44 IJzerman, H. and Semin, G.R. (2010) Temperature perceptions as a ground for social proximity. *J. Exp. Soc. Psychol.* 46, 867–873
45 Carney, D.R. *et al.* (2010) Power posing: brief nonverbal displays affect neuroendocrine levels and risk tolerance. *Psychol. Sci.* 21, 1363–1368
46 Fischer, J. *et al.* (2011) Empower my decisions: the effects of power gestures on confirmatory information processing. *J. Exp. Soc. Psychol.* 47, 1146–1154
47 Meier, B.P. *et al.* (2012) Embodiment in social psychology. *Top. Cogn. Sci.* 4, 705–716
48 Foroni, F. and Semin, G. (2009) Language that puts you in touch with your bodily feelings: the multimodal responsiveness of affective expressions. *Psychol. Sci.* 20, 974–980
49 Kang, Y. *et al.* (2011) Physical temperature effects on trust behavior: the role of insula. *Soc. Cogn. Affect. Neurosci.* 6, 507–515
50 Cesario, J. *et al.* (2010) The ecology of automaticity: how situational contingencies shape action semantics and social behavior. *Psychol. Sci.* 21, 1311–1317
51 Sherman, G.D. and Clore, G.L. (2009) The color of sin: White and black are perceptual symbols of moral purity and pollution. *Psychol. Sci.* 20, 1019–1025
52 Fiske, S.T. *et al.* (2007) Universal dimensions of social perception: warmth and competence. *Trends Cogn. Sci.* 11, 77–83
53 IJzerman, H. *et al.* (2012) Cold-blooded loneliness: social exclusion leads to lower skin temperatures. *Acta Psychol.* 140, 283–288
54 Mandler, J.M. (1992) How to build a baby: II. Conceptual primitives. *Psychol. Rev.* 99, 587–604
55 Bowlby, J. (1969) In *Attachment and Loss* (Vol. I: Attachment), Hogarth Press and the Institute of Psycho-Analysis
56 Williams, L.E. *et al.* (2009) The scaffolded mind: higher mental processes are grounded in early experience of the physical world. *Eur. J. Soc. Psychol.* 39, 1257–1267
57 Anderson, M.L. *et al.* (2012) Eroding the boundaries of cognition: Implications of embodiment. *Top. Cogn. Sci.* 4, 717–730
58 Eisenberger, N.I. *et al.* (2003) Does rejection hurt? An fMRI study of social exclusion. *Science* 302, 290–292
59 Huang, J.Y. *et al.* (2011) Immunizing against prejudice: effects of disease protection on attitudes toward out-groups. *Psychol. Sci.* 22, 1550–1556
60 Bargh, J.A. and Williams, L.E. (2007) The nonconscious regulation of emotion. In *Handbook of Emotion Regulation* (Gross, J.J., ed.), pp. 429–445, Guilford
61 Mauss, I.B. *et al.* (2007) Automatic emotion regulation. *Soc. Pers. Psychol. Compass* 1, 146–167
62 Mauss, I.B. *et al.* (2007) Automatic emotion regulation during an anger provocation. *J. Exp. Soc. Psychol.* 43, 698–711
63 Williams, L.E. *et al.* (2009) The unconscious regulation of emotion: nonconscious reappraisal goals modulate emotional reactivity. *Emotion* 9, 847–854
64 Haidt, J. (2007) The new synthesis in moral psychology. *Science* 316, 998–1002
65 Horberg, E.J. *et al.* (2011) Emotions as moral amplifiers: an appraisal tendency approach to the influences of distinct emotions on moral judgment. *Emot. Rev.* 3, 237–244
66 Rozin, P. *et al.* (2009) From oral to moral. *Science* 323, 1179–1180
67 Danovitch, J. and Bloom, P. (2009) Children's extension of disgust to physical and moral events. *Emotion* 9, 107–112
68 Chapman, H.A. *et al.* (2009) In bad taste: evidence for the oral origins of moral disgust. *Science* 323, 1222–1226
69 Eskine, K.J. *et al.* (2011) A bad taste in the mouth: gustatory disgust influences moral judgment. *Psychol. Sci.* 22, 295–299
70 Schnall, S. *et al.* (2008) Disgust as embodied moral judgment. *Pers. Soc. Psychol. Bull.* 34, 1096–1109
71 Inbar, Y. *et al.* (2009) Conservatives are more easily disgusted than liberals. *Cogn. Emot.* 23, 714–725
