Available online at www.sciencedirect.com

ScienceDirect

Journal of Consumer Psychology 24, 1 (2014) 96 – 118

Research Review

Content and process priming: A review☆

Chris Janiszewski [a], Robert S. Wyer Jr. [b]

[a] Warrington College of Business Administration, University of Florida, P.O. Box 117155, Gainesville, FL 32611-7155, USA
[b] Department of Marketing, Chinese University of Hong Kong, Hong Kong

Received 8 November 2012; accepted 29 May 2013
Available online 21 September 2013

Abstract

The last forty years of social science research have produced over 12,000 articles on priming. The range, complexity, and novelty of priming effects are hard to comprehend, let alone explain, using a single model or perspective. In this review, we discuss content priming and process priming effects. We then propose an integrative model that can account for the combined results.

Keywords: Priming; Information processing; Knowledge accessibility; Associative network; Nonconscious processes

Contents

☆ The preparation of this article was supported in part by Grants GRF 453110 and GRF 640011 from the Research Grants Council, Hong Kong.
E-mail addresses: chris.janiszewski@warrington.ufl.edu (C. Janiszewski), mkwyer@ust.hk (R.S. Wyer).

1057-7408/$ -see front matter
http://dx.doi.org/10.1016/j.jcps.2013.05.006

Introduction

Priming is an experimental framework in which the processing of an initially encountered stimulus is shown to influence a response to a subsequently encountered stimulus. Priming occurs because the processing of the prime stimulus makes content, and the cognitive operations used to comprehend and manipulate this content, more accessible. In turn, accessible content and operations can influence subsequent judgments, decisions and overt behavior. Priming can occur without awareness of the factors that increase the accessibility of the content and operations. Priming can also influence all stages of information processing, including attention, comprehension, memory retrieval, inference, and response generation (for a review, see Förster & Liberman, 2007; Wyer, 2008).

Priming paradigms have five basic characteristics. First, there must be a prime stimulus and a target stimulus. Second, the prime must alter a judgment about, or response to, the target stimulus. Third, a specific characteristic of the prime must be responsible for the altered response to the target stimulus. Fourth, the influence of the prime on the target stimulus should temporary. That is, learning paradigms (e.g., classical conditioning, associative learning) are not priming paradigms. Finally, the effects of primes are unintended and can occur without awareness; when individuals become aware of the possible biasing effect of a prime, they often try to correct for its influence (Lombardi, Higgins, & Bargh, 1987; Martin, Seta, & Crelia, 1990; see also Wegener & Petty, 1994).

The literature on priming effects is vast, making a comprehensive review impossible. Consequently, our review will not address classes of priming effects that are not of direct relevance to consumer psychology. First, visual priming of object locations in visual search and identification task will not be reviewed (Kristjánsson & Campana, 2010). Second, lexical priming effects, priming that occurs because words often occur contiguously (needle, thread), on word identification or recognition will not be discussed (Jones & Estes, 2012). Third, reaction time investigations into the influence of orthographic, phonetic, and semantic priming on memory retrieval will not be reviewed (Schmidt et al., 2011). Fourth we will not discuss priming effects in survey responses (Sudman, Bradburn, & Schwarz, 1996). Fifth, we will not review negative priming effects (Tipper, 2001). Sixth, we will not address priming that operates via metacognitive attributions (e.g., fluency effects) (Reber, Schwarz, & Winkielman, 2004). Finally, we will not address priming effects in impaired populations (Schacter & Buckner, 1998).

Our review is organized into five parts. First, we discuss content priming. Content priming involves attempts to influence the content that will be used in a cognitive process. Second, we discuss cognitive process priming. Cognitive process priming involves attempts to influence the processes that will operate on content. Third, we discuss the interface between content priming and cognitive process priming. Historically, these two types of priming have been assumed to be independent. Yet, there is growing evidence that this may not be the case. Fourth, we propose a hybrid model that can allow for content priming, process priming, or a synergistic influence of the two. Finally, we discuss research opportunities implied by a hybrid model as well as methods for investigating these topics.

Content priming

Content priming effects occur when the perception of a piece of information makes the mental representation of that information, or content, more accessible. In turn, more accessible content can influence a subsequent response. An increase in the accessibility of content increases the likelihood the content will be integrated into ongoing perceptions, judgments, and choices.

Models of content priming take a variety of forms, but all can be encompassed by the associative network representation in Fig. 1. Fig. 1 shows that knowledge consists of four types of content: semantic, affective, goal (motivational), and behavioral (motor). Within these classifications of content are the classes of primes that are commonly studied. For example, semantic content refers to persons, events, objects, attributes, and the relations between them. It can also refer to beliefs about oneself and the world in general, scripts, personal experiences, implicit theories, or the steps required to attain a goal.

Each of these types of content can be *directly* or *indirectly* primed. As Fig. 1 indicates, direct priming occurs when a stimulus increases the accessibility of content that is a direct consequence of experiencing the stimulus (e.g., prime A can increase the accessibility of semantic content, prime E can increase the accessibility of behavioral content). Indirect priming occurs when a stimulus increases the accessibility of content that is associated with the directly primed content, and this associated content influences a subsequent perception judgment, or overt behavior (e.g., semantic prime A makes semantic content associated with

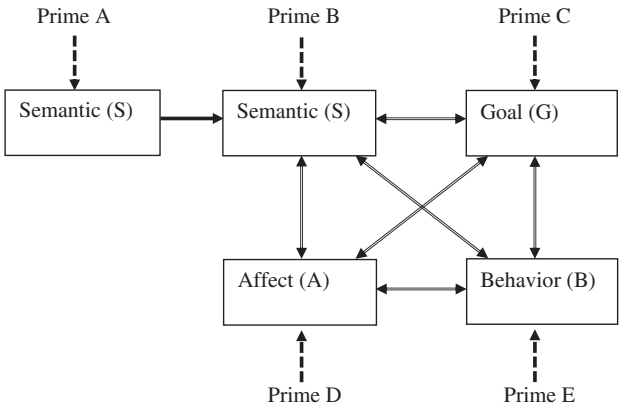

Fig. 1. Associative model of content priming. The material inside the boxes is the type of content that can be primed. Lines between boxes are associative pathways.

the primed content more accessible, semantic prime B makes goal, affective, or behavioral content associated with the primed content more accessible).

An a priori specification of the content that is indirectly primed by a stimulus requires assumptions about the manner in which content is associated in memory. Several models specify the nature of these associations (e.g., Collins & Loftus, 1975; Higgins, Bargh, & Lombardi, 1985; Hintzman, 1986; Ratcliff & McKoon, 1988; Wyer & Carlston, 1979; Wyer & Srull, 1989). A discussion of the differences between these conceptualizations is beyond the scope of this article. However, the models do share two basic assumptions. First, priming exerts an influence on judgments and behavior by increasing the accessibility of previously formed concepts and knowledge in memory and, therefore, the likelihood that they will come to mind at the time a target response is generated. Second, primed content is more likely to influence a response when the primed content is relevant to the response (i.e., the primed content is diagnostic). These assumptions, along with Fig. 1, provide the basis for discussing a number of findings obtained in research on consumer behavior.

Semantic priming

Direct semantic priming

Direct semantic priming has been shown to influence product evaluation (Adaval & Monroe, 2002; Braun, 1999), consideration set formation (Nedungadi, 1990), and choice (Nedungadi, 1990). Product evaluation priming occurs when a prime influences the attributes recruited to judge a product or the perceived performance of a product on an attribute. Braun used advertising (i.e., prime) to influence a remembered experience. Braun had participants taste a low quality orange juice. Afterwards, some of the participants read promotional material that asked them to imagine a positive taste experience with the juice. The combination of the promotional materials and the imagination task embellished the participants' memories of product performance (i.e., the juice was remembered as sweeter, pulpier, "orangier," etc.). Thus, the advertisement increased the accessibility of content that could mistakenly be incorporated into the recollection of the actual taste experience. With respect to perceive performance on an attribute, Adaval and Monroe (2002) found that subliminally priming large or small numbers affected participants' interpretation of the price of a target product and their consequent willingness to make a purchase.

Nedungadi (1990) provides an example of how a prime can influence judgment and choice. Nedungadi used semantic primes to increase the accessibility of brand names, and consequently influence their retrieval, inclusion in a consideration set, and likelihood of being chosen. Nedungadi (1990) primed the accessibility of brand names (e.g., McDonald's, Wendy's, Subway, Joe's Deli) by having participants judge the truth of statements about these brands. Subsequently, participants were asked to recall appropriate brands for a situation (e.g., where to go for lunch), form a consideration set, and make a choice. Exposure to a specific brand name (i.e., priming) increased the likelihood the brand would be recalled, considered, and chosen, especially when the brand name was not easily accessible. These results have been extended to show that the incidental exposure (i.e., subliminal) to brand names can influence choice (Karremans, Stroebe, & Claus, 2006).

Many demonstrations of direct semantic priming are not product-related. To provide a few noteworthy illustrations, the anchoring literature shows that arbitrary number primes influence subsequent judgments (see Chapman & Johnson, 2002 for review). Priming traits alters a person's self-concept as well as the perception of others (Srull & Wyer, 1979; Wheeler, DeMarree, & Petty, 2007). More specific examples include the following. Subliminally priming luck, using a lucky number or word, increases feelings of being lucky and heightens estimates of the likelihood of winning a lottery (Jiang, Cho, & Adaval, 2009). Subliminally presenting sexual material increases the accessibility of sexual content and thoughts (Gillath, Mikulincer, Birnbaum, & Shaver, 2007; Janssen, Everaerd, Spiering, & Janssen, 2000). Priming naïve theories (e.g., "good-art-takes-effort") increases the likelihood the naïve theory will be used to interpret a situation (e.g., the association between effort and quality in art) (Cho & Schwarz, 2008). Signing ones name increases the accessibility of the self-concept and encourages behaviors that are consistent with this information (Kettle & Häubl, 2011).

There are also semantic priming effects that are not assimilative (i.e., do not bias cognitive responses in a manner that is consistent with the prime). Primed concepts and knowledge only have an assimilative influence if they are applicable. Inapplicable concepts may be either ignored or, in some cases, produce a contrast effect (for reviews, see Bless & Schwarz, 2010; Wheeler et al., 2007). Contrast effects of priming occur for at least two reasons. First, although primed concepts could potentially be applied to the stimuli being judged, individuals may be aware that the concepts have come to mind for reasons that have nothing to do with the judgment being made. Therefore, individuals may resist using the primed concept. For example, Martin et al. (1990) showed that individuals who were aware that a primed concept (e.g., "adventurous") might bias their interpretation of a person's behavior searched for an alternative concept (e.g., "reckless") if they were both motivated and able to do so. Consequently, the primed concept had a contrast effect on their evaluations of the person. If they were either unmotivated or unable to identify an

alternative, then the primed concept had an assimilative effect. Analogously, Lombardi et al. (1987) found that primed trait concepts only had an assimilative effect on the interpretation of stimulus information if participants were unable to recall the priming items that activated these concepts. When they could recall the priming stimuli, they were apparently aware of their biasing influence and corrected for it, producing a contrast effect.

Second, individuals may perceive a primed concept to be inapplicable if its implications fall outside the range of meanings that the information can have. In this case, the concept may be used as a standard of comparison, producing contrast effects. In a study by Herr (1986), for example, participants were primed with names of either moderately hostile persons (e.g., Mohammed Ali, an obnoxious talk-show host, etc.) or extremely hostile individuals (e.g., Stalin, Hitler, etc.) before they were asked to evaluate a target person whose behavior was ambiguous with respect to hostility. Although priming moderately hostile exemplars had an assimilative effect on judgments of the target's hostility, priming extreme exemplars (whose implications were outside the range of meanings that the ambiguous behavior could have) had a contrast effect on judgments.

Whether a primed concept has an assimilative or contrastive effect on judgments can also depend on the range of meanings that the concept can have and whether these meanings overlap with the possible meanings of the target stimulus. In a study by Lambert and Wyer (1990), for example, participants were told that either a priest or a salesperson had committed an immoral act (e.g., embezzlement). If participants believed that priests (although favorable on average) varied widely in terms of morality, they judged the priest more favorably than the salesperson. If they believed priests to be homogeneous with respect to morality, and thus considered embezzlement to be outside the range of behaviors that a priest would normally manifest, they judged the priest less favorably than the salesperson.

There is a qualification to the conclusion that inapplicable primes will produce a contrast effect. A conceptualization by Mussweiler and Strack (Mussweiler, 2002; Mussweiler & Strack, 1999, 2001) assumes that when individuals consider an object's membership in a category, they activate attributes that are associated with members of the category, and these attributes, once activated, are applied to judgments even if the category itself is inapplicable. Thus, if individuals are asked if the average price of a sweater is greater than $500, they would undoubtedly respond negatively. In making this judgment, however, they are likely to think about the attributes of high quality sweaters, leading them to apply these attributes to sweaters in general when considering whether they would buy one. Thus, they may be willing to pay more for a sweater than they would if they had estimated if its price was greater or less than $10 (Adaval & Wyer, 2011). Moreover, to the extent that the attributes activated by the prime are applicable to other types of products, the prime could influence reactions to these products as well (Adaval & Wyer, 2011). Nunes and Boatwright (2004) confirmed this possibility in a field experiment. That is, individuals were willing to pay a higher price for CDs sold at a beach-front stall if the prices of sweaters at a nearby stall were high rather than low.

Indirect semantic priming

Indirect semantic priming occurs when a prime makes content that is associated with the primed content more accessible. Spreading activation allows the primed content to increase the accessibility of the associated content (in Fig. 1, prime A makes associated semantic content B more accessible). Consequently, the likelihood the associated content will be used in a subsequent cognitive operation increases. Indirect semantic priming has been shown to influence product evaluation (Mandel & Johnson, 2002), evaluation set formation (Berger & Fitzsimons, 2008), persuasion (Légal, Chappé, Coiffard, & Villard-Forest, 2012), and choice (Nedungadi, 1990). Mandel and Johnson (2002), for example, used the background colors of a website display to prime the associated concepts of either safety or frugality and these concepts, in turn, influenced participants' product choices. Berger and Fitzsimons (2008) asked shoppers to list eight types of candy/chocolate and six types of soda on the day before Halloween. The dominant color of Halloween (orange) primed brands with which this color was associated (e.g., Reese's, Orange Crush, Sunkist) and increased the likelihood that these brands were mentioned. Légal et al. (2012) found that priming the goal "to trust" led to greater acceptance of a persuasive message about drinking tap water and an increased intention to engage in the advocated behavior. Nedungadi (1990) showed that priming brands in a given category increased the likelihood that competing brands in the category (i.e., associates of the primed brand) would be recalled, considered, and chosen.

Other indirect priming effects are evident in research on the impact of culture-related concepts. For example, priming concepts associated with collectivism can increase individuals' tendency to describe themselves in terms of groups to which they belong rather than their personal traits and attitudes, can increase their sensitivity to the needs of in-group members, and can increase the importance they attach to social obligations rather than individual rights (for reviews, see Oyserman & Lee, 2008; Oyserman & Sorensen, 2009). Furthermore, priming individuals with cultural icons representative of their identity as Asians or North Americans can indirectly activate semantic concepts and values that reflect a collectivist or individualistic orientation and, therefore, can have similar effects (Chiu & Hong, 2007; Hong, 2009).

