Physical Attractiveness Stereotype and Memory

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Five experiments examined explicit and implicit memory for information that is congruent with the physical attractiveness stereotype (i.e. attractive-positive and unattractive-negative) and information that is incongruent with the physical attractiveness stereotype (i.e. attractive-negative and unattractive-positive). Measures of explicit recognition-sensitivity and implicit discriminability revealed a small (but significant) memorial advantage for congruent information compared to incongruent information. Measures of explicit memory showed a reliable recognition-bias towards congruent information compared to incongruent information; this recognition-bias was unrelated to reports of subjective confidence in retrieval. The present findings shed light on the cognitive mechanisms that might mediate discriminatory behaviour towards physically attractive and physically unattractive individuals.

Keywords: Physical attractiveness, stereotype, memory

Humans seem to believe that physical attractiveness co-varies with a number of positive personal characteristics. Social skills, potency, adjustment and intellectual ability are more readily attributed to attractive than to unattractive persons, even if they are complete strangers (Adams, 1982; Dion, Berscheid, & Walster, 1972; Eagly, Ashmore, Makhijani, & Longo, 1991; Feingold, 1992; Langlois et al., 2000). In the present research we examine explicit and implicit memory for positive and negative information about attractive and unattractive individuals; stereotypes[1] involving physical attractiveness may cause explicit and implicit memory-biases towards congruent or towards incongruent information. Currently, there are no reported studies that have examined this issue[2] and the present

[1] It could be discussed whether the term “attitude” or “stereotype” should be used to denote mental representations that link physical attractiveness to positive attributes. On one hand, “attitude” might be more appropriate because “attitude” is defined as implying a consistent evaluative response to an object, while definitions of “stereotype” allow for diverging evaluative implications (e.g. Greenwald & Banaji, 1995). On the other hand, “physical attractiveness stereotype” is the term that is used most frequently in the literature on the subject (e.g. Eagly et al., 1991; Langlois et al., 2000). Following this last tradition, we use the term “stereotype” here.
[2] In June 2006 we conducted a search of PsychInfo using the following search-string: (ti=memory or ab=memory or kw=memory) and (ti=attractiv* or ti=beaut* or ab=attractiv* or ab=beaut* or kw=attractiv* or kw=beaut*). This

experiments can shed light on some of the cognitive processes involved in friendly and hostile behaviours towards attractive and unattractive people.

Several studies have shown that attractive children and adults are treated more favourably than unattractive children and adults (e.g. Langlois et al., 2000). A possible explanation for this phenomenon is that evaluative information about attractive and unattractive people is inaccurately represented in memory. Person-memory affects behaviour in at least two important ways. First, memory retrieval can activate (prime) certain mental representations of people; this, in turn, can have a direct causal effect on overt behaviour. Behaviour is caused by the mere activation of mental content, and is independent of conscious decisions to act in a certain way; the perceiver may even attribute his or her actions to another, irrelevant, cause (Bargh, 2005; Dijksterhuis & Bargh, 2001; Prinz, 1997). Retrieving negative information about a target could, for instance, cause hostile behaviour towards the target; the perceiver may instead believe that his or her actions were caused by aspects of the situation. Secondly, memory retrieval can inform conscious decision-making, which in turn can cause overt behaviour (Dawes, 1998). Remembering that a person had certain qualities would motivate certain decisions regarding how to behave in relation to the person. In this case, the perceiver is aware that his or her actions were the result of a certain decision but is unaware that the decision could have been founded on biased sampling of information from memory. Remembering that somebody was an arrogant person, for example, might lead to the conscious conclusion that avoidance is appropriate; in turn, this would lead to overt behavioural avoidance. The perceiver may believe that this recollection is accurate and not correct for the fact that memory-retrieval is biased sometimes.

How, then, does memory represent positive and negative information about attractive and unattractive targets? Before considering possible hypotheses it is practical to define a few terms. Following the famous phrase “Beautiful is good” (Dion et al., 1972) we use the term *BIG-congruent* to denote information consisting of attractive faces and positive attributes and information consisting of unattractive faces and negative attributes. We use the term *BIG-incongruent* to denote information consisting of attractive faces and negative attributes and information consisting of unattractive faces and positive attributes. By the same token, *BIG-congruence* is a variable that describes whether information is BIG-congruent (or not). BIG-congruence could influence memory in two main ways: (1) by producing higher or lower explicit recognition-sensitivity and implicit discriminability; (2) by producing more or less explicit recognition-bias. Measures of recognition-sensitivity in tests of explicit memory tap the ability to distinguish between events that actually occurred and those that did not by asking participants to report their memories; typically recognition-sensitivity is estimated by subtracting false alarms (the proportion of new items that participants incorrectly identify as old) from hits (the proportion of old items that participants correctly identify as old). A recognition-bias in tests of explicit memory is a general tendency to identify both old and new items as old, independently of