72 Dasgupta, N. *et al.* (2009) Fanning the flames of prejudice: the influence of specific incidental emotions on implicit prejudice. *Emotion* 9, 585–591
73 Haidt, J. and Joseph, C. (2007) The moral mind: how five sets of innate intuitions guide the development of many culture-specific virtues, and

perhaps even modules. In *The Innate Mind* (Vol. 3) (Carruthers, P. *et al.*, eds), In pp. 367–391, Oxford University Press
74 Greene, J.D. and Paxton, J.M. (2009) Patterns of neural activity associated with honest and dishonest moral decisions. *Proc. Natl. Acad. Sci. U.S.A.* 106, 12506–12511
75 Mikhail, J. (2007) Universal moral grammar: theory, evidence and the future. *Trends Cogn. Sci.* 11, 143–152
76 Greene, J.D. *et al.* (2008) Cognitive load selectively interferes with utilitarian moral judgment. *Cognition* 107, 1144–1154
77 Suter, R.S. and Hertwig, R. (2011) Time and moral judgment. *Cognition* 119, 454–458
78 Eyal, T. *et al.* (2008) Judging near and distant virtue and vice. *J. Exp. Soc. Psychol.* 44, 1204–1209
79 Agerström, J. and Björklund, F. (2009) Moral concerns are greater for temporally distant events and are moderated by value strength. *Soc. Cogn.* 27, 261–282
80 Bargh, J.A. (1990) Auto-motives: preconscious determinants of social interaction. In *Handbook of Motivation and Cognition* (Vol. 2) Higgins, E.T. and Sorrentino, R.M.,eds In pp. 93–130, Guilford
81 Kruglanski, A.W. (1996) Goals as knowledge structures. In *The Psychology of Action: Linking Cognition and Motivation to Behavior* (Gollwitzer, P.M. and Bargh, J.A., eds), pp. 599–618, New York, Guilford
82 Bargh, J.A. *et al.* (2001) The automated will: Nonconscious activation and pursuit of behavioral goals. *J. Pers. Soc. Psychol.* 81, 1014–1027
83 Chartrand, T.L. and Bargh, J.A. (1996) Automatic activation of social information processing goals: nonconscious priming reproduces effects of explicit conscious instructions. *J. Pers. Soc. Psychol.* 71, 464–478
84 Lewin, K. (1926) *Vorsatz, Wille, und Beduerfnis* [Intention, will, and need]. *Psychologische Forschung* 7, 330–385
85 McCulloch, K.C. *et al.* (2008) Taking a closer look: On the operation of unconscious impression formation. *J. Exp. Soc. Psychol.* 44, 614–623
86 Pessiglione, M. *et al.* (2007) How the brain translates money into force: a neuroimaging study of subliminal motivation. *Science* 316, 904
87 Bargh, J.A. (2005) Bypassing the will: towards demystifying the nonconscious control of social behavior. In *The New Unconscious* (Hassin, R.R. *et al.*, eds), pp. 37–58, Oxford University Press
88 Hassin, R.R. (2008) Being open-minded without knowing why: evidence from nonconscious goal pursuit. *Soc. Cogn.* 26, 578–592
89 Hassin, R.R. *et al.* (2009) Automatic and flexible: the case of nonconscious goal pursuit. *Soc. Cogn.* 27, 20–36
90 Marien, H. *et al.* (2012) Unconscious goal activation and the hijacking of the executive function. *J. Pers. Soc. Psychol.* http://dx.doi.org/10.1037/a0028955
91 Dijksterhuis, A. and Aarts, H. (2010) Goals, attention and (un)consciousness. *Annu. Rev. Psychol.* 61, 467–490
92 Chen, M. and Bargh, J.A. (1999) Consequences of automatic evaluation: Immediate behavioral predispositions to approach or avoid the stimulus. *Pers. Soc. Psychol. Bull.* 25, 215–224
93 Ferguson, M. (2008) On becoming ready to pursue a goal you don't know you have: Effects of nonconscious goals on evaluative readiness. *J. Pers. Soc. Psychol.* 95, 1268–1294
94 Fitzsimons, G.M. and Shah, J.Y. (2009) Confusing one instrumental other for another: Goal effects on social categorization. *Psychol. Sci.* 20, 1468–1472
95 Fitzsimons, G. and Fischbach, A. (2010) Shifting closeness: interpersonal effects of personal goal progress. *J. Pers. Soc. Psychol.* 98, 535–549