Finally, subjective experiences that result from physical behavior can activate semantic concepts that are associated with these experiences which, in turn, can influence subsequent judgments (in Fig. 1, a behavior makes associated semantic content more accessible). For example, responding to a questionnaire on a heavy (versus light) clipboard increases the perceived value of foreign currencies (Jostmann, Lakens, & Schubert, 2009) and the amount of money given to solve important social issues (Ackerman, Nocera, & Bargh, 2010). Similarly, holding a physically heavy book can lead individuals to anticipate that the book will be more influential (Chandler, Reinhard, & Schwarz, 2012). Carrying a heavy shopping bag can

increase the perceived importance of nutritional information when buying packaged food (Zhang & Li, 2012). Touching a flimsy/sturdy beverage container can influence the perceived quality of the beverage served in the container (Krishna & Morrin, 2008). Writing about personal attributes with a dominant (non-dominant) hand can influence the relevance of those attributes in judgments of the self (Briñol & Petty, 2003).

Special case of evaluative priming

A special case of semantic priming is evidenced by the impact of primed content on evaluations. That is, priming a content that has favorable or unfavorable implications can activate general evaluative concepts (e.g., "good" and "bad"). These evaluative concepts, once accessible, can influence evaluations of stimuli that are unrelated to the semantic content that was originally primed. These effects can be of two types. First, the general evaluative concept that is activated by a valenced priming stimulus can have a direct impact on judgments. For example, the subliminal presentation of smiling or angry faces (primes) can activate the general concepts of "good" or "bad," respectively, and influence the evaluation of subsequently presented novel stimuli (Murphy & Zajonc, 1993). Second, the evaluative concepts that are primed by a valenced stimulus can influence the accessibility of other concepts that have evaluatively similar implications. For example, priming "love" can increase the ease of recognizing other words that are evaluatively similar to "love," but denotatively unrelated (e.g. "sunshine") (Fazio, Sanbonmatsu, Powell, & Kardes, 1986). As Bargh's extensive research on automatic evaluation effects indicates, these effects do not depend on the magnitude of the valence associated with the concepts involved (Bargh, Chaiken, Govender, & Pratto, 1992; Bargh, Chaiken, Raymond, & Hymes, 1996).

Evaluative concepts can also be primed by motor behavior. Strack, Martin, and Stepper (1988) had participants rate how funny and amusing cartoons were using a pen that was held in their mouths. Participants that smiled while holding the pen in their mouth rated the cartoons more positively than participants that pursed their lips while holding the pen in their mouth. Wells and Petty (1980) showed that making vertical head movements while listening to a counter attitudinal message increased persuasion, whereas making horizontal head movements while listening to the same message decreased persuasion. The head movements made different types of evaluative content more accessible. Cacioppo, Priester, and Berntson (1993) presented participants with novel stimuli while they were pulling a lever toward themselves or pushing a lever away. Participants liked the novel stimuli more when they pulled as opposed to pushed, suggesting that the pull/push behavior made evaluative content (i.e., approach, avoid) more accessible. There is some evidence that motor-behavior-induced evaluative content is only diagnostic when the prime and target are affectively congruent (Förster & Strack, 1997). For example, nodding while viewing a positively valenced stimulus increased evaluations of it relative to control conditions, but nodding one's head while judging a negatively valenced stimulus had no impact.

Goal priming

Goals are represented in memory as semantic knowledge (Kruglanski, 1996; Kruglanski et al., 2002; van Osselaer & Janiszewski, 2012). Unlike other semantic concepts, however, goals have motivational properties. Motivation can result from either (a) being out of homeostasis or (b) the positive affect that results from anticipating goal attainment (Custers & Aarts, 2005; see Veltkamp, Aarts, & Custers, 2009 for an extended discussion). Moreover, these motivational properties led goal priming to operate differently than other types of semantic priming. For example, goals show temporal escalation (i.e., grow in influence if they are not fulfilled), whereas semantic content shows temporal decay (Bargh, Gollwitzer, Lee-Chai, Barndollar, & Troetschel, 2001). Goals also show a reduction in activation subsequent to goal consistent behavior, whereas semantic content shows an increase in activation subsequent to prime consistent behavior (Sela & Shiv, 2009).

Direct priming

Priming a goal can activate concepts associated with its attainment and these concepts may stimulate behavior that is directed to this end. In a prototypic study, Chartrand, Huber, Shiv, and Tanner (2008) asked participants to form sentences using sets of four of five scrambled words. In some cases, "prestige"-relevant words were included in the set (e.g., "he prestige what want did") and in other cases, thrift-related words were included in the set (e.g., "he frugal what want did"). After either a 3-minute or 8-minute delay, participants made choices between high-priced and low-priced options in three product categories (socks, apartments, and sound systems). Priming prestige increased preferences for the higher-priced options whereas priming thrift decreased these preferences. Furthermore, these effects increased with the length of the delay (i.e., temporal escalation).

The consumer psychology literature includes additional demonstrations of direct goal priming. For example, priming helpfulness, hostility, politeness, and rudeness encouraged people to perform behaviors that were consistent with this content (Macrae & Johnston, 1998). Priming achievement encouraged people to work harder at a mundane task (Bargh et al., 2001). Priming fun (prestige) increased the choice of a fun (fine) restaurant for a dinner reservation (Laran, Janiszewski, & Cunha, 2008). Priming "be social" encouraged students to work harder to win lottery tickets to a student party (Custers & Aarts, 2007). Priming an action (inaction) goal led to a desire for more information in a choice task (Laran, 2010). Subliminal presentation of the words "thirst" and "dry" increased the consumption of sweetened Kool-Aid (Strahan, Spencer, & Zanna, 2002). In all of these situations, stimuli activated a goal and encouraged people to pursue means that were consistent with the goal.

Indirect goal priming

Indirect goal priming occurs when the activation of primed semantic, affective, or behavioral content spreads to an associated goal. For example, thinking about a friend (i.e., semantic content)

made people more willing to help an experimenter owing to the indirect priming of cooperation (i.e., goal content) (Fitzsimons & Bargh, 2003). Similarly, subliminal presentation of the word "nurse" increased helping on a subsequent task (Aarts et al., 2005). Seeing a black-leather portfolio (i.e., indirectly priming competition), as opposed to a school backpack (i.e., indirectly priming cooperation), made participants greedier in an ultimatum game (Kay, Wheeler, Bargh, & Ross, 2004). Priming the concept of money made people more frugal in their shopping choices (Tong, Zheng, & Zhao, 2013). Fearful (romantic) stimuli primed the desire for safety (differentiation) which in turn increased the appeal of social (scarce) goods (Griskevicius et al., 2009). Thoughts that anthropomorphized a healthy (indulgent) brand increased the intention to engage in healthy (indulgent) behavior, provided the brand was liked (Aggarwal & McGill, 2012).

Associations between means and goals allow for means to prime a goal. For example, Shah and Kruglanski (2003) used the means *to study* to activate the goal *to be educated*, as measured by the accessibility of the concept. In turn, activation of the goal *to be educated* increased persistence at tasks that were instrumental to goal achievement. In the consumer realm, Chartrand et al. (2008) used semantic concepts that were associated with saving money (e.g., retailers Wal-Mart, Kmart, The Dollar Store) or achieving status (e.g., retailers Tiffany, Neiman Marcus and Nordstrom) to prime a goal. Priming the thrift (prestige) goal increased the participant's preference for thrift-priced (prestige-priced) merchandise relative to prestige-priced (thrift-priced) merchandise. Kambouropoulos and Staiger (2001) primed a reward-seeking goal, by presenting drinkers with an image of a beer, which in turn increased their effort on a task designed to provide non-food rewards.

Goals can be indirectly primed by affective experiences. An excellent example of the association between affect and goals is mood repair and mood maintenance. People that are in a negative mood activate goals associated with reestablishing a neutral or positive mood. For example, people that are placed in a bad mood will elect to listen to happy music (Knobloch & Zillmann, 2002) or eat more snacks (Tice, Bratslavsky, & Baumeister, 2001). People that are in a positive mood activate goals associated with sustaining this mood. For example, people expressed a stronger preference to watch videos with happy themes if they were in a happy mood than if they were in a neutral or sad state (Wegener & Petty, 1994). More nuanced emotional experiences also activate goals. For example, Zemack-Rugar, Bettman, and Fitzsimons (2007) showed that the subliminal priming of guilt, but not anger, increased indulgent (study 1) and helping (study 2) behavior. Affective primes (e.g., happy, angry) can also modify goal pursuit. For example, thirsty people poured and drank more of a beverage when they were happy, as opposed to sad (Winkielman, Berridge, & Wilbarger, 2005).

Imagining or engaging in behaviors can prime goals that, once activated, motivate goal attainment. Zhong and Liljenquist (2006) showed how copying a first person story that described an unethical act (e.g., sabotaging a co-worker), as opposed to an ethical act, primed the goal "to be clean" and increased the desirability of cleansing products, but not non-cleansing products. Laran and Janiszewski (2009) showed that eating (refraining from eating) a chocolate activated an indulgence (health) goal and influenced the desire for indulgent (healthy) food. Wadhwa, Shiv, and Nowlis (2008) showed that having a small bite of food activated a pleasure goal and increased the desire for a massage. Hung and Labroo (2011) show how firming one's muscles could increase a person's willingness to resist pain, refrain from eating indulgent food, consume unpleasant medicine, and attend to disturbing material, provided there was a benefit to doing so.

Affective priming

Semantic network models of emotion (see Niedenthal, 2008, for a discussion of relevant models) propose that emotional experience can be represented in a semantic network. These models assume that an emotion is represented by a memory node and that thoughts, beliefs, goals, and behavioral actions that have been experienced concurrently with the emotion become associated with the emotion. Thus, associative pathways allow emotions to prime associated content and associated content to prime emotions.

Direct affective priming

Direct affective priming occurs when an affective prime makes affective states (e.g., moods, feeling states, emotions) more accessible. Direct affective primes can be chemical (e.g., opioids, depressants) or stimulus-based (e.g., conditioned stimuli, stimuli that evoke visceral reactions). We restrict our discussion to stimulus-based affective priming.

Direct affective priming is often observed in the affect-as-information literature. The affect-as-information hypothesis proposes that an affective state produces feelings that can influence judgments about unrelated stimuli (Clore & Storbeck, 2006; Schwarz & Clore, 1983, 1988). Gorn, Goldberg, and Basu (1993) illustrate the typical paradigm. Subjects were put in a positive (negative) mood by listening to pleasant (unpleasant) music played over a set of speakers. Then participants were asked to provide an overall evaluation of the speakers as well as judgments about specific speaker attributes (e.g., stereo separation, background noise, distortion). The salience of the source of the affective state was manipulated by having half of the participants rate the music before (i.e., salient) or after (i.e., not salient) evaluating the speakers. When the source of the mood effects was not salient (salient), the participant's mood influenced (did not influence) the evaluation of speakers, but not the assessment of the speaker attributes. Adaval (2001) and Yeung and Wyer (2004) also show that priming affect has little effect on the evaluation of products and attributes that are typically judged on the basis of functional criteria.

There are boundary conditions on affective priming. First, as shown in Gorn et al. (1993), the affective state (e.g., positive, negative) must be relevant to the target judgment (e.g., evaluation). In their study, a participant's feeling state was relevant to the overall evaluation of the product but not to judgments about performance attributes. Relevance can be manifest in numerous

ways. Pham (1998) found that feelings had more influence on unrelated judgments when the motive to consume was experiential as opposed to instrumental. Chang and Pham (2013) found that feelings were more diagnostic for temporally proximate than temporally distant judgments. Second, people must be willing to "see how it feels" (i.e., engage in heuristic processing). Pham (1998) has shown that visualizers (people that are more likely to imagine using a product) are more likely to use affect-as-information than verbalizers (people that are more likely to verbally represent a product). Avnet, Pham, and Stephen (2012) show that people who trust their feelings are more likely to use affect-as-information. These boundary conditions indicate that affective priming effects are constrained by opportunity. That is, the effects only occur when the affective state is relevant to the judgment, provided the person does not try to discount the affective information.

Emotions can increase one's preference for emotion-congruent outcomes, alter responses to emotion-congruent outcomes, or bias judgments about unrelated stimuli. Priming anger increases the desire for anger-related products (Veling, Ruys, & Aarts, 2012). Fear/disgust pictures are more easily classified after experiencing fear/disgust (Neumann & Lozo, 2012). Positive events are judged more likely after a positive emotional experience (Estes, Jones, & Golonka, 2012). Positive emotional primes make animate objects (musicians and dentists) seem more similar, but have no influence in the perceived similarity of inanimate objects (e.g., saws and spoons), owing to the social projection of the emotion (Estes et al., 2012).

Indirect affective priming

Indirect affective priming occurs when semantic content, goals, or motor behavior induce an affective state owing to an association between the primed content and the affective state. Given that almost all procedures for generating an affective state rely on exposure to, imagination of, or recollection of semantic material that is affectively relevant, indirect affective priming via semantic content is often indistinguishable from direct affective priming. For this reason, we concentrate on indirect affective priming via goals and behaviors.

Indirect affective priming via goals involves the unintended consequences of unsuccessful or successful progress. For example, goal progress, or lack thereof, is known to influence a person's mood state (Houser-Marko & Sheldon, 2008). Chartrand, Cheng, Dalton, and Tesser (2010) show that negative ghost mood states (i.e., moods that emerge as a result of unsuccessful non-conscious goal pursuit) increase the tendency to self-enhance. Failure to make progress owing to goal conflict also results in disillusionment and disengagement. When athletes were primed with the goals of academic achievement and exercise, they experienced goal conflict and reduced their physical exercise (Bailis, Thacher, Aird, & Lipschitz, 2011).

Indirect affective priming via behavior involves a physical act that primes an affective state. Kraft and Pressman (2012) found that inducing a smile produced an affective state that increased the rate of stress recovery. This implies that the smile did not simply increase access to positive semantic information, as was likely the case in other smiling (e.g., Strack et al., 1988) and arm flexion (e.g., Cacioppo et al., 1993) studies. Further, Foroni and Semin (2011) found that subliminal affective primes are only successful when a person is allowed to freely move facial muscles (but not when a person has to control facial muscles). This suggests muscular behavior is instrumental to emotional experience and this experience is independent of semantic priming effects.

Special case of semantic-affective priming

Semantic-affective priming occurs when the association between semantic content and affective content primes other content that has a similar associative structure. Mood congruence effects are an example of semantic-affective priming. The mood congruence hypothesis proposes that an affective state increases the accessibility of semantic content that has a similar affective tone (Bower, 1981). Bower (1981; see also Bower & Forgas, 2000) proposes that the semantic associate network is structured so that concepts have affective tags. When a person is in a specific mood, like-tagged content becomes more accessible and, consequently, is more likely to be used in a judgment. Thus, unlike the affect-as-information effect, mood congruence effects involve the priming of affectively tinged content.

The typical mood congruence paradigm puts participants in a positive, negative, or neutral mood, using program media (e.g., Axelrod, 1963), scenarios (e.g., Batra & Stayman, 1990), or gifts (e.g., Isen, Shalker, Clark, & Karp, 1978). Participant are then asked to judge a person, advertisement, or product or to report on life satisfaction, plans for future consumption, perceptions of risk, etc. Typically, participants who are put in a positive (negative) mood provide more positive (negative) judgments (see Cohen, Pham, & Andrade, 2008 for review). For example, people in a positive mood rated ambiguous materials more positively (Isen & Shalker, 1982), rated owned products more positively (Isen et al., 1978), formed more positive impressions of ambiguous others (Forgas & Bower, 1987), had higher ratings of life satisfaction (Schwarz & Clore, 1983), and had a reduced perception of the frequency of undesirable events (Johnson & Tversky, 1983).