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search returned 162 matches that we inspected for content. None of the papers examined memory (either long-term, short-term, explicit, or implicit) for information congruent or incongruent with the physical attractiveness stereotype.

variation in recognition sensitivity. Conceptually, measures of recognition-bias correspond to the sum of hits and false alarms. Measures of discriminability in tests of implicit memory, instead, tap the ability to distinguish between old and new information without relying on conscious reports of memory. A test of implicit memory may, for example, involve measures of reaction-time.

RECOGNITION-SENSITIVITY AND DISCRIMINABILITY

The empirical evidence suggests that stereotype-incongruent information, in general, has a memorial advantage over stereotype-congruent information (Fiske, 1998; Macrae & Bodenhausen, 2000; Stangor & McMillan, 1992). However, there is an important moderator of the effect of congruency on recognition-sensitivity. Stangor and McMillan (1992) conducted a meta-analysis on the influence of social expectations on explicit memory for expectancy-congruent and expectancy-incongruent information. The 54 studies that were included used individuals, groups, and evaluative and descriptive attributes as stimulus materials. Overall, measures of recognition-sensitivity revealed a memorial advantage for expectancy-incongruent information over expectancy-congruent information. Importantly, though, the data showed a moderating effect of type of attribute. Attributes that were *descriptively*[3] incongruent produced higher recognition-sensitivity than attributes that were descriptively congruent, in agreement with the general pattern of results. The opposite was observed, however, for attributes that were *evaluatively*[4] incongruent; recognition-sensitivity was higher for evaluatively congruent than for evaluatively incongruent information (the effect of descriptive congruence was larger than the effect of evaluative congruence explaining why there was an overall advantage for incongruent information). Because BIG-congruent information is evaluatively congruent and because BIG-incongruent information is evaluatively incongruent, it can be predicted that BIG-congruent information is recognized more accurately than BIG-incongruent information.

The advantage for evaluatively congruent information can be understood by examining potential mechanisms by which stereotype-congruent and stereotype-incongruent information is encoded into and retrieved from long-term memory.

Encoding information about people in long-term memory heavily depends on both attention and elaboration (see Brown & Craik, 2000 for example). Paying attention, by allocating mental processing capacity or by selecting visual or auditory sensory information from the environment, generally leads to better memory-encoding (Pashler, 1998). The kind of processing that is dedicated to attended items at study also has a general effect on how well they are encoded. Deep semantic elaboration (e.g. categorizing stimuli for valence) leads to better memory-encoding than shallow perceptual processing (e.g. categorizing stimuli for colour) (Brown & Craik, 2000; Craik & Lockhart, 1972; Tyler, Hertel, McCallum, & Ellis, 1979).

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[3] For example, the combination attractive – intelligent would be descriptively incongruent; the combination attractive – beautiful would be descriptively congruent.

[4] For example, the combination attractive – intelligent would be evaluatively congruent; the combination attractive – unintelligent would be evaluatively incongruent.

Long-term memory representations can be retrieved in different ways. Explicit memory retrieval is based on conscious recognition either in the form of remembering or in the form of knowing (Gardiner & Richardson-Klavehn, 2000; Tulving, 1985)[5]. Remembering refers to a subjective state of awareness in which details of past events can be brought to mind, producing an experience of vivid recollection and of reliving past events. Knowing refers to a subjective state of awareness in which past events feel familiar, without the experience of recollection (Gardiner & Richardson-Klavehn, 2000; Tulving, 1985). Remembering is thus associated with more confidence in memory than knowing (e.g. Dunn, 2004). Implicit memory retrieval is observed when participants show signs of memory retrieval even if they are unaware that memory is being measured (e.g. Graf & Schacter, 1985; Toth, 2000). Attention and elaboration at study have similar effects on different forms of memory retrieval, even if some dissociations are observed. Dividing attention at study (e.g. by requiring subjects to perform a concurrent task) generally leads to decreases in remembering, knowing and implicit memory, but the decrease in remembering is larger. Elaboration at study generally leads to increases in remembering, knowing and implicit memory, but again, the increase in remembering is larger (Brown & Craik, 2000; Gardiner & Richardson-Klavehn, 2000; H. L. Roediger, III & Amir, 2005; Toth, 2000).