96 Bargh, J.A. and Huang, J.Y. (2009) The selfish goal. In *The Psychology of Goals* (Moskowitz, G. and Grant, H., eds), pp. 127–150, Guilford
97 Hill, S.E. and Durante, K.M. (2011) Courtship, competition, and the pursuit of attractiveness: mating goals facilitate health-related risk taking and strategic risk suppression in women. *Pers. Soc. Psychol. Bull.* 37, 383–394
98 Aarts, H. *et al.* (2008) Preparing and motivating behavior outside of awareness. *Science* 319, 1639
99 Holland, R.W. *et al.* (2009) Self-symbols as implicit motivators. *Soc. Cogn.* 27, 579–600
100 Bermeitinger, C. *et al.* (2009) The hidden persuaders break into the tired brain. *J. Exp. Soc. Psychol.* 45, 320–326
101 Karremans, J.C. *et al.* (2006) Beyond Vicary's fantasies: the impact of subliminal priming and brand choice. *J. Exp. Soc. Psychol.* 42, 792–798
102 Strahan, E.J. *et al.* (2002) Subliminal priming and persuasion: striking while the iron is hot. *J. Exp. Soc. Psychol.* 38, 556–568
103 Pelham, B.W. *et al.* (2002) Why Susie sells seashells by the seashore: implicit egotism and major life decisions. *J. Pers. Soc. Psychol.* 82, 469–487
104 Walton, G. *et al.* (2012) Mere belonging: the power of social connections. *J. Pers. Soc. Psychol.* 102, 513–532
105 Bongers, K.C.A. *et al.* (2009) Self-esteem regulation after success and failure to attain unconsciously activated goals. *J. Exp. Soc. Psychol.* 45, 468–477
106 Chartrand, T.L. and Bargh, J.A. (2002) Nonconscious motivations: their activation, operation, and consequences. In *Self and Motivation: Emerging Psychological Perspectives* (Tesser, A. *et al.*, eds), pp. 13–41, American Psychological Association
107 Moore, S.G. *et al.* (2011) Affect in the aftermath: how goal pursuit influences implicit evaluations. *Cogn. Emot.* 25, 453–465
108 Veling, H. *et al.* (2008) When approach motivation and behavioral inhibition collide: behavior regulation through stimulus devaluation. *J. Exp. Soc. Psychol.* 44, 1013–1019
109 Bar-Anan, Y. *et al.* (2010) Inaccurate self-knowledge formation as a result of automatic behavior. *J. Exp. Soc. Psychol.* 46, 884–894
110 van Overwalle, F. *et al.* (2012) Spontaneous goal inferences are often inferred faster than spontaneous trait inferences. *J. Exp. Soc. Psychol.* 48, 13–18
111 Lichtenstein, E.H. and Brewer, W.F. (1980) Memory for goal-directed events. *Cogn. Psychol.* 12, 412–445
112 Aarts, H. *et al.* (2004) Goal contagion: perceiving is for pursuing. *J. Pers. Soc. Psychol.* 87, 23–37
113 Kawada, C.L.K. *et al.* (2004) The projection of implicit and explicit goals. *J. Pers. Soc. Psychol.* 86, 545–559
114 Loersch, C. *et al.* (2009) The influence of social groups on goal contagion. *J. Exp. Soc. Psychol.* 44, 1555–1558
115 Leander, N.P. *et al.* (2011) The object of my protection: shielding fundamental motives from the implicit motivational influence of others. *J. Exp. Soc. Psychol.* 47, 1078–1087
116 Spelke, E.S. (2000) Core knowledge. *Am. Psychol.* 55, 1233–1243
117 Spelke, E.S. and Kinzler, K.D. (2007) Core knowledge. *Dev. Sci.* 10, 89–96
118 Baillargeon, R. (2004) Infants' physical world. *Curr. Dir. Psychol. Sci.* 13, 89–94
119 Xu, F. *et al.* (2005) Number sense in human infants. *Dev. Sci.* 8, 88–101
120 Woodward, A. (2009) Infants' grasp of others' intentions. *Curr. Dir. Psychol. Sci.* 18, 53–57
121 Hamlin, J.K. *et al.* (2008) Do as I do: 7-month-old infants selectively reproduce others' goals. *Dev. Sci.* 11, 487–494
122 Hamlin, J.K. *et al.* (2007) Social evaluation by preverbal infants. *Nature* 45, 557–560
123 Hamlin, J.K. *et al.* (2010) Three-month-old infants show a negativity bias in social evaluation. *Dev. Sci.* 13, 923–929
124 Over, H. and Carpenter, M. (2009) Eighteen-month-old infants show increased helping following priming with affiliation. *Psychol. Sci.* 20, 1189–1193