Forgas and Eich (2012) have identified a number of boundary conditions for mood-congruency effects. Mood-congruency effects require (a) an intense affective prime (Bower & Mayer, 1985), (b) that the primed content be diagnostic to the judgment (Bower, 1991), and (c) that the judgment task require constructive processing (e.g., inference, impression formation) (Bower & Forgas, 2000; Mayer, Gaschke, Braverman, & Evans, 1992), and (d) that a person not be motivated to prevent mood congruency effects (Batra & Stayman, 1990). The first boundary condition increases the availability of affectively-tinged content, whereas the latter boundary conditions increase the likelihood the content will be incorporated into a judgment. There are also situations in which the procedures used to induce a mood influence the effectiveness of mood primes (Wyer, Clore, & Isbell, 1999; Wyer, 2004; but see Forgas, 1995, for an opposing view). Parrott and Sabini (1990) found that when positive or negative moods were induced using procedures that called (did not call) attention to the semantic concepts that the moods exemplified, participants recalled more favorable experiences if they were

happy (unhappy) than when they were unhappy (happy). Although the reason for this reversal is difficult to explain (but see Wyer, 2004), it calls into question the assumption that recall is consistently mood-congruent.

Behavioral priming

Models of embodied cognition posit that physical behaviors can influence subsequent behaviors or judgments because physical behaviors are experiences that have meaning (Landau, Meier, & Keefer, 2010; Zhang & Li, 2012). This experience/meaning can be represented in a semantic network, so that the physical acts are represented as the semantic concepts they embody (e.g., running is the experience of being free, fast, mobile) and the semantic concepts they imply (e.g., running means active, hurried, athletic). Thus, physical behaviors are represented as unique cognitive entities that are associated with semantic, affective, and goal information.

Direct behavioral priming

Direct behavioral priming occurs when the observation of a behavior increases the accessibility of the cognitive representation of the behavior and, consequently, the likelihood the behavior will be executed (in Fig. 1, prime E). The most common type of direct behavioral priming is mimicry. Mimicry occurs when people mirror the behavior of another individual. That is, to the extent an observer has a collection of behaviors to choose from at any one time, the observer becomes more likely to execute a recently observed behavior. The potential for mimicry is supported by the existence of mirror neurons, neurons that allow primates to observe and execute behaviors (Gallese, Fadiga, Fogassi, & Rizzolatti, 1996).

People mimic a wide variety of behaviors, including verbal behaviors (e.g., accents, speech rates, syntax), facial expressions, body movements (e.g., posture, physical acts), and consumption behavior (see Chartrand & Dalton, 2008 for review). A study by Tanner, Ferraro, Chartrand, Bettman, and van Baaren (2008) provides an example. Participants were told to watch a videotape of a confederate describing some advertisements, with the objective of remembering the descriptions. Both the confederate and the participants had access to goldfish crackers and animal crackers. Observing a confederate that exclusively ate goldfish animal (crackers) increased the likelihood the participant would eat goldfish (animal) crackers.

There are a number of boundary conditions on mimicry effects. First, the opportunity to mimic must be easy to execute. For example, mimicry was facilitated in the Tanner et al. (2008) study by having the appropriate snacks easily accessible. Second, mimicry is facilitated when people have a relevant goal. For example, Lakin and Chartrand (2003) show that mimicry is facilitated by the goal to affiliate. Third, mimicked behavior must be contextually appropriate. For example, Johnston (2002) finds that people mimic the ice cream consumption behavior of a thin person, but not of an obese person. Fourth, people must be sensitive to contextual information. For example, Van Baaren, Horgan, Chartrand, and Dijkmans (2004) find that mimicry is more likely to occur when people are more contextually sensitive (sensitive to the interrelations between events in the environment) than contextually insensitive. Relatedly, Chartrand and Bargh (1999) find greater mimicry among people that can take the perspective of others. Fifth, mimicry is influenced by mood. For example, Van Baaren, Fockenberg, Holland, Janssen, and Van Knippenberg (2006) show that participants in a positive mood are more likely to mimic the "pen playing" behavior of a confederate than participants in a negative mood.

Indirect behavioral priming

Indirect behavioral priming occurs when the activation of semantic, goal, or affective content makes behaviors associated with that content more accessible and, hence, more likely to be executed. For example, priming semantic content can increase the likelihood behaviors associated with that content are pursued (in Fig. 1, priming semantic content makes associated behaviors more accessible). Carver, Ganellen, Froming, and Chambers (1983) used hostility related words (prime) to influence the behavior of a teacher who was trying to modify the behavior of a student via electric shock. Primed participants gave longer shocks. Bargh, Chen, and Burrows (1996) found that participants primed with rudeness (politeness) were more (less) willing to interrupt an experimenter on a subsequent occasion. Numerous other examples exist in the stereotype priming literature (see Wheeler & Petty, 2001 for review). In each case, the semantic prime made behaviors consistent with the semantic prime more accessible.

There are also cases of indirect behavior priming from goal primes (in Fig. 1, priming a goal makes associated behaviors more accessible). Given that the large majority of human behavior is goal directed, it is important to define how goal-to-behavior priming differs from simple goal priming. First, goal-to-behavior priming should automatically motivate a specific behavior owing to the association between the goal and the behavior. That is, strong associations between the goal and the behavior should make the behavior more accessible. Second, in keeping with priming effects, people should be unaware of the goal prime and the influence it is having on behavior. Third, there should be some evidence that the priming is a consequence of an association between a goal and a behavior, as opposed to an association between semantic content and a behavior.

Despite the strict criteria for goal-to-behavior priming effects, there is considerable evidence that activating goals increases the accessibility of behaviors that satisfy the goals (Aarts & Dijksterhuis, 2000, 2003; Aarts, Dijksterhuis, & Custers, 2003; Aarts, Dijksterhuis, & De Vries, 2001; Ratneshwar, Pechmann, & Shocker, 1996; Ratneshwar & Shocker, 1991). For example, priming a travel goal (e.g., to attend lectures at the university) increases the accessibility of behaviors (the word "bicycle") most often used to satisfy the goal (Aarts & Dijksterhuis, 2000). Similarly, words representing thirst related behaviors (e.g., water, juice, soda, glass, bottle, cup) become more accessible when people are thirsty (i.e., have a highly active goal to quench thirst) (Aarts et al., 2001). Ratneshwar et al. (1996) show that activating the goal to escape the heat of summer increased the likelihood

that products needed to achieve the goal would enter a consideration set.

Procedural priming

Our aforementioned examples of behavioral priming relate to physical behaviors that are often performed in the context of goal pursuit. Behavioral priming makes these physical behaviors more accessible and increases the likelihood they will be chosen as a means to achieve the goal. Yet, physical behavior is only one type of goal attainment strategy. Cognitive behaviors can also help one achieve goals. When cognitive behaviors are an associated sequence of cognitive acts (e.g., execute process one then process two then process three), knowledge of this sequence is called procedural knowledge (i.e., knowledge about how to do things) (Kolers & Roediger, 1984). Procedural knowledge can be primed.

A particularly good example of procedural priming is provided by research on behavioral mindsets (Wyer, Shen, & Xu, 2013; Wyer & Xu, 2010; Wyer, Xu, & Shen, 2012). As the study by Shah and Kruglanski (2003; see also Kruglanski et al., 2002) indicates, semantic concepts and knowledge can prime procedures for attaining goals. Procedures, however, may be associated with more than one goal. Thus, the procedures involved in pursuing one goal can activate general procedure-related concepts that, once accessible in memory, influence the strategies that individuals employ to pursue subsequent goals. In a study by Xu and Wyer (2012), for example, some participants listed thoughts about a series of propositions with which they agreed (disagreed), thereby stimulating them to elaborate (counterargue). This behavior activated more general concepts of elaboration or counterarguing that subsequently influenced responses to an advertisement presented in an unrelated situation. Consequently, the ad had a greater impact in the former condition than in the latter. A further study showed that listening to a speech by a liked or disliked person (e.g., a political candidate of one's own or a different party) could spontaneously activate an elaboration or counterarguing mindset and have similar effects.

Different types of procedures can be involved in various stages of goal pursuit. Goal-directed behavior can often proceed in two stages: a deliberative stage, in which individuals evaluate alternative courses of action, and an implemental stage, in which individuals consider how to pursue the course of action they have chosen (see Gollwitzer, Heckhausen, & Steller, 1990, for an elaboration). However, deciding to implement action may activate an implemental mindset that leads persons to pursue this course of action again later without considering whether they should pursue the goal or not (i.e., deliberative mindset). This possibility is exemplified by the shopping momentum effect (Dhar, Huber, & Khan, 2007). Participants were given an opportunity to purchase a product that was being sold at a high or low price. They were more likely to purchase the product at the low price. All participants were subsequently offered a second product at a common price. Participants were more likely purchase the second product if they had purchased the first product than if they had not.

A related phenomenon was examined by Xu and Wyer (2007, 2008). In one series of studies (Xu & Wyer, 2008), participants were first given several pairs of animals and asked to indicate which animal they preferred. Others were asked which animal had more of a physical attribute. Both of these activities induced a "which-to-choose" mindset that led participants to purchase one of several snacks upon leaving the experiment without considering the option of deferring the purchase.

The effects of priming a "variety-seeking" mindset were investigated by Shen and Wyer (2010). Participants were first asked several questions about animals, answers to which were either all different or all the same. Then, in an unrelated task, they chose the flavor of herbal tea they would like to drink on each of four consecutive days. Individuals chose a greater variety of tea in the first condition than in the second. Moreover, calling participants' attention to the animal judgment task before making their tea choices eliminated its effects.

Models of content priming

A number of models have been proposed to account for content priming effects. One way to explain, compare, and contrast these models is to situate the models in Fig. 1. First, there are models that explain the influence of priming semantic content (e.g., Higgins et al., 1985; Wyer & Carlston, 1979). One of the more recent content priming models is the inclusion/exclusion model (Bless & Schwarz, 2010). This model explains assimilation and contrast effects. A semantic prime can aid in the interpretation of a target, resulting in an assimilation effect, or serve as a standard by which the target is judged, resulting in a contrast effect. A number of factors contribute to whether a prime operates as an assimilative frame or a contrasting standard (see Bless & Schwarz, 2010 for a review).

Second, there are models that seek to explain the influence of priming semantic content and/or goals. Cesario, Plaks, and Higgins (2006) propose a motivated preparation account of stereotype-based behaviors. Cesaro et al. observe that a stereotype prime can activate semantic content, as when homosexuality primes femininity (semantic content ⟶ semantic content association) or a goal, as when homosexuality primes hostility (semantic content ⟶ goal association). Wheeler et al. (2007) propose an active-self account that integrates semantic content and goal content into a self-concept. This self-concept can be chronic (i.e., base level of activation and association strengths) or dynamic (i.e., temporary changes to content activation or association strengths owing to primed material). To the extent a prime activates traits or goals that are part (not part) of the self, the prime will result in assimilative (contrastive) behavior.

Third, there are models that seek to explain the influence of priming semantic content, goals, and/or behavior. Bargh and Ferguson (2000) provide an account of automatic goal pursuit. Perception of a goal activates the goal and encourages an instrumental behavior. If goal activation simply encourages the pursuit of means, then this is an example of a prime directly activating a goal. If goal activation encourages an automatic performance of a behavior, then this is an example of behavior execution via a goal ⟶ behavior association. Bargh and colleagues also seek to explain automatic perception ⟶ behavior links (Bargh & Chartrand, 1999; Chartrand & Bargh,

1999; Dijksterhuis & Bargh, 2001). When perception is of an actual behavior, this is the equivalent of directly priming a behavior. When perception is of a verbal description of a behavior, this is the equivalent of indirectly priming a behavior via a semantic content ⟶ behavior association. Wheeler and Petty (2001) discuss how stereotype primes can increase the accessibility of semantic content or activate goals and, subsequently, influence behavior. Prinz (1990) discusses the shared representation of language comprehension and language production (i.e., semantic content, behavior, and the semantic content ⟶ behavior associations).

There are more formal models of semantic content, goal, and behavior priming. For example, Dijksterhuis, Chartrand, and Aarts (2007) propose a model of perception, goal pursuit, and behavior. They discuss how semantic content can be directly primed, how behavior can be directly primed, how behavior can be indirectly primed by priming a goal (via a goal ⟶ behavior association), how behavior can be indirectly primed by priming semantic content (via a semantic content ⟶ behavior association), and how priming semantic content can activate a goal and encourage instrumental behavior (via a semantic content ⟶ goal ⟶ behavior association). Wheeler and DeMarree (2009) propose a similar model. They discuss how semantic content can be directly or indirectly primed (with a focus on self-perception, person-perception, and situation-perception), how goals can be directly or indirectly primed, and how behavior can be directly or indirectly primed. Thus, the Wheeler and DeMarree model is similar to the model presented in Fig. 1, except for the fact that is it limited to social perception.

There are three comprehensive models of priming that are not easily situated in Fig. 1. According to the bin model, units of knowledge are stored in content-addressable "bins" (Wyer & Srull, 1989). When information about a stimulus is required for the purpose of attaining a particular objective, a bin pertaining to the referent is identified and a probabilistic, top-down search is performed. When an applicable unit of knowledge is found, a copy of it is retrieved and, once it has been used, is returned to the top of the bin. Thus, the likelihood of accessing a particular knowledge unit is a function of both its proximity to the top of the bin (and thus the recency of its prior use) and the number of copies of it that are contained there (and thus the frequency of its use in the past). Critically, the storage and retrieval processes apply to all types of knowledge (e.g., semantic, goal, behavior, procedural) and at all stages of processing. Moreover, the cognitive steps required to attain a goal are monitored by an executor, based on the content of a goal schema (i.e., procedural knowledge on how to attain the goal).

Schröder and Thagard (2013) offer a model of priming that is founded on connectionist principles. Their model contains three mechanisms: parallel constraint satisfaction, affective meaning maintenance, and semantic pointers. Parallel constraint satisfaction is the idea that active content consists not only of corresponding nodes, but facilitatory and inhibitory pathways between these nodes. Any new piece of information (e.g., a prime) updates the configuration of these node activation levels and pathways so that the system reaches a new balance (see the Wheeler et al., 2007 discussion of the active self for a specific application of this idea). Affective meaning maintenance is the idea that cultural expectations (1) determine how a social context will be interpreted and (2) allow a person to anticipate the expected impact of social behavior (i.e., it is a way of expressing how means are valued with respect to specific goals). Semantic pointers allow there to be links between semantic content, linguistic correlates, and perceptual, emotional, and motor representations. Thus, Schröder and Thagard (2013) posit that priming is a dynamic act that depends on the interface between cognitive representation and a social context.

Loersch and Payne (2011) propose a very different model of content priming. In their situated inference model, they assume that a prime makes content accessible, this content is misattributed to be a personal response to an object in the environment, and then this content is used to inform the most salient behaviors given the environment. The unique characteristic of this model is that the environment shapes the perception of the prime as well as the perceptions, goals, and behaviors influenced by the prime. Thus, the prime is not an independent piece of information that has to be fit into an available cognitive process, but a stimulus that takes on meaning and influence given the affordances (constraints) of the situation. While the idea that a prime only influences cognitions and behaviors for which it is relevant is not novel, the idea that a prime will have a contextually-determined meaning is at odds with all of above-mentioned models of content priming (i.e., the other models assume all possible meanings of the prime are available). Loersch and Payne (2011) provide compelling evidence for the misattribution portion of their model, but provide less evidence that situations determine a unique meaning for a prime. We note that it is hard to provide evidence for the idea that situational cues determine the most appropriate meanings and against the idea that primes make all possible meanings available (Marcel, 1983). Thus, evidence for the claim that situations imbue primes with unique meanings may be hard to garner.