Different theoretical accounts have been forwarded to describe why stereotypically congruent information has a memorial advantage. A common theme is that attention and elaboration are seen as important mediators of the effect of stereotype-congruency on recognition-sensitivity. That is, attention and elaboration are thought to vary as a function of whether stimulus information is congruent or incongruent with a stereotypic expectancy; attention and elaboration, in turn, affect memory-encoding. Attention and elaborative processing may be directed towards stereotype-congruent information and away from stereotype-incongruent information for at least two reasons. Congruent information is easier to encode than incongruent information; devoting cognitive capacity to incongruent information, by paying attention or by engaging in elaborative processing, is unattractive to cognitive misers that operate under the principle of least effort (Allport, 1954; Fiske & Taylor, 1991). Attention may also be averted from incongruent information for another reason. Perceivers prefer information that supports their beliefs rather than information that challenges their beliefs; incongruent information is avoided in an attempt to maintain cognitive consistency (Festinger, 1957, 1964). Evaluatively congruent information is thus, according to these explanations, encoded more completely in long-term memory because cognitive resources are directed away from incongruent information, towards congruent information.

In the present studies we measured explicit recognition-memory and implicit memory for BIG-congruent and BIG-incongruent information. Given that people have stereotypes that link physical attractiveness to positive attributes and given that meta-analytic research has demonstrated a memorial

[5] We deliberately avoid inferring familiarity from reports of knowing and recollection from reports of remembering because currently there is some controversy regarding how these indicators should be interpreted (Dunn, 2004; Rotello, Macmillan, & Reeder, 2004; Yonelinas, 2002).

advantage for other evaluatively congruent information, we should find that BIG-congruence leads to higher recognition-sensitivity in explicit memory. I.e. memory should be more accurate for information containing attractive-positive and unattractive-negative than for information containing attractive-negative and unattractive-positive. A similar pattern may be evident in tests of implicit memory, with higher discriminability for information that is compatible with the physical attractiveness stereotype.

RECOGNITION-BIAS

A number of studies have shown that stereotype-congruency is connected with more recognition-bias; i.e. a greater tendency to respond ”old” to old and new congruent information than to old and new incongruent information (e.g. Lenton, Blair, & Hastie, 2001; MacRae, Schloerscheidt, Bodenhausen, & Milne, 2002; Payne, Jacoby, & Lambert, 2004; Sherman & Bessenoff, 1999; Stangor & McMillan, 1992). This pattern was also observed in the meta-analysis by Stangor and McMillan (1992). In contrast to the results for recognition-sensitivity, however, type of attribute did not exert a moderating effect on recognition-bias (both evaluatively and descriptively congruent information showed higher recognition-bias than evaluatively and descriptively incongruent information).

Recognition-biases for stereotype-congruent information can be understood by examining the factors that tend to bring about false remembering. A prominent feature of retrieval is its reconstructive nature; general knowledge and expectancies colour the contents of what is retrieved in addition to information from an actual experience (Bartlett, 1932; Brown & Craik, 2000; H. L. Roediger & McDermott, 2000; Schank & Abelson, 1977). This phenomenon is seen in tests of recognition memory when participants tend to identify both old and new expectancy congruent information as old. Such recognition-biases can result for different reasons. First, participants may simply adopt a conscious guessing-strategy, responding “old” to a number of items even if they are aware that they are uncertain of the correct answer (e.g. Payne et al., 2004). Secondly, recognition biases can arise because of misattributions of fluency (Jacoby, Woloshyn, & Kelley, 1989; Kelley & Rhodes, 2002; Payne et al., 2004; H. L. Roediger & McDermott, 2000). According to this explanation, ease of processing, per se, is sometimes taken as a sign of conscious memory. Participants may, for example, believe that a pair of semantically related test-items (that are easy to process) were presented at study even if they were not (e.g. Rajaram & Geraci, 2000; Whittlesea, 1993). Information that matches semantic memory-representations is processed more fluently; in turn, this causes the experience of recognition.

Stereotype-congruent information may produce a recognition-bias by influencing guessing and/or the fluency of processing. People may adopt a conscious guessing-strategy, concluding that they have experienced congruent information more often than concluding that they have not experienced congruent information, even if they are aware that they are uncertain of what actually happened. This explanation suggests that a recognition-bias towards stereotype-congruent information is more probable when people have low confidence in their responses. I.e. the bias is driven by guessing; guessing is connected with low confidence (Payne et al., 2004). Alternatively, if stereotypes are mentally represented in associative networks (see Smith, 1998), like semantic relations involving non-social concepts, recognition-bias could arise because of misattributions of fluency. Stereotype-consistent information is, presumably, processed more fluently than stereotype-inconsistent information; when deciding whether consistent information was encountered previously or not, people may identify both old and new consistent information as old, interpreting fluency as a sign of conscious memory. Recognition-bias should be less likely for stereotype-inconsistent information, which by assumption, is processed less fluently. In contrast to the guessing explanation, the misattribution of fluency explanation does not suggest that recognition-bias increases as a function of low confidence (Payne et al., 2004).