125 Over, H. and Carpenter, M. (2009) Priming third-party ostracism increases affiliative imitation in children. *Dev. Sci.* 12, F1–F8
126 Williams, K.D. (2007) Ostracism. *Annu. Rev. Psychol.* 58, 425–452
127 Banaji, M.R. *et al.* (2008) The development of intergroup social cognition: early emergence, implicit nature and sensitivity to group status. In *Intergroup Attitudes and Relations in Childhood through Adulthood* (Killen, M. and Levy, S.R., eds), pp. 87–104, Oxford University Press
128 Greenwald, A.G. *et al.* (1998) Measuring individual differences in implicit cognition: the Implicit Association Test. *J. Pers. Soc. Psychol.* 74, 1464–1480
129 Baron, A.S. and Banaji, M.R. (2006) The development of implicit attitudes: evidence of race evaluations from ages 6 and 10 and adulthood. *Psychol. Sci.* 17, 53–58
130 Rutland, A. *et al.* (2005) Social norms and self–presentation: children's implicit and explicit intergroup attitudes. *Child Dev.* 76, 451–466

131 Dunham, Y. *et al.* (2006) From American city to Japanese village: A cross-cultural investigation of implicit race attitudes. *Child Dev.* 77, 1268–1281
132 Newheiser, A. and Olson, K.R. (2012) White and Black American children's implicit intergroup bias. *J. Exp. Soc. Psychol.* 48, 264–270
133 Nosek, B.A. *et al.* (2002) Harvesting implicit group attitudes and beliefs from a demonstration web site. *Group Dyn. Theor. Res. Pract.* 6, 101–115
134 Dijksterhuis, A. and Nordgren, L.F. (2006) A theory of unconscious thought. *Perspect. Psychol. Sci.* 1, 95–109
135 Bargh, J.A. (2011) Unconscious Thought Theory and its discontents: a critique of the critiques. *Soc. Cogn.* 29, 629–647
136 Newell, B.R. and Rakow, T. (2011) Revising beliefs about the merit of unconscious thought: evidence in favor of the null hypothesis. *Soc. Cogn.* 29, 711–726
137 Strick, M. *et al.* (2011) A meta-analysis on unconscious thought effects. *Soc. Cogn.* 29, 738–762
138 Ham, J. *et al.* (2009) Lady Justice thinks unconsciously: unconscious thought can lead to more accurate justice judgments. *Soc. Cogn.* 27, 509–521
139 Ham, J. and van den Bos, K. (2010) On unconscious morality: the effects of unconscious thinking on moral decision making. *Soc. Cogn.* 28, 74–83
140 Ham, J. and van den Bos, K. (2010) The merits of unconscious processing of directly and indirectly obtained information about social justice. *Soc. Cogn.* 28, 180–190
141 Tooby, J. and Cosmides, L. (1992) The psychological foundations of culture. In *The Adapted Mind: Evolutionary Psychology and the Generation of Culture* (Barkow, J. *et al.*, eds), pp. 19–136, Oxford University Press
142 Tetlock, P.E. (2002) Social-functionalist frameworks for judgment and choice: the intuitive politician, theologian, and prosecutor. *Psychol. Rev.* 109, 451–472
143 Nordgren, L.F. *et al.* (2011) The best of both worlds: integrating conscious and unconscious thought best solves complex decisions. *J. Exp. Soc. Psychol.* 47, 509–511
144 Maner, J.K. *et al.* (2009) The implicit cognition of relationship maintenance: inattention to attractive alternatives. *J. Exp. Soc. Psychol.* 45, 174–179
145 Miller, S.L. and Maner, J.K. (2011) Ovulation as a male mating prime: subtle signs of women's fertility influence men's mating cognition and behavior. *J. Pers. Soc. Psychol.* 100, 295–308
146 Miller, S.L. and Maner, J.K. (2010) Scent of a woman: men's testosterone responses to olfactory ovulation cues. *Psychol. Sci.* 21, 276–283
147 Miller, S.L. and Maner, J.K. (2010) Evolution and relationship maintenance: fertility cues lead committed men to devalue relationship alternatives. *J. Exp. Soc. Psychol.* 46, 1081–1084