All of the aforementioned models are effective at explaining results within their respective literatures. Yet, they all have shortcomings. First, these models are unconstrained in their predictions about the impact of the prime. It is difficult to anticipate if a prime will increase the accessibility of semantic, goal, affective, or behavioral content (Loersch & Payne, 2011 being the exception). Second, these models avoid the issue of diagnosticity (Bless & Schwarz, 2010; Schröder & Thagard, 2013 being the exception). In the event a specific type of content is primed, it is difficult to anticipate when this content will impact experience, judgment, or behavior. Third, these models were not designed to account for process priming (see next section). They are limited to the domain of content priming. Fourth, these models cannot explain complex behavior. In general, content-based models of priming are static, in that they cannot account for the influence of the prime on multiple behaviors, performed either in concert or in sequence. For example, while these models can explain how a prime might initiate a scripted behavior, they cannot predict how primes might create variations in the scripted behavior.

Cognitive process priming

A cognitive process is defined as a mental act that results in the manipulation, transformation, or reorganization of content. Cognitive process priming occurs when the increased accessibility of a process increases the likelihood it will be used in a subsequent task. Process priming is typically investigated by (1) using primes to increase the availability of one or another cognitive process, (2) providing participants with a constant set of content, (3) observing outcomes that should be sensitive to the competing ways to process the content. Implicit is this approach is that the initial content is equivalent in the various priming conditions—it is the primed processes that are responsible for altering responses.

A review of process priming is difficult because all information processing involves cognitive operations. Thus, almost any event, instruction, or constraint that leads to a different outcome could be construed as process priming. Consequently, we decided to limit our review to examples of unplanned and/or non-deliberative influences on process.

Process priming

Direct process priming

Direct process priming occurs when the execution of a process at time one (prime) makes that same process more accessible for use in a subsequent cognitive task. Direct process priming can also occur at all stages of information processing, including the attention to new information, comprehension, memory retrieval, inference, and response generation. For example, Higgins and Chaires (1980) show how to prime processes involved in the perceptual organization of information. During the priming phase, participants viewed pictures with captions designed to induce holistic processing (e.g., "a plate of candies") or piecemeal processing (e.g., "a plate and candies"). In the test phase, participants who had experience piecemeal priming were better able to solve the Dunker candle problem (i.e., how to mount a candle on the wall using a box of tacks).

To provide another example, Shen and Wyer (2008) asked participants either rank order a set of stimuli from high to low or low to high along a particular dimension (favorableness, price, test scores, etc.). As part of an ostensibly different experiment, participants were given an array of stimuli (e.g., the prices of hotels in a city) and asked to estimate an average value for the stimuli. Participants who had ranked stimuli from high to low directed their attention to high-valued stimuli in the array and, therefore, made higher estimates than those who had ranked stimuli from low to high. This example shows how priming attention and search processes (i.e., initially directing attention to high or low value stimuli) influenced subsequent judgments.

In a second series of studies (Shen, Wyer, & Cai, 2012), participants shadowed a speech that required them to talk either rapidly or slowly. This behavior affected the speed with which they completed a product survey that they were given later. In some conditions of these studies, however, participants were induced to feel happy or sad while performing the speech-shadowing task, thus making the task seem more or less desirable. Under these conditions, mentioning that the time to complete the survey was limited (thus activating a goal of working quickly) either increased or decreased participants' rate of completing it, depending on whether speaking quickly in the shadowing task was associated with positive or negative affect. When the time available to complete the survey was not mentioned, however, participants' speed of completing the questionnaire depended only on their rate of speaking in the shadowing task (i.e., process priming), with affect having no effect. In other words, participants' behavior during the first task affected their later behavior independently of the desirability of performing it.

There are other demonstrations of direct process priming. Macrae and Lewis (2002) used a global or local processing prime to influence the recognition of faces. Bock (1986) showed that exposure to specific syntactic structure encouraged people to select a similar structure when describing subsequently seen pictures. Smith and Branscombe (1987) show how repeating a certain type of inference making (e.g., inferring traits from behavior) encouraged the use of these cognitive processes in a subsequent task. Crusius and Mussweiler (2012) show that priming people to focus on similarities (differences) encourages them to behave more consistently (inconsistently) with goals such as neatness and achievement. Sassenberg and Moskowitz (2005) show how a "think different" prime can interfere with automatic stereotype activation (though this could be goal priming). Zarkadi and Schnall (2013) show that processing black and white figure with a greater degree of visual contrast encourages more extreme moral judgments.

A final example of direct process priming is provided by research on automatic evaluation effects (Bargh, Chaiken, et al., 1996; Bargh et al., 1992). In this research, individuals were subliminally primed with a positively or negatively valenced stimulus word before being asked to evaluate a word having a valence that was either congruent or incongruent with the first. Participants responded more quickly to congruent words than to incongruent words. This effect was evident (a) regardless of the extremity of the words' evaluative implications, (b) when participants were only asked to pronounce the words, as opposed to evaluating them, and (c) if the priming stimuli were unfamiliar (e.g., Chinese ideographs, in the case of North American subjects). The latter result suggests that the automatic evaluation effect is not a result of differences in the consistency of previously conditioned affective responses to the stimuli involved. Rather, as Wyer (2004) suggested, it may have resulted from differences in the process of categorizing the stimuli as good or "bad." That is, the categorization of a stimulus as "good" primes a disposition to categorize the second stimulus similarly. This disposition facilitates the actual categorization of the stimulus, if it is a consistent categorization, but might interfere with categorization, if it is an inconsistent categorization. Thus, a categorization process is being primed.

Indirect process priming

Indirect process priming occurs when a semantic concept, affect, or goal primes a cognitive process. Indirect process

priming varies from direct process priming because people do not actually engage in the critical cognitive process when experiencing the prime. Instead, the prime makes the process more accessible because it is associated with the primed content. For example, Chartrand and Bargh (1996) used a scrambled sentence task to prime a memory process (i.e., the primes were words like *absorb*, *remember*, *retain*) or an impression formation process (i.e., the primes were words like *opinion*, *personality*, *evaluate*). Subsequently, participants were exposed to a description of a person. Impression-formation-primed participants had superior memory organization. Oyserman and Lee (2008) review a variety of situations in which priming individualism (collectivism) encouraged people to use processing strategies that focus more on contrasting, discriminating, and competing (versus assimilating, integrating, and compromising).

Indirect process priming can contribute to the execution of a behavior. Bargh, Chen, et al. (1996) used a scrambled sentence task to prime the concept of "elderly" and found that the prime led participants to walk more slowly to the elevator after leaving the experiment (see also Doyen, Klein, Pichon, & Cleeremans, 2012). Similarly, exposing participants to the names of fast or slow animals influenced the speed at which they retrieved a questionnaire from another room (Aarts & Dijksterhuis, 2000). In these studies, the prime influenced how participants executed a behavior (e.g., slowly), as opposed to the type of behavior to execute (e.g., walking). Hence, we consider these examples of process priming.

Other studies imply process priming, although they do not provide specific evidence for the nature of these processes. Dijksterhuis and van Knippenberg (1998) showed that listing the qualities of a college professor (soccer hooligans) increased (decreased) performance on a general knowledge test (also see Galinsky, Wang, & Ku, 2008). To the extent the qualities listed primed cognitive processes that improved (degraded) strategies for responding to multiple choice questions, this is an instance of indirect process priming. Wheeler, Jarvis, Blair, and Petty (2001) primed the identify of a Caucasian or African American student by having participants write about a day in the life of Erik Walker or Tyrone Walker. On a subsequent math test, participants primed with the Caucasian identity performed better on the test than participants primed with the African American identity. Apparently, the identity primes altered information retrieval strategies and/or the choice of problem solving strategies, though it is also possible that the two identities primed different performance goals. Dijksterhuis et al. (2000) found that priming people with the elderly concept reduced their ability to remember the features of a room in a subsequent surprise memory task. The implication is that "elderly" primed cognitive processes that are responsible for memory encoding and/or retrieval.

There is also evidence that affect can prime cognitive processes. Chartrand (2005; Leander, Moore, & Chartrand, 2009) primed an achievement goal and then had participants complete easy or difficult anagrams. Subsequently, participant reported their mood or took a portion of a Verbal GRE test. Participants that completed easy anagrams were happier and performed better on the Verbal GRE. This is an example of affect influencing process (though it is not obvious which processes are being influenced). It is unlikely that the results are a consequence of goal priming because more achievement on the anagram task should have reduced goal activation (i.e., completing easy anagrams should have reduced the motivation to achieve). It is also unlikely that the results are a consequence of direct process priming because difficult anagrams are likely to prime a wider array of processes than easy anagrams, hence, should have been more beneficial to performance on the Verbal GRE test. Other demonstrations of affect-process priming show that positive (negative) affect encourages people to process information more abstractly (concretely) (Schwarz, 1990).

Processing orientations

There are situations were a prime increases the accessibility of a wide array of processes (i.e., a processing orientation), as opposed to a targeted processes. To illustrate a processing orientation, consider construal level theory (Liberman & Trope, 1998). According to construal level theory, people represent psychologically near events using concrete construals (i.e., detailed representations that include subordinate, contextualized information) and represent psychologically distal events using abstract construals (gist-like representations that include superordinate, decontextualized information). Trope and colleagues have amassed a body of evidence showing that judgments involving temporal, physical, social, and hypothetical distance can influence judgments on different topics within and across these domains (Trope & Liberman, 2010). Processes involved in perception, categorization, inference, evaluation, choice, mental simulation, and communication can vary in their level of abstractness and, thus, be influenced by the construal of the situation. Direct manipulations of the state of construal in an initial situation can influence the state of construal in a subsequent situation (e.g., Hansen, Kutzner, & Wänke, 2013; Kim & John, 2008; Liberman, Sagristano, & Trope, 2002).

To provide another example of priming a processing orientation, Förster (2011) showed that engaging in a global versus a local processing at one point of time primed the use of a similar process at a subsequent time, even though the content across situations was quite different. Specifically, participants were given either an auditory task (listening to the gestalt verses the details of a song), a haptic task (feeling the outside contour or the inner details of a physical object), a gustatory task (eating a medley of flavors or a series of unique flavors), or a olfactory task (smelling a medley of scents or a series of unique scents). Then, participants were asked to indicate which of two test drawings (e.g. a large rectangle composed of smaller rectangles and a large triangle composed of smaller triangles) was more similar to a target figure composed of a large rectangle made up of four triangles. Participants were more likely to base their similarity decision on global (local) features when they had been primed to focus on global (local) characteristics of the stimuli in the first task. For numerous other examples of priming global and local processing, see Förster and Dannenberg (2010).

Models of process priming

The components-of-process framework offers an account of process priming (Cabeza & Moscovitch, 2013; Kolers, 1973; Moscovitch, 1994). This framework has been used account for the synergies that result from the use of common processes when learning material and when probing the memory of that learning (Roediger, Buckner, & McDermott, 1999). The framework assumes that an overlap in cognitive operations used during learning and test is responsible for increases in memory performance. Similar principles can be applied to the availability of processes. Using a specific set of cognitive operations during the performance of a priming task should increase the likelihood these same operations will be used in a subsequent task. The components-of-process framework is a neural-location model, so the model is limited to explaining direct priming effects.

A second model of process priming assumes that the execution of any cognitive process is a consequence of goal activation. Wyer and Xu (2010) propose that cognitive processes can be means of satisfying process goals, just as behavioral means satisfy consumption goals. Process goals are represented in plan-goal schemas and typically consist of subgoal concepts that specify the cognitive operations required to attain a goal. As such, process goals are procedural knowledge about how to represent, transform, and integrate content. This procedural knowledge can exist at the level of a mental script (i.e., a well-practiced sequence of cognitive processes) or can be a much more molecular process (e.g., "count," "compare," "integrate"). In this model, processes are activated because either (a) a process goal has been primed or (b) an associated process goal has been primed.

Perhaps the most elaborate process priming model is a hybrid model that used content to prime process (as opposed to using a process to prime process or using a goal to prime process). Wyer et al. (2012; Wyer et al., 2013) propose that behavior is governed by a set of "if [X], then [Y]" ("[X] ⟶ [Y]") productions, where [X] is a configuration of stimulus features and [Y] is a sequence of cognitive or motor actions that are elicited spontaneously when the conditions specified in [X] are encountered. The features of [X] can include goal concepts, situational features, and cognitions that are fortuitously present in working memory. However, the configuration is responded to holistically without an analysis of its components. This means that some of the features that activate a production can occur without awareness. Moreover, the sequence of acts composing [Y] is also elicited automatically without conscious monitoring.

The utility of this conceptualization is that the features of a primed concept may be part of a configuration that can activate a production (process) that is pertinent to future processing. In the aforementioned study by Bargh, Chen, et al. (1996), for example, completing a questionnaire that contains concepts of the elderly may lead a feature "slow" to become accessible in memory. This feature along with the goal concept "leave the experiment" and "elevator" may compose the precondition of a production of the form: [elevator, leave experiment, slow] ⟶ [walk slowly] that elicits the behavior without awareness of how fast one is moving. Similarly, in a study by Shen et al. (2012), inducing participants to speak rapidly in a speech shadowing task may activate a general concept "do things quickly" that, along with a representation of the goal of completing the survey, may activate a production of the form "[do things quickly, questionnaire] ⟶ [work quickly] that leads individuals to complete the questionnaire rapidly, without awareness of the speed at which they are working." This conceptualization provides a fairly parsimonious account of the process priming we have described.

Are content and process priming independent?

Information processing models typically assume that concepts and knowledge are independent of the processes that operate on them. This assumption may not hold. Several studies exemplify the need to incorporate the assumption of content ⟶ process associations into a more integrative model of priming.

Meyers-Levy and Zhu (2007) provide a compelling demonstration of how a content prime can influence the accessibility of processes. They used a high (low) ceiling height to prime the semantic concept of "freedom" ("confinement"), which is associated with a relational (item-specific) processing style. Subsequently, a participant's processing style was assessed by having the participant complete a categorization task. Participants received a number of sporting equipment items and were asked to (1) identify shared dimensions, and (2) categorize the items based on the dimensions. Participants in a room with a high (i.e., 10 ft) versus low (i.e., eight feet) ceiling identified more shared dimensions, identified these dimensions at a more abstract level, and created fewer subgroups of items, as would be expected if they were engaged in relational processing.

A second example of how content priming can alter the accessibility of processes is provided by Brasel and Gips (2011). They showed that priming participants with the brand name "Red Bull" encouraged them to take more risks in a video game (e.g., go faster in a racing game). Although Red Bull is associated with living an extreme lifestyle, it is unlikely that the concept of Red Bull is associatively linked to any of the processes that support the playing of video games. Instead, it must be that Red Bull is linked to concepts like "risk" or "aggression" which in turn have meaning within the context of a gaming environment (i.e., are associated with processes or behaviors that are specific to gaming). If so, this interpretation once again implies content ⟶ process associations.

As a third example, Van den Bergh, Dewitte, and Warlop (2008) found that exposing heterosexual men to pictures of sexually suggestive stimuli made them demand more money to accept a delay in a monetary reward. To explain these findings, one most assume a link between sexual arousal and the processes that influence temporal judgments (e.g., distribution of attention, information integration, reasoning). For example, sexually suggestive stimuli might activate attentional processes associated with rewards (i.e., direct more attention to the monetary reward) and, in turn, these processes might increase the importance of this content. Consistent with this claim, the

priming effect was greater for men that had a greater a priori disposition to engage in reward-seeking behaviors.

Other studies suggest that content priming and process priming effects are not necessarily independent. In a study by Kolers and Perkins (1975), people read text that had been transformed into a variety of formats (e.g., upside down, backwards, mirrored, etc.). Participants were then tested one year later, using the same or different presentation formats and the same or new information. There was learning retention for presentation formats, in that learning to read in one format facilitated reading new material in that format one year later. More importantly, there was learning retention for content-format combinations, so that old content presented in the same format was more easily read than old content presented in another format. This performance improvement suggests content and the processes that operate on that content are interdependent. This result also implies that priming models could be modified to allow for the possibility that an original training episode can create an association between information content and processes that operated on that content. An association between content and process would allow content to prime the process on a subsequent occasion, thus, improving performance at test.