Given that other stereotypes produce recognition-bias for related information and given that people have stereotypes that link-physical attractiveness to positive attributes, we can predict a recognition-bias towards BIG-congruent information rather than towards BIG-incongruent information. I.e. we should find that people are more likely to believe that they have seen information involving attractive-positive and unattractive-negative than information involving attractive-negative and unattractive-positive, independently of whether the information is shown or not. If recognition-bias for information congruent with the physical attractiveness stereotype arises because of conscious guessing, we should find that correct and false recognition of congruent information is connected with lower confidence and with more know-responses than correct and false recognition of incongruent information.

GENERAL AIMS

The present studies were designed to examine how stereotypes towards physically attractive and unattractive individuals affect recognition-sensitivity and recognition-bias in explicit and implicit memory. Physical attractiveness is an important external feature; if attractiveness moderates memory for positive and negative information about people, we may be able to pinpoint a key cognitive process involved in behaviour towards attractive and unattractive individuals. Stereotypes involving physical attractiveness may exert their effects on behaviour through biases in person-memory. Currently, there are no reported studies that have examined memory for information that relates to the physical attractiveness stereotype.

We address three main questions. (1) Does BIG-congruence affect explicit recognition-sensitivity and implicit discriminability? (2) Does BIG-congruence affect explicit recognition-bias? (3) Does BIG-congruence affect the phenomenological quality of correct and false explicit recognition?

OVERVIEW OF METHODS

Materials

In all experiments stimuli consisted of pairs containing a face and a word. A total of 142 greyscale images of faces were initially collected from Ekman and Friesen's Pictures of Facial Affect (Ekman & Friesen, 1976), from the Karolinska Directed Emotional Faces (Lundkvist, Flykt, & Öhman, 1998) and from the Internet. Six judges (three female and three male) then rated these images for attractiveness on a four point scale that ranged from "very unattractive" to "very attractive". Forty faces that received the lowest and the highest average attractiveness ratings were used as attractive faces (20) and unattractive faces (20), respectively. An ANOVA, with stimuli as cases, also confirmed that attractive faces received significantly higher average attractiveness ratings than unattractive faces, F (1, 38) = 231.14, $p < 0.05$, $\eta^2 = 0.86$, $M = 3.22$ and $M = 1.54$, respectively. Unattractive and attractive faces were matched on emotional expression (17 neutral and 3 happy in each category) and sex (10 female and 10 male in each category).

Six other judges (three female and three male), rated the valence ("positive" or "negative") of a total of 93 words that described personality traits, abilities and various psychological states. Twenty words that all judges rated as positive were used as positive words and 20 words that all judges rated as negative were used as negative words. Positive and negative words were matched on frequency of occurrence in Swedish newspapers and on word length. Table 1 shows English translations of the stimulus-words.

Table 1

Positive and negative words used in experiments 1 – 5

Negative		Positive	
Anxious	Negligent	Active	Extraverted
Apprehensive	Passive	Acute	Gifted
Depressed	Slow	Ambitious	Nice
Disagreeable	Uncommunicative	Amiable	Determined
Dejected	Unhappy	Assiduous	Productive
Edgy	Unimaginative	Competent	Reliable
Gloomy	Unintelligent	Dynamic	Resolute
Incompetent	Unproductive	Effective	Sharp
Ineffective	Unreliable	Energetic	Trustworthy
Listless	Untalented	Enterprising	Vigorous

Stimuli in experiments 1, 2, 4 and 5 were constructed using the same general procedure (materials for experiment 3 are described in the method section of this experiment). A set of face-word combinations was compiled for each participant, as follows. Twenty old BIG-congruent and 20 old BIG-incongruent combinations were formed by: (1) Randomly dividing each of attractive faces, unattractive faces, negative words, and positive words into two equally large sets; (2) combining attractive faces from set 1 with positive words from set 1 and combining unattractive faces from set 1 with negative words from set 1; (3) combining attractive faces from set 2 with negative words from set 2 and combining unattractive faces from set 2 with positive words from set 2. Twenty new BIG-congruent and 20 new BIG-incongruent combinations were formed by randomly recombining words and faces within old attractive-positive, old unattractive-negative, old attractive-negative, and old unattractive-positive categories. New combinations thus had the same congruency (or incongruency) as old combinations. Note that this procedure has the following advantages: (1) in the long run BIG-congruent combinations contain the same faces and words as BIG-incongruent combinations; (2) in the long run old combinations contain the same faces and words as new combinations.