148 Koranyi, N. and Rothermund, K. (2012) Automatic coping mechanisms in committed relationships: increased interpersonal trust as a response to stress. *J. Exp. Soc. Psychol.* 48, 180–185
149 Thibaut, J.W. and Kelley, H.H. (1959) *The Social Psychology of Groups*, John Wiley and Sons
150 LeBel, E.P. and Campbell, L. (2009) Implicit partner affect, relationship satisfaction, and the prediction of romantic breakup. *J. Exp. Soc. Psychol.* 45, 1291–1294
151 Nuttin, M.J., Jr (1985) Narcissism beyond Gestalt and awareness: the name letter effect. *Eur. J. Soc. Psychol.* 64, 723–739
152 Bosson, J.K. *et al.* (2000) Stalking the perfect measure of implicit self-esteem: the blind men and the elephant revisited? *J. Pers. Soc. Psychol.* 79, 631–643
153 Shiffrin, R.M. (1988) Attention, In *Stevens' Handbook of Experimental Psychology* (2nd edn) (Atkinson, R.C. *et al.*, eds), pp. 739–811, Wiley
154 Baumeister, R.F. and Masicampo, E.J. (2010) Conscious thought is for facilitating social and cultural interactions: How mental simulations serve the animal-culture interface. *Psychol. Rev.* 117, 945–971
155 Baumeister, R. and Bargh, J. Conscious and unconscious: toward an integrative understanding of human mental life and function. In *Dual Process Theories in Social Psychology* (2nd edn) (Sherman, J. and Trope, Y., eds), Guilford (in press)
156 Briñol, P. and DeMarree, K.G., eds (2012) *Social Metacognition*, Psychology Press
157 Loersch, C. and Payne, B.K. (2012) On mental contamination: the role of (mis)attribution in behavior priming. *Soc. Cogn.* 30, 241–252
158 Watson, J.B. (1912) Psychology as the behaviorist views it. *Psychol. Rev.* 20, 158–177
159 Searle, J. (1983) *Intentionality*, Cambridge University Press
160 Perkins, A. and Forehand, M. (2010) Implicit social cognition and indirect measures of consumer behavior. In *Handbook of Implicit Social Cognition* (Gawronski, B. and Payne, B.K., eds), pp. 535–547, Guilford
161 Ackerman, J.M. *et al.* (2012) Evolutionary perspectives on social cognition. In *The SAGE Handbook of Social Cognition* (Fiske, S.T. and Macrae, C.N., eds), pp. 451–473, SAGE Publications
162 Wiers, R.W. *et al.* (2010) Implicit cognition in health psychology: why common sense goes out the window. In *Handbook of Implicit Social Cognition* (Gawronski, B. and Payne, B.K., eds), pp. 463–488, Guilford
163 Petty, R.E. *et al.*, eds (2009) *Attitudes: Insights from the New Implicit Measures*, Psychology Press
164 Ericsson, K.A. *et al.* (1993) The role of deliberate practice in the acquisition of expert performance. *Psychol. Rev.* 100, 363–406
165 Brown, T.L. and Carr, T.H. (1989) Automaticity in skill acquisition: mechanisms for reducting interference in concurrent performance. *J. Exp. Psychol. Hum. Percept. Perform.* 15, 686–700
166 Logan, G.D. (1988) Toward an instance theory of automatization. *Psychol. Rev.* 95, 492–527
167 Song, H. *et al.* (2012) Brighten up: smiles facilitate perceptual judgment of facial lightness. *J. Exp. Soc. Psychol.* 48, 450–452
168 Hespos, S.J. and vanMarle, K. (2012) Physics for infants: characterizing the origins of knowledge about objects, substances, and number. *WIRES Cogn. Sci.* 3, 19–27
169 Feigenson, L. *et al.* (2004) Core systems of number. *Trends Cogn. Sci.* 8, 307–313
170 Vasilyeva, M. and Lourenco, S.F. (2012) The development of spatial cognition. *WIRES Cogn. Sci.* 3, 349–362
171 Hamlin, J.K. and Wynn, K. (2011) Young infants prefer prosocial to antisocial others. *Cogn. Dev.* 26, 30–39
172 Baillargeon, R. *et al.* (2010) False belief understanding in infants. *Trends Cogn. Sci.* 14, 110–118
173 Perner, J. and Roessler, J. (2012) From infants' to children's appreciation of belief. *Trends Cogn. Sci.* 16, 519–525
174 Pascalis, O. *et al.* (2011) Development of face processing. *WIRES Cogn. Sci.* 2, 666–675