A model of content–process priming

The evidence we have reviewed thus far suggests there can be content priming, process priming, or, in some rare cases, an intersection of the two. The limited instances of content ⟶ process priming may be a reflection of the models that have been proposed to account for priming effects. If models focus solely on explaining content priming, or solely on explaining process priming, then it is unlikely that researchers will look for interactions between the two types of priming effects. We propose a content–process priming model that allows for synergistic effects between content and process priming. We first discuss how to conceptualize an associative network and an information processing model that support both content and process primes. We then discuss how the content–process model can provide insight into some of the more unusual priming effects, opportunities for research, and procedures that might be used to investigate the model's predictions.

Associative network

Our model adopts many of the characteristics of the spreading activation models of associative memory discussed earlier (e.g., Collins & Loftus, 1975; Higgins et al., 1985; Wyer & Carlston, 1979). In contrast to existing versions of this model, however, we assume that the network contains not only content nodes, but also process nodes. Process nodes are pointers, in that they are associated with a process (i.e., they can initiate the process), but they are not themselves the process. The likelihood a process node will initiate a process is a function of its relative level of activation. The relative level of activation of a process node depends on its base level of activation plus activation owning to associations to other nodes, divided by the summed activation levels of the other process nodes. Formally,

1. Content nodes (i.e., semantic, goal, affect, and behavior) and process nodes (pointers to cognitive operations) exist in a shared associative network.
2. Content nodes have a level of activation. The higher the relative activation level, the more likely the content will be used in a process.
3. Content nodes have diagnosticity. The higher the diagnosticity, the more likely the content will be used in a process.
4. Process nodes have a level of activation. The higher the relative activation level, the more likely the process will be executed.
5. The associative network contains content ⟶ content associations, process ⟶ process associations, and content ⟶ process associations.
6. The activation level of a target node is the sum of
    a. Its base level of activation (a function of the recency and frequency of its prior activation)
    b. Incoming activation from associated nodes, expressed as the product of the activation of the associated node multiplied by the strength of the associative pathway linking the associated node to the target node.
7. The strength of an association pathway depends on
    a. The frequency of concurrent activation/execution.
    b. The recency of concurrent activation/execution.

These ideas are illustrated in Fig. 2, which includes content nodes, process nodes, and associations between these nodes. There are associations among content nodes, as was shown in Fig. 1. There are associative pathways from content nodes to process nodes, but not vice-versa. There are associative pathways among the process nodes, so that the activation (and execution) of one process can prompt the execution of another (as in scripted thought or behavior). Process nodes are linked to process execution, but these links are not associative pathways. Instead, they are pointers that allow for automatic execution of a process when a node is sufficiently activated. Finally, the figure does not speak to the issue of content use. That is, an association between content and process does not dictate that the content will be used in the process. Although it is likely that content will be used in associated processes, priming could not occur unless there was the opportunistic use of alternative content in a process.

Process model

Fig. 3 illustrates how content priming (e.g., semantic, goal, affective, behavioral) might operate in an associate network that consists of content nodes and process nodes. The figure is organized into two time periods, the time that a person encounters the content prime (left-hand side of figure) and the time that a person encounters a target (right-hand side of figure). At the time the prime is encountered, the content prime increases the accessibility of not only the content itself but also associated content and process nodes. The content of the prime

and its associated content can be used in the processes that are executed because their node activation passes some relative threshold. In Fig. 3, process node 1 did not reach a threshold level of activation (i.e., the relative level of activation was insufficient) and so the process was not executed. Process node 2 did reach an activation threshold so primed content was input into the process and content C was produced. Process node 3 also reached an activation threshold, even though it was not associated with the prime content. Associated content B was input into the process and content D was produced.

At the time the target is encountered, the content (i.e., associated contents A and B, along with the produced contents C and D) and process nodes (processes 1, 2, and 3) that were activated during the processing of the content prime remain accessible. Option 1 and Option 2 show two different potential influences of the prime on a response. Option 1 shows how a primed process can influence a response. The content prime made the process 1 node more accessible. If the activation of this node exceeds the threshold level of activation, target content is input into the process and content E is produced. Option 2 shows how primed content can influence a response. Option 2 uses a procedure whereby content is to be processed using process 4 (i.e., the process 4 node is sufficiently activated). Target content is input into process 4, but so is produced content D (i.e., the content produced by the prime). Produced content D creates the content priming effect. Note that if only primed content had entered into process 4, it would be an example of direct content priming. When associated content or produced content enters process 4, however, it is an example of indirect content priming.

In summary, there are three distinguishing features of the content–process priming model. First, the model assumes a prime perpetuates an act of processing. A prime is not an isolated piece of content or a single processing event. A prime results in the activation of an array of content and process nodes. Second, the influence of a prime is always contextualized. In any priming procedure, there are the primes that are purposely being manipulated by the experimenter, but there are also a host of incidental primes that are a part of the stimulus material and procedures (i.e., the context). These incidental primes are an additional source of content and process activation that can influence outputs. Third, it is possible for certain combinations of semantic content, affect, goals, and behavior can combine to encourage the execution of certain processes (via content ⟶ process node associations).

Examples

A few examples will help illustration the model's operation. First, consider an example of process priming. Spivey and Geng (2001) showed that the presentation of the word "bird" encouraged people to shift their gaze upwards. Birds are often viewed by looking upwards, so it is likely that the semantic concept of bird has become associated with a process node that represents the process execution of looking up. "Bird" makes the process node more active and increases the likelihood the activation of the process node will surpass an executional threshold.

Second, consider the finding that motivationally consistent primes are more effective. Recall that Strahan et al. (2002) found that drinking-related word primes only increased consumption of a beverage when participants were thirsty. These results can be explained by assuming that drinking-related word primes and the feeling of thirst are both associated with process nodes that support beverage consumption. Multiple primes can influence the likelihood that a specific process is executed (e.g., taking a drink) or multiple processes are executed (e.g., long drink, big drink). When drinking-related word primes are not accompanied by feelings of thirst, however, fewer of the drinking-related process nodes are likely to reach a threshold level of activation and less of the beverage is consumed.

Third, Dijksterhuis et al. (1998) provide an interesting example of a contrast effect in what could be interpreted as a content ⟶ process priming study. Dijksterhuis et al. primed people with exemplars or stereotypes and then measured their performance on a math test. Participants primed with professors (supermodels) performed better (worse) on the math test, an

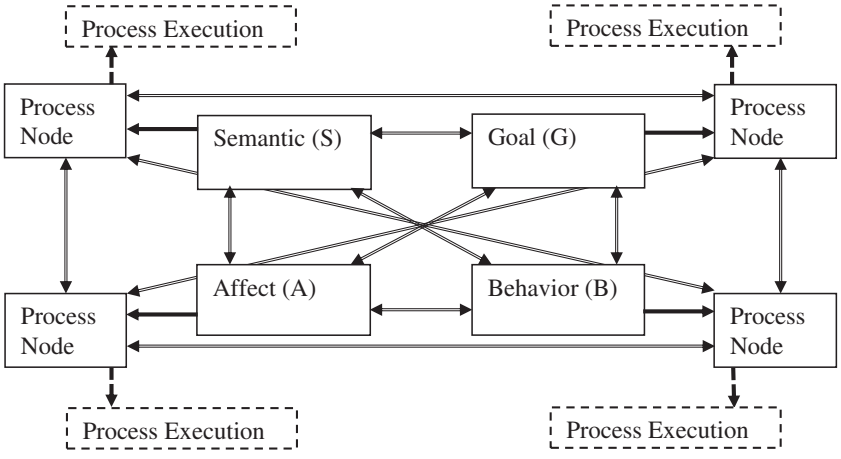

Fig. 2. Content and process associative network. The solid boxes represent process and content nodes. The solid lines represent associative pathways. The dotted boxes and lines represent executable cognitive acts.

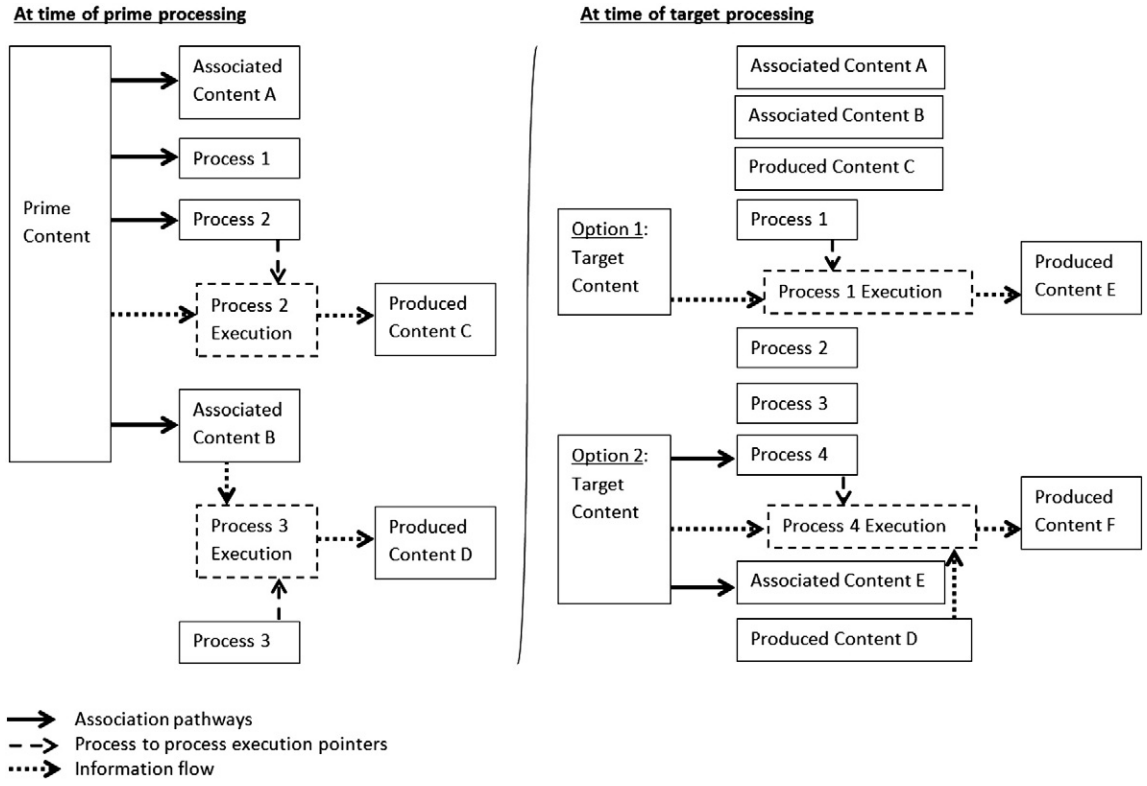

Fig. 3. Priming in a content and process associative network.

assimilation effect. Participants primed with Albert Einstein (Claudia Schiffer) performed worse (better) on the math test, a contrast effect. Subsequent results showed that professors (Albert Einstein) increased the accessibility of the concept intelligent (stupid), suggesting that cognitive processes that are effective (ineffective) for solving math problems are associated with semantic content. An alternative explanation, however, is that prototypes and exemplars primed different process nodes. The Dijksterhuis et al. procedure required participants to spend five minutes listing typical behaviors, lifestyle, and appearance attributes of the prime. This listing task could have increased the accessibility of process nodes that were beneficial for solving math problems, as in the case of a professor or Schiffer, or process nodes that were detrimental for solving math problems (thus, making effective processes less accessible), as in the case of a supermodel or Einstein.

Zhang and Wang (2009) provided a much more complex example of process priming. Zhang and Wang demonstrate asymmetric priming in a study of cross-dimensional priming. They used words to prime spatial ("local," "foreign"), temporal ("tomorrow," "one year later"), social ("soul mate," "stranger"), or hypothetical ("90% chance," "10% chance") construal dimensions and then measured distance judgments using each dimension. Although spatial primes influenced judgments along all four types of judgment, the other three types of primes influenced only judgments along the dimension to which they were relevant. These results can be explained in two ways. First, it may be that spatial primes had had strong associations to the process nodes responsible for construal level effects, whereas the other types of primes did not (a process activation explanation). Second, it may be that spatial primes have associations to process nodes that are relevant for a variety of construal judgments (i.e., general processes), whereas the other primes have associations to process nodes that are only relevant to a specific domain of judgment (a process applicability explanation).

Finally, it is important to note that the content–process model retains the flexibility of prior content and process priming models (see options 1 and 2 in Fig. 3). To illustrate, consider a situation in which an arm contraction (e.g., flexing arm toward oneself) is the priming event (e.g., Cacioppo et al., 1993). The arm contraction could be interpreted for its semantic content (e.g., "strength"), goal (e.g., goal of "getting someone to approach"), affective (e.g., "liking"), or behavioral (e.g., the motion of food ingestion) consequences. Each type of content could in turn be associated with process nodes. For example, "strength" might encourage a comparison process by which the relative power of actors within a social context is assessed, whereas "getting someone to approach" might engage processes involved in controlling facial expressions and body posture. Moreover, additional primed content may be incorporated into, or activate, processes. Consequently, the model explains how primes can increase content accessibility and process accessibility.

Supporting evidence

The information-process priming model is an associative network model, thus, the accessibility of content and process nodes should be sensitive to the same factors that influence any associative network that assumes automatic activation

(e.g., Collins & Loftus, 1975; Higgins et al., 1985; Wyer & Carlston, 1979). For example, the accessibility of specific content or process should be a function of its relative level of activation (Anderson, 1983; Anderson & Neely, 1996; McGeoch, 1942). In turn, the relative level of activation of a content node, a process node, or a content ⟶ process association should depend on the uniqueness of the processing objective and situation. Uniqueness should create states where the interference from competing nodes is limited.

The influence of uniqueness is best illustrated in situation where content ⟶ process associations are relevant. First, reconsider the finding that the skill to read text in unusual formats (e.g., upside down, backwards, mirrored, etc.) is facilitated when the same content is used, even when the testing period is one year later (Kolers & Perkins, 1975). Reading unusual text formats requires the use of spatial rotation and organizational processes that are likely to be unpracticed. Moreover, the successful implementation of specific rotational/organizational strategies is likely to depend on certain formats and specific lexical profiles (e.g., letter combinations). Thus, content (in this case, the physical format of the printed words) should become associated with process when people read unusual text formats. In the case of Kolers and Perkins, these associations were likely to have remained relatively strong over time because attempts to read sentences in the unusual formats were unlikely to have occurred in the interim. This implies that information content ⟶ process associations are likely to exert a stronger priming effect when the content and processes are unique, but not when the content and processes are common. Common content likely has associations to a wide variety of processes, so any one process is less likely to have a relatively high level of activation when the content is revisited (i.e., relative association strength is weak).

A second example of enduring priming effects is provided by Morwitz, Johnson, and Schmittlein (1993). Morwitz et al. asked members of a consumer panel when they planned to acquire a new car and three months later measured their purchase behavior. Queried households had a higher purchase rate than households that had not previously been asked about their intentions. Morwitz et al. argued that measuring intent increased the number and accessibility of pro-purchase related thoughts. This may be so, but it is hard to fathom how these thoughts, generated in the few seconds needed to respond to the query, were available weeks later. We posit that the original response to the query made associations between content information and the process nodes involved in a purchase assessment. Given the unusualness of this type of decision, a consideration of the decision at a later time made the exact same processes and produced content available, a prediction confirmed by Janiszewski and Chandon (2007). In effect, the content ⟶ process association allows people to "reprime" themselves with relevant information at the time of the decision. This longevity of process primes can be observed in a number of other studies (e.g., Fitzsimons, Chartrand, & Fitzsimons, 2008; Smith & Branscombe, 1987).