Procedure

Experiments 1, 2, 4 and 5 consisted of a study phase, a distraction phase and a test phase, each phase being preceded by a written instruction (the procedure for experiment 3 is described below). At study participants were shown 20 old BIG-congruent and 20 old BIG-incongruent face-word combinations in random order; the task was to indicate whether they thought that each combination had a certain characteristic. I.e. they viewed combinations under incidental relational encoding conditions.

During the distraction phase participants completed a vocabulary test in which they had to determine the meaning of each of 14 words by choosing one of 5 alternative answers. Words and response-alternatives were presented on the computer monitor (to the left and right, respectively) and participants made their choice by clicking on an answer with the computer-mouse. This task usually took between 4 and 12 minutes.

Finally participants completed a test phase, which contained 20 old BIG-congruent, 20 old BIG-incongruent, 20 new BIG-congruent and 20 new BIG-incongruent face-word combinations presented in random order. On each trial, participants had to decide whether a given combination was shown at study or if the combination was new.

Pilot testing revealed rather high accuracy levels. To reduce the risk for ceiling effects, the test phase contained 40 filler-trials in addition to old and new face-word combinations. In these trials a given face appeared together with a word that had the opposite valence of the word that had appeared together with that face at study. I.e. if a given face was shown with a positive word at study, on filler trials, that face was shown with a negative word.

At the end of each experiment, participants were debriefed and offered the opportunity to see their results.

Data analysis

Measures of recognition-sensitivity and recognition-bias were computed using the same formula in all experiments that measured explicit memory in order to make results from different experiments comparable. Recognition sensitivity was defined as hits minus false alarms, H - F (e.g. Snodgrass & Corwin, 1988). Recognition bias was defined as hits plus false alarms, H + F. Note that these definitions represent the observations' coordinates on a new basis (with recognition sensitivity and recognition bias as axes) that is a rigid rotation of the original coordinate system (with hits and false alarms as axes) by 45 degrees. The operationalizations of recognition sensitivity and recognition bias are thus orthogonal[6].

All experiments used the same outlier-correction procedure: Variables included in inferential statistical tests were inspected for values with a two-tailed probability lower than 0.01 in a normal distribution. Outliers were then replaced with the values (raw scores) that correspond to 0.01/2 and 1 – 0.01/2, using an iterative procedure that only ended when all outliers were gone (i.e. by recalculating means, standard deviations and probabilities after each group of outliers had been removed); see Tabachnick and Fidell (2001).

EXPERIMENT 1

Experiment 1 examined effects of BIG-congruence on explicit recognition-sensitivity and recognition-bias. Previous research suggests that people have higher recognition-sensitivity for other evaluative stereotype-congruent information and a recognition-bias towards other stereotype-congruent information. Given this observation, we should find that BIG-congruence leads to higher recognition-sensitivity and more recognition-bias. If recognition-bias depends on conscious guessing, correct and false recognition of BIG-congruent information should be connected with low confidence.

Method

Participants

Twenty university students, 50% male and 50% female, completed experiment 1. Mean age was 24.25 with a standard deviation of 1.55.

Materials

Stimuli consisted of the BIG-congruent and BIG-incongruent face-word combinations described in the introduction. At study and test faces and words measured about 7 x 8 cm and 0.5 x 2-6 cm, respectively. A Macintosh computer with a 15'' monitor running custom software presented stimuli and collected responses.

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[6] Note also that these formulas correspond to measures of discriminability and response bias in signal detection theory (SDT, see Snodgrass & Corwin, 1988 for example), except for the Gaussian transformation that is used in SDT (the transformation still preserves the rank-order of observations).

Procedure

Study instructions told participants that men and women have different traits and that the task was to find out if a given trait was characteristic of men or characteristic of women by deciding if a trait-word was compatible with a (female or male) face or not[7]. The study phase consisted of 20 old BIG-congruent and 20 old BIG-incongruent combinations presented in random order. On each trial subjects saw one face-word pair centrally on the computer monitor and two response buttons marked with “Yes” and “No”, shown below a face-word pair. They responded by clicking with the computer mouse, there being no time-limit in this task. The position of faces and words varied randomly from trial to trial (i.e. randomly face to the left and word to the right, or face to the right and word to the left).

In the distraction phase, participants completed the 14-item vocabulary test described in the introduction.

Test-instructions told participants to decide if a given combination was shown at study or if the combination was new and to rate their confidence in this decision, stressing that the task was to respond if combinations were old or new and not if faces or words were old or new. The test phase contained 20 old BIG-congruent combinations, 20 old BIG-incongruent combinations, 20 new BIG-congruent combinations and 20 new BIG-incongruent combinations presented in random order, in addition to the 40 filler trials that are described in the introduction. Face-word combinations were shown centrally on the computer monitor together with response-buttons labelled “Old” and “New”, shown below a face-word combination. The position of words and faces (left-right or right-left) again varied randomly. Confidence ratings were made by choosing one of four buttons labelled “Very uncertain”, “Quite uncertain”, “Quite certain”, “Very certain” that appeared after an old/new response had been made, horizontally below a face-word combination. Participants responded by clicking with the computer-mouse, there being no time-limit (neither on old/new decisions nor on confidence ratings).

Data analysis

Outliers were corrected according to the procedure described in the introduction. The variable that had the highest number of outliers had 5.00% outliers.

Results and Discussion

A repeated measures ANOVA with material (2: old, new) and congruence (2: congruent, incongruent) as factors, and the proportion of ”old”-responses as the dependent variable revealed a significant interaction between material and congruence, F (1, 19) = 29.66, $p < 0.05$, $\eta^2 = 0.61$. Figure 1A shows that recognition sensitivity (the difference between hits and false alarms) was higher for congruent than for incongruent stimulus-combinations. The ANOVA also revealed a significant main effect of

[7] The purpose of this task was only to direct attention to the stimuli; responses and response latencies were thus not saved.

congruence, F (1, 19) = 40.66, $p < 0.05$, $\eta^2 = 0.68$, indicating a recognition-bias towards congruent information; see Figure 1B. Follow-up analyses showed a significant effect of congruence for hits, F (1, 19) = 63.49, $p < 0.05$, $\eta^2 = 0.77$, but not for false alarms, F (1, 19) = 0.10, $p = 0.76$, $\eta^2 = 0.01$. Participants thus tended to respond “old” more frequently on old congruent stimulus-combinations than on old incongruent stimulus-combinations, there being no such difference on new combinations (see Figures 1C and 1D) [8].

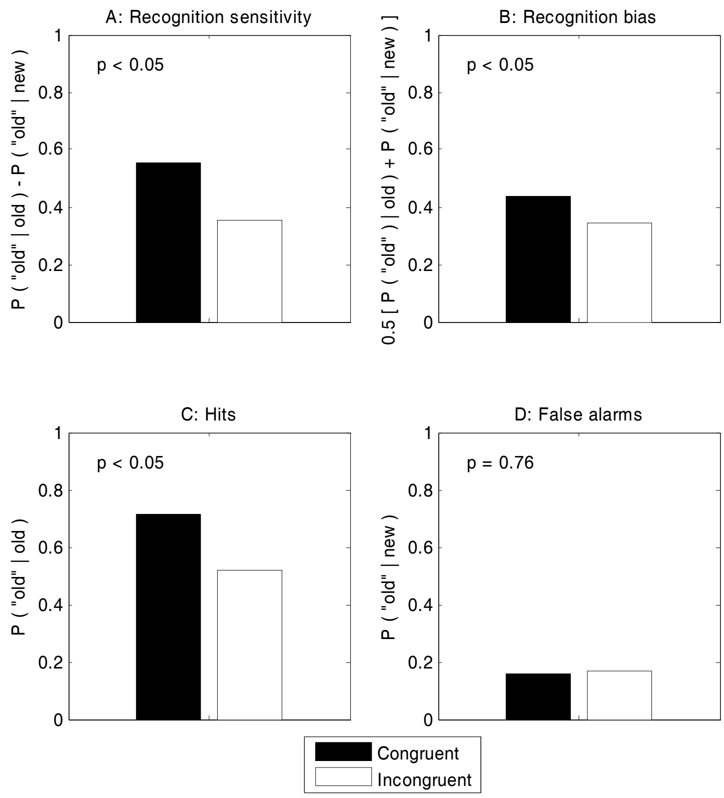

Figure 1. Experiment 1. Recognition sensitivity and recognition bias on BIG-congruent and BIG-incongruent combinations. *Note.* *P*-values refer to comparisons between BIG-congruent and BIG incongruent combinations on paired samples *t*-tests (two-tailed probability).