It is likely that the influence of uniqueness is much more complex, owing to the variety of factors that contribute to the selection of any one behavior. For example, consider selecting a restaurant for dinner (Laran et al., 2008). The activity is quite common, but the context can be familiar (e.g., in hometown) or unfamiliar (e.g., in novel city). One might hypothesize that the relative accessibility of a primed goal (e.g., *have fun*) might vary by context if a context can activate ancillary goals. When the context is familiar (i.e., the activity is commonly executed in the context), there should be few other goals that become activated by the context. Thus, the relative activation of the primed goal should be high. When the context is unfamiliar, alternative ways to perform the activity should become more accessible. These alternatives approaches to the behavior can activate other goals and reduce the accessibility of the primed goal. Laran et al. (2008) report data consistent with this prediction. That is, behavior was consistent with a goal prime in a common context, but inconsistent with a goal prime in an uncommon context.

These first three examples illustrate that it is critical to understand the relative accessibility of primed content or processes. Another way to create uniqueness, and limit the competition to primed content or processes, is to make the priming events unique. Lee and Schwarz (2010) illustrate this point. They asked participants to engage in ethical or unethical behavior via voice-mail or e-mail. Subsequently, participants indicated their willingness to pay for a variety of products, including mouthwash and hand sanitizer. Mouthwash (hand sanitizer) was more valued when unethical behavior occurred via voice-mail (e-mail) as compared to e-mail (voice-mail). In this case, unethical behavior activated goals that were specific to a modality (e.g., *restore morality to mouth*, *restore morality to hands*). A more general goal, like *get clean*, was not activated because there were not preexisting associations between these specific behaviors (immoral acts) and the general goal.

A second example of the influence of unique versus common priming events is provided by Shen and Wyer (2010). Shen and Wyer asked participants to make four choices in product categories where repeated choices should be consistent (e.g., milk) or varied (e.g., juice), followed by four choices in a target category that was appropriate for consistent or varied choices (e.g., tea). One-half of the participants made their initial choices in categories related to the target category (e.g., food categories) and one-half made their initial choices in unrelated category (e.g., animal categories). Interestingly, the related categories choices were also more common than the unrelated category choices. The critical finding was that the priming task exerted an influence when participants were unaware of the time one choice strategy and the target category was unrelated. Making choices in a common category may have increased the accessibility of competing choice strategies (i.e., other strategies that were commonly used), whereas making choices in an uncommon category did increase the accessibility of these strategies. As a consequence, process priming was more effective when done in the uncommon category.

Given these effects of common and uncommon contexts on content primes, content ⟶ process associations, and process primes, there are still effects that are puzzling. For example, Williams and Bargh (2008) investigated the influence of

physical coldness or warmth on perceptions of social coldness or warmth. In their procedure, an experimenter accompanied a participant on the elevator ride to a behavioral lab. Participants were asked to hold a cup of hot coffee or iced coffee while the experimenter recorded their name. Participants that held the hot coffee subsequently judged a described person as warmer. A subsequent study showed that holding a hot pad (ice-pack) increased the likelihood a person would choose a prosocial gift (personal reward). Bargh and Shalev (2012) extend these results by showing that holding an ice-pack increases feeling of loneliness relative to holding a neutral temperature pack.

These studies are unusual content priming studies because the semantic information made accessible by the prime is not necessary the semantic information that is relevant to the target judgment. Moreover, any content ⟶ process associations created using one meaning of the prime should not be relevant to the competing meanings of the prime. The only way to account for these effects is to allow for alternative representations of the information owing to process transformations of the information. Moreover, one has to assume that physical, social, and affective warmth/coldness have interconnected representations that can prime common processes. It is interesting to note that these shared processes become irrelevant when cold/warm information primes a goal (e.g., "to get warm") as opposed to semantic information. Zhong and Leonardelli (2008) show that people made to feel socially cold (i.e., lonely) have an increased desire for warm food and drinks. Hong and Sun (2012) show that being physically cold increases the desire to see romantic movies. Thus, cold stimuli lead to judgments of social coldness, but being cold leads to a desire for warming products.

Opportunities

The model we have proposed suggests a number of ways that one could gain further insight into priming effects. First, use multiple-prime paradigms. Although most researchers are aware that incidental material (e.g., content, affective state, chronic goals) influences the effectiveness of a prime, there are few systematic investigations of multiple-prime situations. Although it should be relatively straight forward to combine multiple primes to increase the strength of a priming effect, the real opportunity might be in interference and inhibition effects (anti-priming). Reduced accessibility is a common explanation for memory interference and inhibition effects (Anderson & Neely, 1996), so the accessibility of primed content and processes should be sensitive to the same factors that influence memory accessibility. Moreover, it is likely that interference priming could not be explained by models that focus on the inclusion/exclusion of the prime information in the target domain (e.g., Bless & Schwarz, 2010).

Second, investigate factors that influence the input of content into execution processes. Diagnosticity may be important when an experimental procedure encourages the use of specific content or processes, as was illustrated by option 1 on the right-side of Fig. 3. Diagnosticity may be less relevant when primed and contextual content is being subjected to executional processes at the time of priming (see the left-hand side of Fig. 3). The fact that content can prime processes might allow for primed or associated content to engage a series of sequential processes, the output of a process initiating the execution of the next process in the sequence. The processes, and the associated output, would be executed automatically, so that "rogue" content could be produced. This raises the question of "What is being primed?" It would be interesting to design priming paradigms for controlling/influencing what is being primed, be it different content within a class (i.e., different goals) or different content across classes (e.g., semantic content versus goals).

Third, investigate how priming can influence a complex sequence of behaviors. It is typically assumed that a prime exerts an influence soon after it is experienced. Yet, as we discussed, some priming effects can last up to a year. We do not consider these long-lasting priming effects to be cases of learning because they manifest only when the conditions are "right" (i.e., repriming). If this is so, primes might create content–process associations that are poised for the opportunity to exert an influence. It would be desirable to identify the conditions under which a prime exerts its influence in a given situation as well as the influence of a prime across a variety of situations. In effect, what conditions create the opportunity for sleeper priming effects (e.g., Macrae, Bodenhausen, Milne, & Jetten, 1994)?

Several research techniques might be useful when investigating these issues. For example, primes could be embedded in different contexts. To the extent that the dimensions of contexts are identifiable (e.g., uniqueness), the influence of a prime can be assessed under different levels of the dimension. Second, one might determine the influence of a prime on different dependent measures. If different dependent measures are sensitive to different processes, this strategy would be a useful tool in diagnosing the influence of the prime. Third, one might vary the order of primes. This might be especially valuable when investigating process priming because the associations between processes are likely to be asymmetric. If one imagines that a sequence of four processes creates a cognitive script, then the sequential priming of process one and two is more likely to encourage use of the script than the sequential priming of process two and one or three and four. Fourth, varying the sequence of performed behaviors. This could involve altering the sequence of behaviors at priming (e.g., Xu & Wyer, 2007, 2008) or at test. Varied sequences of behavior could be especially relevant to understanding process priming, as has been shown by the considerable work on content priming (Sudman et al., 1996).

Conclusion

In this paper, we reviewed a number of content and process priming effects. We proposed a model that can make predictions about the (dis)synergies between content and process priming. We hope that this model will encourage the reader to consider alternative ways in which priming might operate and, in so doing, provide new insights into how knowledge accessibility influences behavior.

References

Aarts, H., Chartrand, T. L., Custers, R., Danner, U., Dik, G., Jefferis, V., et al. (2005). Social stereotypes and automatic goal pursuit. *Social Cognition*, *23*, 464–489.

Aarts, H., & Dijksterhuis, A. (2000). Habits as knowledge structures: Automaticity in goal-directed behavior. *Journal of Personality and Social Psychology*, *78*, 53–63.

Aarts, H., & Dijksterhuis, A. (2003). The silence of the library: Environment, situational norm, and social behavior. *Journal of Personality and Social Psychology*, *84*, 18–28.

Aarts, H., Dijksterhuis, A., & Custers, R. (2003). Automatic normative behavior in environments: The moderating role of conformity in activating situational norms. *Social Cognition*, *21*, 447–464.

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

Ackerman, J. M., Nocera, C. A., & Bargh, J. A. (2010). Incidental haptic decisions influence social judgments and decisions. *Science*, *328*, 1712–1715.

Adaval, R. (2001). Sometimes it just feels right: The differential weighting of affect-consistent and affect-inconsistent product information. *Journal of Consumer Research*, *7*, 207–245.

Adaval, R., & Monroe, K. B. (2002). Automatic construction and use of contextual information for product and price evaluations. *Journal of Consumer Research*, *28*, 572–588.

Adaval, R., & Wyer, R. S. (2011). Conscious and nonconscious influences of a price anchor: Effects on willingness to pay for related and unrelated products. *Journal of Marketing Research*, *48*, 355–365.

Aggarwal, P., & McGill, A. L. (2012). When brands seem human, do humans act like brands? Automatic behavioral priming effects of brand anthropomorphism. *Journal of Consumer Research*, *39*, 307–323.

Anderson, J. R. (1983). A spreading activation theory of memory. *Journal of Verbal Learning and Verbal Behavior*, *22*, 261–295.

Anderson, M. C., & Neely, J. R. (1996). Interference and inhibition in memory retrieval. In E. L. Bjork, & R. A. Bjork (Eds.), *Memory: Handbook of perception and cognition* (pp. 237–315). New York: Academic Press.

Avnet, T., Pham, M. T., & Stephen, A. T. (2012). Consumers' trust in feelings as information. *Journal of Consumer Research*, *39*, 720–735.

Axelrod, J. N. (1963). Induced moods and attitudes toward products. *Journal of Advertising Research*, *3*, 19–24.

Bailis, D. S., Thacher, T. M., Aird, N. C. A., & Lipschitz, L. J. (2011). Affective and behavioral traces of goal conflict with physical activity. *Basic and Applied Social Psychology*, *33*, 128–144.

Bargh, J. A., Chaiken, S., Govender, R., & Pratto, F. (1992). The generality of the automatic attitude activation effect. *Journal of Personality and Social Psychology*, *62*, 893–912.

Bargh, J. A., Chaiken, S., Raymond, P., & Hymes, C. (1996). The automatic evaluation effect: Unconditionally automatic attitude activation in a pronunciation task. *Journal of Experimental Social Psychology*, *32*, 104–120.

Bargh, J. A., & Chartrand, T. L. (1999). The unbearable automaticity of being. *American Psychologist*, *54*, 462–476.

Bargh, J. A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action. *Journal of Personality and Social Psychology*, *71*, 230–244.

Bargh, J. A., & Ferguson, M. J. (2000). Beyond behaviorism: On the automaticity of higher mental processes. *Psychological Bulletin*, *126*, 925–945.

Bargh, J. A., Gollwitzer, P. M., Lee-Chai, A., Barndollar, K., & Troetschel, R. (2001). The automated will: Nonconscious activation and pursuit of behavioral goals. *Journal of Personality and Social Psychology*, *81*, 1014–1027.

Bargh, J. A., & Shalev, I. (2012). The substitutability of physical and social warmth in daily life. *Emotion*, *12*, 154–162.

Batra, Rajeev, & Stayman, S. M. (1990). The role of mood in advertising effectiveness. *Journal of Consumer Research*, *17*, 203–214.

Berger, J., & Fitzsimons, G. M. (2008). Dogs on the street, Pumas on your feet: How cues in the environment influence product evaluation and choice. *Journal of Marketing Research*, *45*, 1–14.

Bless, H., & Schwarz, N. (2010). Mental construal and the emergence of assimilation and contrast effects. *Advances in Experimental Social Psychology*, *42*, 319–373.

Bock, J. K. (1986). Syntactic persistence in sentence production. *Cognitive Psychology*, *18*, 355–387.

Bower, G. H. (1981). Mood and memory. *American Psychologist*, *36*, 129–148.

Bower, G. H. (1991). Mood congruity of social judgments. In J. P. Forgas (Ed.), *Emotion and social judgments* (pp. 31–53). Oxford, UK: Pergamon.

Bower, G. H., & Forgas, J. P. (2000). Affect, memory, and social cognition. In E. Eich, J. F. Kihlstrom, G. H. Bower, J. P. Forgas, & P. M. Niedenthal (Eds.), *Cognition and emotion* (pp. 87–168). New York, NY: Oxford University Press.

Bower, G. H., & Mayer, J. D. (1985). Failure to replicate mood dependent retrieval. *Bulletin of the Psychonomic Society*, *23*, 39–42.

Brasel, S., & Gips, A. (2011). Red Bull "Gives You Wings" for better or worse: A double-edged impact of brand exposure on consumer performance. *Journal of Consumer Psychology*, *21*, 57–64.

Braun, K. A. (1999). Postexperience advertising effects on consumer memory. *Journal of Consumer Research*, *25*, 319–334.

Briñol, P., & Petty, R. E. (2003). Overt head movements and persuasion: A self-validation analysis. *Journal of Personality and Social Psychology*, *84*, 1123–1139.

Cabeza, R., & Moscovitch, M. (2013). Memory systems, processing modes, and components: Functional neuroimaging evidence. *Perspectives on Psychological Science*, *8*, 49–55.

Cacioppo, J. T., Priester, J. R., & Berntson, G. G. (1993). Rudimentary determinants of attitudes: II. Arm flexion and extension have differential effects on attitudes. *Journal of Personality and Social Psychology*, *65*, 5–17.

Carver, C. S., Ganellen, R. J., Froming, W. J., & Chambers, W. (1983). Modeling: An analysis in terms of category accessibility. *Journal of Experimental Social Psychology*, *19*, 403–421.

Cesario, J., Plaks, J. E., & Higgins, E. T. (2006). Automatic social behavior as motivated preparation to interact. *Journal of Personality and Social Psychology*, *90*, 893–910.

Chandler, J. J., Reinhard, D., & Schwarz, N. (2012). To judge a book by its weight you need to know its content: Knowledge moderates the use of embodied cues. *Journal of Experimental Social Psychology*, *48*, 948–952.

Chang, H. H., & Pham, M. T. (2013). Affect as a decision making system of the present. *Journal of Consumer Research*, *40*, 42–63.

Chapman, G. B., & Johnson, E. J. (2002). Incorporating the irrelevant: Anchors in judgments of belief and value. In T. Gilovich, D. W. Griffin, & D. Kahneman (Eds.), *The psychology of judgment: Heuristics and biases* (pp. 120–138). New York: Cambridge University Press.

Chartrand, T. L. (2005). Mystery moods and perplexing performance: Consequences of succeeding and failing at a nonconscious goal. *Working paper*: Duke University.

Chartrand, T. L., & Bargh, J. A. (1996). Automatic activation of impression formation and memorization goals: Nonconscious goal priming reproduces effects of explicit task instructions. *Journal of Personality and Social Psychology*, *71*, 464–478.

Chartrand, T. L., & Bargh, J. A. (1999). The chameleon effect: The perception-behavior link and social interaction. *Journal of Personality and Social Psychology*, *76*, 893–910.

Chartrand, T. L., & Dalton, A. (2008). Mimicry: Its ubiquity, importance, and functionality. In E. Morsella, J. Bargh, & P. Gollwitzer (Eds.), *Oxford handbook of human action* (pp. 458–483). New York: Oxford University Press.

Chartrand, T. L., Cheng, C. M., Dalton, A. N., & Tesser, A. (2010). Nonconscious goal pursuit: Isolated incidents or adaptive self-egulatory tool? *Social Cognition*, *28*, 569–588.

Chartrand, T. L., Huber, J., Shiv, B., & Tanner, R. (2008). Nonconscious goals and consumer choice. *Journal of Consumer Research*, *35*, 189–201.

Chiu, C. -y., & Hong, Y. -y. (2007). *Social psychology of culture.* New York: Psychology Press.

Cho, H., & Schwarz, N. (2008). Of great art and untalented artists: Effort information and the flexible construction of judgmental heuristics. *Journal of Consumer Psychology*, *18*, 205–211.

Clore, G. L., & Storbeck, J. (2006). Affect as information about liking, efficacy and importance. In J. P. Forgas (Ed.), *Affect in social thinking and behavior* (pp. 123–142). New York: Psychology Press.

Cohen, J. B., Pham, M. T., & Andrade, E. B. (2008). The nature and role of affect in consumer behavior. In C. P. Haugtvedt, P. Herr, & F. Kardes (Eds.), *Handbook of consumer psychology* (pp. 297–348). Mahwah, NJ: Lawrence Erlbaum.

Collins, A. M., & Loftus, L. F. (1975). A spreading activation theory of semantic processing. *Psychological Review*, *82*, 407–428.

Crusius, J., & Mussweiler, T. (2012). To achieve or not to achieve? Comparative mindsets elicit assimilation and contrast in goal priming. *European Journal of Social Psychology*, *42*, 780–788.

Custers, R., & Aarts, H. (2005). Positive affect as implicit motivator: On the nonconscious operation of behavioral goals. *Journal of Personality and Social Psychology*, *89*, 129–142.

Custers, R., & Aarts, H. (2007). In search of the nonconscious sources of goal pursuit: Accessibility and positive affective valence of the goal state. *Journal of Experimental Social Psychology*, *43*, 312–318.

Dhar, R., Huber, J., & Khan, U. (2007). The shopping momentum effect. *Journal of Marketing Research*, *44*, 370–378.

Dijksterhuis, A., Bargh, J. A., & Miedema, J. (2000). Of men and mackerels: Attention and automatic behavior. In H. Bless, & J. P. Forgas (Eds.), *Subjective experience in social cognition and behavior* (pp. 36–51). Philadelphia: Psychology Press.

Dijksterhuis, A., & Bargh, J. A. (2001). The perception-behavior expressway: Automatic effects of social perception on social behavior. *Advances in Experimental Social Psychology*, *33*, 1–40.

Dijksterhuis, A., Chartrand, T. L., & Aarts, H. (2007). Effects of priming and perception on social behavior and goal pursuit. In J. A. Bargh (Ed.), *Social psychology and the unconscious: The automaticity of higher mental processes* (pp. 51–131). Philadelphia: Psychology Press.

Dijksterhuis, A., Spears, R., Postmes, T., Stapel, D., Koomen, W., van Knippenberg, A., et al. (1998). Seeing one thing and doing another: Contrast effects in automatic behavior. *Journal of Personality and Social Psychology*, *75*, 862–871.

Dijksterhuis, A., & van Knippenberg, A. (1998). The relation between perception and behavior or how to win a game of Trivial Pursuit. *Journal of Personality and Social Psychology*, *74*, 865–877.

Doyen, S., Klein, O., Pichon, C., & Cleeremans, A. (2012). Behavioral priming: It's all in the mind, but whose mind? *PLoS One*, *7*, 1–7.

Estes, Z., Jones, L. L., & Golonka, S. (2012). Emotion affects similarity via social projection. *Social Cognition*, *30*, 584–609.

Fazio, R. H., Sanbonmatsu, D. M., Powell, M. C., & Kardes, F. R. (1986). On the automatic activation of attitudes. *Journal of Personality and Social Psychology*, *50*, 229–238.

Fitzsimons, G., & Bargh, J. A. (2003). Thinking of you: Nonconscious pursuit of interpersonal goals associated with relationship partners. *Journal of Personality and Social Psychology*, *84*, 148–164.

Fitzsimons, G. M., Chartrand, T. L., & Fitzsimons, G. J. (2008). Automatic effects of brand exposure on motivated behavior: How Apple makes you 'think different'. *Journal of Consumer Research*, *35*, 21–35.

Forgas, J. P. (1995). Mood and judgment: The affect infusion model (AIM). *Psychological Bulletin*, *117*, 39–66.

Forgas, J. P., & Bower, G. H. (1987). Mood effects on person perception judgments. *Journal of Personality and Social Psychology*, *53*, 53–60.

Forgas, J. P., & Eich, E. E. (2012). Affective influences on cognition: Mood congruence, mood dependence, and mood effects on processing strategies. In A. F. Healy, & R. W. Proctor (Eds.), *Handbook of psychology: Experimental psychology*, *Vol. 4*. (pp. 61–82). New York: Wiley.

Foroni, F., & Semin, G. R. (2011). When does mimicry affect evaluative judgment? *Emotion*, *11*, 687–690.

Förster, J. (2011). Local and global cross-modal influences between vision and hearing, tasting, smelling, or touching. *Journal of Experimental Psychology. General*, *140*, 364–389.

Förster, J., & Dannenberg, L. (2010). GLOMO^{sys}: A systems account of global versus local processing. *Psychological Inquiry*, *21*, 175–197.

Förster, J., & Liberman, N. (2007). Knowledge activation. In A. W. Kruglanski, & E. T. Higgins (Eds.), *Social psychology: Handbook of basic principles* (pp. 201–231) (2nd ed.). New York: Guilford Press.

Förster, J., & Strack, F. (1997). The influence of motor actions on retrieval of valenced information: A motor congruence effect. *Perceptual and Motor Skills*, *85*, 1419–1427.

Galinsky, A. D., Wang, C. S., & Ku, G. (2008). Perspective-takers behave more stereotypically. *Journal of Personality and Social Psychology*, *95*, 404–419.

Gallese, V., Fadiga, L., Fogassi, L., & Rizzolatti, G. (1996). Action recognition in the premotor cortex. *Brain*, *119*, 593–609.

Gillath, O., Mikulincer, M., Birnbaum, G. E., & Shaver, P. R. (2007). Does subliminal exposure to sexual stimuli have the same effects on men and women? *Journal of Sex Research*, *44*, 111–121.

Gollwitzer, P. M., Heckhausen, H., & Steller, B. (1990). Deliberative vs. implemental mind-sets: Cognitive tuning toward congruous thoughts and information. *Journal of Personality and Social Psychology*, *59*, 1119–1127.

Gorn, G. J., Goldberg, M. E., & Basu, K. (1993). Mood, awareness, and product evaluation. *Journal of Consumer Psychology*, *2*, 237–256.

Griskevicius, V., Goldstein, N. J., Mortensen, C. R., Sundie, J. M., Cialdini, R. B., & Kenrick, D. K. (2009). Fear and loving in Las Vegas: Evolution, emotion, and persuasion. *Journal of Marketing Research*, *46*, 384–395.

Hansen, J., Kutzner, F., & Wänke, M. (2013). Money and thinking: Reminders of money trigger abstract construal and shape consumer judgments. *Journal of Consumer Research*, *39*, 1154–1166.

Herr, P. M. (1986). Consequences of priming: Judgment and behavior. *Journal of Personality and Social Psychology*, *51*, 1106–1115.

Higgins, E. T., Bargh, J. A., & Lombardi, W. J. (1985). Nature of priming effects on categorization. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *11*, 59–69.

Higgins, E. T., & Chaires, W. M. (1980). Accessibility of interrelational constructs: Implications for stimulus encoding and creativity. *Journal of Experimental Social Psychology*, *64*, 348–361.

Hintzman, D. L. (1986). 'Schema abstraction' in a multiple-trace memory model. *Psychological Review*, *93*, 411–428.

Hong, Y. -y (2009). A dynamic constructivist approach to culture: Moving from describing culture to explaining culture. In R. S. Wyer, C. -y. Chiu, & Y. -y. Hong (Eds.), *Understanding culture: Theory, research and application* (pp. 3–24). New York: Psychology Press.

Hong, J., & Sun, Y. (2012). Warm it up with love: The effect of physical coldness on liking of romance movies. *Journal of Consumer Research*, *39*, 293–306.

Houser-Marko, L., & Sheldon, K. M. (2008). Eyes on the prize or nose to the grindstone? The effects of level of goal evaluation on mood and motivation. *Personality and Social Psychology Bulletin*, *34*, 1556–1569.

Hung, I. W., & Labroo, A. A. (2011). From firm muscles to firm willpower: Understanding the role of embodied cognition in self-regulation. *Journal of Consumer Research*, *37*, 1046–1064.

Isen, A. M., & Shalker, T. E. (1982). The influence of mood state on evaluation of positive, neutral, and negative stimuli: When you "accentuate the positive," do you "eliminate the negative"? *Social Psychology Quarterly*, *4*, 58–63.

Isen, A. M., Shalker, T. E., Clark, M., & Karp, L. (1978). Affect, accessibility of material in memory, and behavior: A cognitive loop? *Journal of Personality and Social Psychology*, *36*, 1–12.

Janiszewski, C., & Chandon, E. (2007). Transfer appropriate processing, response fluency, and the mere measurement effect. *Journal of Marketing Research*, *43*, 309–323.

Janssen, E., Everaerd, W., Spiering, M., & Janssen, J. (2000). Automatic processes and the appraisal of sexual stimuli: Towards an information processing model of sexual arousal. *Journal of Sex Research*, *37*, 8–23.

Jiang, Y., Cho, A., & Adaval, R. (2009). The unique consequences of feeling lucky: Implications for consumer behavior. *Journal of Consumer Psychology*, *19*, 171–184.

Johnson, E., & Tversky, A. (1983). Affect, generalization, and the perception of risk. *Journal of Personality and Social Psychology*, *45*, 20–31.

Johnston, L. (2002). Behavioral mimicry and stigmatization. *Social Cognition*, *20*, 18–35.

Jones, L. L., & Estes, Z. (2012). Lexical priming: Associative, semantic, and thematic influences on word recognition. In J. S. Adelman (Ed.), *Visual word recognition*, *Vol. 2*. (pp. 44–72). Hove, UK: Psychology Press.

Jostmann, N. B., Lakens, D., & Schubert, T. W. (2009). Weight as an embodiment of importance. *Psychological Science*, *20*, 1169–1174.

Kambouropoulos, N., & Staiger, P. K. (2001). The influence of sensitivity to reward on reactivity to alcohol-related cues. *Addiction*, *96*, 1175–1185.
Karremans, J. C., Stroebe, W., & Claus, J. (2006). Beyond Vicary's fantasies: The impact of subliminal priming and brand choice. *Journal of Experimental Social Psychology*, *42*, 792–798.
Kay, A. C., Wheeler, S. C., Bargh, J. A., & Ross, L. (2004). Material priming: The influence of mundane physical objects on situational construal and competitive behavioral choice. *Organizational Behavior and Human Decision Processes*, *95*, 83–96.
Kettle, K. L., & Häubl, G. (2011). The signature effect: Signing influences consumption-related behavior by priming self-identity. *Journal of Consumer Research*, *38*, 474–489.
Kim, H., & John, D. R. (2008). Consumer response to brand extensions: Construal level as a moderator of the importance of perceived fit. *Journal of Consumer Psychology*, *18*, 116–126.
Knobloch, S., & Zillmann, D. (2002). Mood management via the digital jukebox. *Journal of Communication*, *52*, 351–366.
Kolers, P. A. (1973). Remembering operation. *Memory & Cognition*, *1*, 347–355.
Kolers, P. A., & Perkins, D. N. (1975). Spatial and ordinal components of form perception and literacy. *Cognitive Psychology*, *7*, 228–267.
Kolers, P. A., & Roediger, H. L. (1984). Procedures of mind. *Journal of Verbal Learning and Verbal Behavior*, *23*, 425–449.
Kraft, T. L., & Pressman, S. D. (2012). Grin and bear it: The influence of manipulated facial expression on the stress response. *Psychological Science*, *23*, 1372–1378.
Krishna, A., & Morrin, M. (2008). Does touch affect taste? The perceptual transfer of product container haptic cues. *Journal of Consumer Research*, *34*, 807–818.
Kristjánsson, A., & Campana, G. (2010). Where perception meets memory: A review of repetition priming in visual search tasks. *Attention, Perception, & Psychophysics*, *72*, 5–18.
Kruglanski, A. W. (1996). Goals as knowledge structures. In P. M. Gollwitzer, & J. A. Bargh (Eds.), *The psychology of action: Linking cognition and motivation to behavior* (pp. 599–618). New York, NY: Guilford Press.
Kruglanski, A. W., Shah, J. Y., Fishbach, A., Friedman, R., Chun, W. Y., & Sleeth-Keppler, D. (2002). A theory of goal systems. *Advances in Experimental Social Psychology*, *34*, 331–378.
Lakin, J., & Chartrand, T. L. (2003). Using nonconscious behavioral mimicry to create affiliation and rapport. *Psychological Science*, *14*, 334–339.
Lambert, A. J., & Wyer, R. S. (1990). Stereotypes and social judgment: The effects of typicality and perceptions of group heterogeneity. *Journal of Personality and Social Psychology*, *59*, 676–691.
Landau, M. J., Meier, B. P., & Keefer, L. A. (2010). A metaphor-enriched social cognition. *Psychological Bulletin*, *136*, 1045–1067.
Laran, J. (2010). The influence of information processing goal pursuit on post-decision affect and behavioral intentions. *Journal of Personality and Social Psychology*, *98*, 16–28.
Laran, J., & Janiszewski, C. (2009). Behavioral consistency and inconsistency in the resolution of goal conflict. *Journal of Consumer Research*, *35*, 967–984.
Laran, J., Janiszewski, C., & Cunha, M. (2008). Context-dependent effects of priming. *Journal of Consumer Research*, *34*, 653–667.
Leander, N. P., Moore, S. M., & Chartrand, T. L. (2009). Mystery moods: Their origins and consequences. In G. Moskowitz, & H. Grant (Eds.), *The psychology of goals* (pp. 480–504). New York: Guilford Press.
Lee, S. W., & Schwarz, N. (2010). Dirty hands and dirty mouths: Embodiment of the moral-purity metaphor is specific to the motor modality involved in moral transgression. *Psychological Science*, *21*, 1423–1425.
Légal, J. -B., Chappé, J., Coiffard, V., & Villard-Forest, A. (2012). Don't you know that you want to trust me? Subliminal goal priming and persuasion. *Journal of Experimental Social Psychology*, *48*, 358–360.
Liberman, N., Sagristano, M. D., & Trope, Y. (2002). The effect of temporal distance on level of mental construal. *Journal of Experimental Social Psychology*, *38*, 523–534.
Liberman, N., & Trope, Y. (1998). The role of feasibility and desirability considerations in near and distant future decisions: A test of temporal construal theory. *Journal of Personality and Social Psychology*, *75*, 5–18.
Loersch, C., & Payne, B. K. (2011). The situated inference model: An integrative account of the effects of primes on perception, behavior, and motivation. *Perspectives on Psychological Science*, *6*, 234–252.
Lombardi, W. J., Higgins, E. T., & Bargh, J. A. (1987). The role of consciousness in priming effects on categorization. *Personality and Social Psychology Bulletin*, *13*, 411–429.
Macrae, C. N., Bodenhausen, G. V., Milne, A. B., & Jetten, J. (1994). Out of mind but back in sight: Stereotypes on the rebound. *Journal of Personality and Social Psychology*, *67*, 808–817.
Macrae, C. N., & Johnston, L. (1998). Help, I need somebody: Automatic action and inaction. *Social Cognition*, *16*, 400–417.
Macrae, C. N., & Lewis, H. L. (2002). Do I know you? Processing orientation and face recognition. *Psychological Science*, *13*, 194–196.
Mandel, N., & Johnson, E. J. (2002). When web pages influence choice: Effects of visual primes on experts and novices. *Journal of Consumer Research*, *29*, 235–245.
Marcel, A. J. (1983). Conscious and unconscious perception: An approach to the relations between phenomenal experience and perceptual processes. *Cognitive Psychology*, *15*, 238–300.
Martin, L. L., Seta, J. J., & Crelia, R. A. (1990). Assimilation and contrast as a function of people's willingness and ability to expend effort in forming an impression. *Journal of Personality and Social Psychology*, *59*, 27–37.
Mayer, J. D., Gaschke, Y. N., Braverman, D. L., & Evans, T. W. (1992). Mood-congruent judgment is a general effect. *Journal of Personality and Social Psychology*, *63*, 119–132.
McGeoch, J. A. (1942). *The psychology of human learning.* New York: Longmans, Green.
Meyers-Levy, J., & Zhu, R. (2007). The influence of ceiling height: The effect of priming on the type of processing people use. *Journal of Consumer Research*, *34*, 174–186.
Morwitz, V. G., Johnson, E., & Schmittlein, D. (1993). Does measuring intent change behavior? *Journal of Consumer Research*, *20*, 46–61.
Moscovitch, M. (1994). Memory and working with memory: Evaluation of a component process model and comparisons with other models. In D. L. Schacter, & E. Tulving (Eds.), *Memory systems* (pp. 269–310). Cambridge, MA: MIT/Bradford Press.
Murphy, S. T., & Zajonc, R. B. (1993). Affect, cognition, and awareness: Affective priming with optimal and suboptimal stimulus exposures. *Journal of Personality and Social Psychology*, *64*, 723–739.
Mussweiler, T. (2002). The malleability of anchoring effects. *Experimental Psychology*, *49*, 67–72.
Mussweiler, T., & Strack, F. (1999). Hypothesis-consistent testing and semantic priming in the anchoring paradigm: A selective accessibility model. *Journal of Experimental Social Psychology*, *35*, 136–164.
Mussweiler, T., & Strack, F. (2001). The semantics of anchoring. *Organizational Behavior and Human Decision Processes*, *86*, 234–255.
Nedungadi, P. (1990). Recall and consumer consideration sets: Influencing choice without altering brand evaluations. *Journal of Consumer Research*, *17*, 263–276.
Neumann, R., & Lozo, L. (2012). Priming the activation of fear and disgust: Evidence for semantic processing. *Emotion*, *12*, 223–228.
Niedenthal, P. M. (2008). Emotion concepts. In M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *The handbook of emotion* (pp. 597–600) (3rd ed.). New York: Guilford Press.
Nunes, J. C., & Boatwright, P. (2004). Incidental prices and their effect on willingness to pay. *Journal of Marketing Research*, *41*, 457–466.
Oyserman, D., & Lee, S. W. S. (2008). Does culture influence what and how we think: Effects of priming individualism and collectivism. *Psychological Bulletin*, *134*, 311–342.
Oyserman, D., & Sorensen, N. (2009). Understanding cultural syndrome effects on what and how we think: A situated cognition model. In C. -Y. Chiu, R. Wyer, & Y. -Y. Hong (Eds.), *Problems and solutions in crosscultural theory, research and application* (pp. 25–52). New York: Psychology Press.
Parrott, G., & Sabini, J. (1990). Mood and memory under natural conditions: Evidence for mood and incongruent recall. *Journal of Personality and Social Psychology*, *59*, 321–336.
Pham, M. T. (1998). Representativeness, relevance, and the use of feelings in decision making. *Journal of Consumer Research*, *25*, 144–159.