We then calculated the proportion of “old” - responses on which participants were confident of their answer, separately for hits and false alarms, as follows: P (“quite certain or very certain old”) / [P (“quite certain or very certain old”) + P (“quite uncertain or very uncertain old”]. This variable was used as the dependent in an ANOVA with material (2: old, new) and congruence (2: congruent, incongruent) as within subjects factors. The ANOVA yielded a non-significant interaction between material and congruence, F (1, 18)[9] = 1.06, $p = 0.32$, $\eta^2 = 0.06$, a non-significant main effect of congruence, F (1, 18) = 1.25, $p = 0.28$, $\eta^2 = 0.07$, and a significant main effect of material, F (1, 18) = 39.77, $p < 0.05$, $\eta^2 = 0.69$. Participants were generally more confident when they made hits than when

[8] We present this information for the sake of clarity even if some of it is redundant.
[9] There were 18 degrees of freedom because one observation was undefined (division by zero).

they made false alarms (the proportion of responses on which participants were confident was M = 0.76 for hits and M = 0.45 for false alarms).

Experiment 1 showed higher recognition-sensitivity and more recognition-bias towards combinations with attractive-positive and unattractive-negative, than for combinations with attractive-negative and unattractive-positive. Confidence in memory did not vary as a function of BIG-congruence. The present findings are thus consistent with the results from meta-analysis on other stereotypes; both regarding recognition-sensitivity and recognition bias (Stangor & McMillan, 1992). Importantly, experiment 1 constitutes the first demonstration that information congruent with the physical attractiveness stereotype is recognized more accurately and produces more recognition bias than incongruent information. Note that the data from experiment 1 seem to exclude a conscious guessing interpretation of the recognition-bias for congruent information, as we failed to find that correct and false recognition of BIG-congruent information was connected with lower confidence.

EXPERIMENT 2

Experiment 1 constitutes a single demonstration that BIG-congruence affects recognition-sensitivity and recognition-bias; experiment 2 was therefore designed as a conceptual replication of experiment 1. In experiment 1 participants responded by indicating old or new; experiment 2 used remember, know and new as responses to measure recognition-sensitivity and recognition-bias. If BIG-congruence causes higher recognition sensitivity and more recognition-bias, we should be able to observe this pattern of results in experiment 2 as well. I.e. that H - F and H + F are higher for BIG-congruent than for BIG-incongruent combinations, where H = (“remember” or “know”) | old, and F = (“remember” or “know”) | new. In experiment 2 we also examined if the phenomenological quality of retrieval varied as a function of BIG-congruence, by comparing the proportion of remember-responses for BIG-congruent and BIG-incongruent stimulus-combinations. If a recognition-bias towards BIG-congruent information depends on conscious guessing, we should find a higher proportion of know-responses when participants identify old and new BIG-congruent information as old. Knowing is connected with lower confidence than remembering (e.g. Dunn, 2004).

Method

Participants

Participants were 40, 52.5% female and 47.5% male, university students. Mean age was 24.45 with a standard deviation of 7.33.

Materials

As in experiment 1, stimuli consisted of BIG-congruent and BIG-incongruent face-word combinations; these were constructed using the method described in the introduction. Faces measured about 7 x 8 cm and words about 0.5 x 2-6 cm. A Macintosh computer with a 15’’ monitor running custom software presented stimuli and collected responses.

Procedure

Study instructions were the same as in experiment 1: Participants were told to note if a trait was characteristic of men or characteristic of women by responding if a trait-word was compatible with a (female or male) face or not. The study phase presented 20 old BIG-congruent and 20 old BIG-incongruent combinations in random order, one-by-one, centrally on the screen. The positions of faces and words varied randomly (face to the left and word to the right, or face to the right and word to the left). Participants had to respond “Yes” or “No” for each combination by selecting one of two response buttons presented below a face-word pair. There was no time-limit in this task.

As in experiment 1, the distraction phase consisted of the 14 word multiple-choice vocabulary test.

The test phase consisted of a Remember-Know (RK) task (Gardiner & Richardson-Klavehn, 2000). Participants were told to respond “new” if they did not recognize a given combination, to respond “remember” if they recognized a combination and could remember what they thought when they saw that combination at study, and to respond “know” if they recognized a combination but could not remember what they thought when they saw the combination at study. As in experiment 1 the instruction emphasized that responses were to be made to combinations and not to individual words or faces. Twenty old BIG-congruent combinations, 20 old BIG- incongruent combinations, 20 new BIG-congruent combinations, 20 new BIG- incongruent combinations and 40 filler trials were presented in random order, one-by-one, centrally on the screen. Again, the position of faces and words (left-right or right-left) was randomized from trial to trial. For each face-word pair participants responded “new”, “remember” or “know” by selecting one of three response buttons shown below each stimulus combination. There was no time limit in this task.