Prinz, W. (1990). A common coding approach to perception and action. In O. Neumann, & W. Prinz (Eds.), *Relationships between perception and action* (pp. 167–201). Berlin: Springer-Verlag.

Ratcliff, R., & McKoon, G. (1988). A retrieval theory of priming in memory. *Psychological Review*, *95*, 385–408.

Ratneshwar, S., Pechmann, C., & Shocker, A. D. (1996). Goal-derived categories and the antecedents of across-category consideration. *Journal of Consumer Research*, *23*, 240–250.

Ratneshwar, S., & Shocker, A. D. (1991). Substitution in use and the role of usage context in product category structures. *Journal of Marketing Research*, *28*, 281–295.

Reber, R., Schwarz, N., & Winkielman, P. (2004). Processing fluency and aesthetic pleasure: Is beauty in the perceiver's processing experience? *Personality and Social Psychology Review*, *8*, 364–382.

Roediger, H. L., III, Buckner, R. L., & McDermott, K. B. (1999). Components of processing. In J. K. Foster, & M. Jelicic (Eds.), *Memory: Systems, process, or function?* (pp. 31–65). Oxford: Oxford University Press.

Sassenberg, K., & Moskowitz, G. B. (2005). Don't stereotype, think different! Overcoming automatic stereotype activation by mindset priming. *Journal of Experimental Social Psychology*, *41*, 506–514.

Schacter, D. L., & Buckner, R. L. (1998). Priming and the brain. *Neuron*, *20*, 185–195.

Schmidt, T., Haberkamp, A., Veltkamp, G. M., Weber, A., Seydell-Greenwald, A., & Schmidt, F. (2011). Visual processing in rapid-chase systems: Image processing, attention, and awareness. *Frontiers in Psychology*, *2*(169), 1–16.

Schröder, T., & Thagard, P. (2013). The affective meanings of automatic social behaviors: Three mechanisms that explain priming. *Psychological Review*, *120*, 255–280.

Schwarz, N. (1990). Feelings as information: Informational and motivational functions of affective states. In E. T. Higgins, & R. Sorrentino (Eds.), *Handbook of motivation and cognition: Foundations of social behavior*, *Vol. 2*. (pp. 527–561)New York: Guilford Press.

Schwarz, N., & Clore, G. L. (1983). Mood, misattribution and judgments of well-being: Informative and directive functions of affective states. *Journal of Personality and Social Psychology*, *45*, 513–523.

Schwarz, N., & Clore, G. L. (1988). How do I feel about it? The informative function of affective states. In K. Fiedler, & J. P. Forgas (Eds.), *Affect, cognition, and social behavior* (pp. 44–62). Toronto, Canada: Hogrefe.

Sela, A., & Shiv, B. (2009). Unraveling priming: When does the same prime activate a goal versus a trait? *Journal of Consumer Research*, *36*, 418–433.

Shah, J. Y., & Kruglanski, A. W. (2003). When opportunity knocks: Bottom-up priming of goals by means and its effects on self-regulation. *Journal of Personality and Social Psychology*, *84*, 1109–1122.

Shen, H., & Wyer, R. S. (2008). Procedural priming and consumer judgments: Effects on the impact of positively and negatively valenced information. *Journal of Consumer Research*, *34*, 727–737.

Shen, H., & Wyer, R. S. (2010). The effect of past behavior on variety seeking: Automatic and deliberative processes. *Journal of Consumer Psychology*, *20*, 33–42.

Shen, H., Wyer, R. S., & Cai, F. (2012). The generalization of deliberative and automatic behavior: The role of procedural knowledge and affective reactions. *Journal of Experimental Social Psychology*, *819–828*.

Smith, E. R., & Branscombe, N. R. (1987). Procedurally mediated social inferences: The case of category accessibility effects. *Journal of Experimental Social Psychology*, *23*, 361–382.

Spivey, M. J., & Geng, J. J. (2001). Oculomotor mechanisms activated by imagery and memory: Eye movements to absent objects. *Psychological Research/Psychologische Forschung*, *65*, 235–241.

Srull, T. K., & Wyer, R. S. (1979). The role of category accessibility in the interpretation of information about persons: Some determinants and implications. *Journal of Personality and Social Psychology*, *37*, 1660–1672.

Strack, F., Martin, L. L., & Stepper, S. (1988). Inhibiting and facilitating conditions of human smile: A nonobtrusive test of the facial feedback hypothesis. *Journal of Personality and Social Psychology*, *54*, 768–777.

Strahan, E. J., Spencer, S. J., & Zanna, M. P. (2002). Subliminal priming and persuasion: Striking while the iron is hot. *Journal of Experimental Social Psychology*, *38*, 556–568.

Sudman, S., Bradburn, N. M., & Schwarz, N. (1996). *Thinking about answers. The application of cognitive processes to survey methodology.* San Francisco: Jossey-Bass.

Tanner, R., Ferraro, R., Chartrand, T. L., Bettman, J., & van Baaren, R. (2008). Of chameleons and consumption: The impact of mimicry on choice and preferences. *Journal of Consumer Research*, *34*, 754–766.

Tice, D. M., Bratslavsky, E., & Baumeister, R. F. (2001). Emotional distress regulation takes precedence over impulse control: If you feel bad, do it! *Journal of Personality and Social Psychology*, *80*, 53–67.

Tipper, S. P. (2001). Does negative priming reflect inhibitory mechanisms? A review and integration of conflicting views. *Quarterly Journal of Experimental Psychology*, *54A*, 321–343.

Tong, L., Zheng, Y., & Zhao, P. (2013). Is money really the root of all evil? The impact of priming money on consumer choice. *Marketing Letters*, *2*, 119–129.

Trope, Y., & Liberman, N. (2010). Construal level theory of psychological distance. *Psychological Review*, *117*, 440–463.

Van Baaren, R. B., Fockenberg, D. A., Holland, R. W., Janssen, L., & Van Knippenberg, A. (2006). The moody chameleon: The effect of mood on non-conscious mimicry. *Social Cognition*, *24*, 426–437.

Van Baaren, R. B., Horgan, T. G., Chartrand, T. L., & Dijkmans, M. (2004). The forest, the trees and the chameleon: Context-dependency and mimicry. *Journal of Personality and Social Psychology*, *86*, 453–459.

Van den Bergh, B., Dewitte, S., & Warlop, L. (2008). Bikinis instigate generalized impatience in intertemporal choice. *Journal of Consumer Research*, *35*, 85–97.

van Osselaer, S. M. J., & Janiszewski, C. (2012). A goal-based model of product evaluation and choice. *Journal of Consumer Research*, *39*, 260–292.

Veling, H., Ruys, K. I., & Aarts, H. (2012). Anger as a hidden motivator: Associating attainable products with anger turns them into rewards. *Social Psychological and Personality Science*, *3*, 438–445.

Veltkamp, M., Aarts, H., & Custers, R. (2009). Unraveling the motivational yarn: A framework for understanding the instigation of implicitly motivated behavior resulting from deprivation and positive affect. *European Review of Social Psychology*, *20*, 345–381.

Wadhwa, M., Shiv, B., & Nowlis, S. M. (2008). A bite to whet the reward appetite: The influence of sampling on reward-seeking behaviors. *Journal of Marketing Research*, *45*, 403–413.

Wegener, D. T., & Petty, R. E. (1994). Mood management across affective states: The hedonic contingency hypothesis. *Journal of Personality and Social Psychology*, *66*, 1034–1048.

Wells, G. L., & Petty, R. E. (1980). The effects of overt head movements on persuasion: Compatibility and incompatibility of responses. *Basic and Applied Social Psychology*, *1*, 219–230.

Wheeler, S. C., & DeMarree, K. G. (2009). Multiple mechanisms of prime-to-behavior effects. *Social and Personality Psychology Compass*, *3*, 566–581.

Wheeler, S. C., DeMarree, K. G., & Petty, R. E. (2007). Understanding the role of the self in prime to behavior effects: The Active-Self Account. *Personality and Social Psychology Review*, *11*, 234–261.

Wheeler, S. C., Jarvis, W., Blair, G., & Petty, R. E. (2001). Think unto others: The self-destructive impact of negative racial stereotypes. *Journal of Experimental Social Psychology*, *37*, 173–180.

Wheeler, S. C., & Petty, R. E. (2001). The effects of stereotype activation on behavior: A review of possible mechanism. *Psychological Bulletin*, *127*, 797–826.

Williams, L. E., & Bargh, J. A. (2008). Experiencing physical warmth promotes interpersonal warmth. *Science*, *606–607*.

Winkielman, P., Berridge, K. C., & Wilbarger, J. L. (2005). Unconscious affective reactions to masked happy versus angry faces influence consumption behavior and judgments of value. *Personality and Social Psychology Bulletin*, *31*, 121–135.

Wyer, R. S. (2004). *Social comprehension and judgment: The role of situation models, narratives and implicit theories.* Mahwah, NJ: Erlbaum.

Wyer, R. S. (2008). The role of knowledge accessibility in cognition and behavior: Implications for consumer information processing. In C. Haugtvedt, P. Herr, & F. Kardes (Eds.), *Handbook of consumer psychology* (pp. 31–76). Mahwah, NJ: Erlbaum.

Wyer, R. S., & Carlston, D. (1979). *Social cognition, inference and attribution.* Hillsdale, NJ: Erlbaum.

Wyer, R. S., Clore, G. L., & Isbell, L. M. (1999). Affect and information processing. In M. P. Zanna (Ed.), *Advances in experimental social psychology*, *Vol 31*. (pp. 1–77). San Diego, CA: Academic Press.

Wyer, R. S., Shen, H., & Xu, A. J. (2013). The role of procedural knowledge in the generalization of social behavior. In D. E. Carlston (Ed.), *The Oxford handbook of social cognition* (3rd ed.). New York: Oxford University Press.

Wyer, R. S., & Srull, T. K. (1989). *Memory and cognition in its social context.* Hillsdale, NJ: Erlbaum.

Wyer, R. S., & Xu, A. J. (2010). The role of behavioral mindsets in goal-directed activity: Conceptual underpinnings and empirical evidence. *Journal of Consumer Psychology*, *20*, 107–125.

Wyer, R. S., Xu, A. J., & Shen, H. (2012). The effects of past behavior on future goal-directed activity. In M. P. Zanna, & J. Olson (Eds.), *Advances in experimental social psychology*, *Vol. 46*. (pp. 237–284). San Diego, CA: Academic Press.

Xu, A. J., & Wyer, R. S. (2007). The effect of mind-sets on consumer decision strategies. *Journal of Consumer Research*, *34*, 556–566.

Xu, A. J., & Wyer, R. S. (2008). The comparative mindset: From animal comparisons to increased purchase intentions. *Psychological Science*, *19*, 859–864.

Xu, A. J., & Wyer, R. S. (2012). The role of bolstering and counterarguing mindsets in persuasion. *Journal of Consumer Research*, *38*, 920–932.

Yeung, C. W. M., & Wyer, R. S. (2004). Affect, appraisal and consumer judgment. *Journal of Consumer Research*, *31*, 412–424.

Zarkadi, T., & Schnall, S. (2013). "Black and White" thinking: Visual contrast polarizes moral judgment. *Journal of Experimental Social Psychology*, *49*, 355–359.

Zemack-Rugar, Y., Bettman, J. R., & Fitzsimons, G. J. (2007). The effects of nonconsciously priming emotion concepts on behavior. *Journal of Personality and Social Psychology*, *93*, 927–939.

Zhang, M., & Li, X. (2012). From physical weight to psychological significance: The contribution of semantic activations. *Journal of Consumer Research*, *38*, 1063–1075.

Zhang, M., & Wang, J. (2009). Psychological distance asymmetry: The spatial dimension vs. other dimensions. *Journal of Consumer Psychology*, *19*, 497–507.

Zhong, C. -B., & Leonardelli, G. J. (2008). Cold and lonely: Does social exclusion literally feel cold? *Psychological Science*, *19*, 838–842.

Zhong, C. -B., & Liljenquist, K. (2006). Washing away your sins: Threatened morality and physical cleansing. *Science*, *313*, 1451–1452.