Data analysis

Outliers were corrected using the procedure described in the introduction. The variable that had the highest number of outliers had 2.50% outliers.

Results and Discussion

An ANOVA computed on proportions of ”old”-responses (i.e. “remember” or “know”) with material (2: old, new) and congruence (2: congruent, incongruent) as factors yielded a significant interaction between material and congruence, F (1, 39) = 10.56, $p < 0.05$, $\eta^2 = 0.21$. As shown in Figure 2A recognition sensitivity was higher for congruent than for incongruent stimulus-combinations. This analysis also revealed a significant main effect of congruence, F (1, 39) = 52.39, $p < 0.05$, $\eta^2 = 0.57$, indicating that participants had a recognition-bias towards congruent rather than towards incongruent information; see Figure 2B. Follow-up analyses showed significant main effects of congruence on both hits and false alarms, but hits produced a larger effect than false alarms, F (1, 39) = 38.38, $p < 0.05$, $\eta^2 = 0.50$, and F (1, 39) = 5.94, $p < 0.05$, $\eta^2 = 0.13$, respectively. Participants made more know and remember responses on both old and new congruent combinations as evident in Figures 2C and 2D.

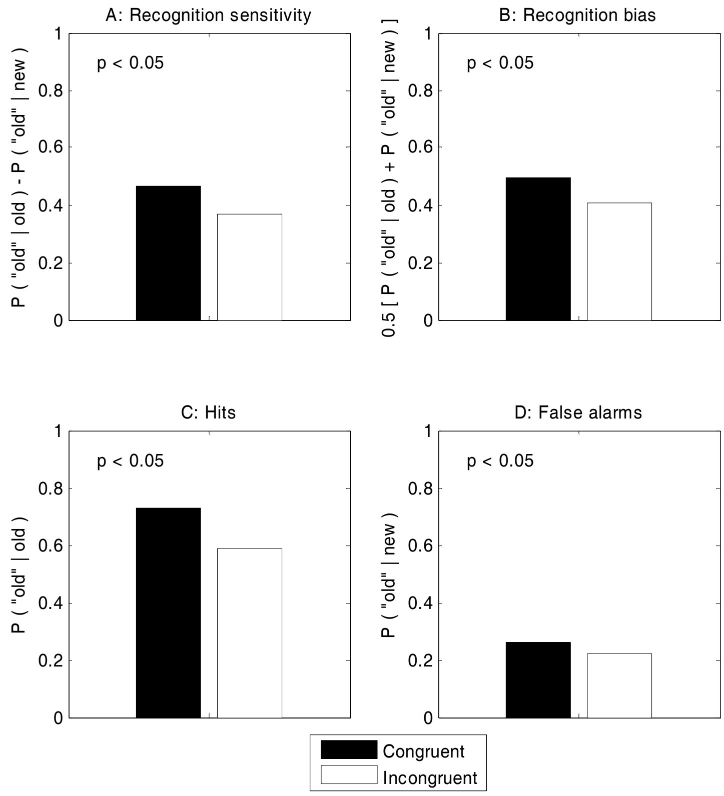

Figure 2. Experiment 2. Recognition sensitivity, hits and false alarms on BIG-congruent and BIG-incongruent stimuli. *Note. P*-values refer to comparisons between BIG-congruent and BIG incongruent combinations on paired samples t-tests (two-tailed probability).

We then calculated the proportion of remember responses as P (“remember”) / [P (“remember”) + P (“know”)] separately for hits and false alarms. This variable was used as the dependent in an ANOVA with material (2: old, new) and congruence (2: congruent, incongruent) as factors. The ANOVA yielded a non-significant interaction between material and congruence, F (1, 38)[10] = 2.78, $p = 0.10$, $\eta^2 = 0.07$, a significant main effect of congruence, F (1, 38) = 4.15, $p < 0.05$, $\eta^2 = 0.10$, and a significant main effect of material F (1, 38) = 59.63, $p < 0.05$, $\eta^2 = 0.61$. Participants had a higher proportion of remember responses on congruent ($M = 0.49$) than on incongruent stimulus-combinations ($M = 0.42$). The main effect of material indicated that the proportion of remember responses was higher for hits ($M = 0.60$) than for false alarms ($M = 0.31$).

[10] Thirty eight degrees of freedom because one observation was undefined (due to division by zero).

Experiment 2 thus provided a conceptual replication of experiment 1. As in experiment 1, the data showed higher recognition-sensitivity and more recognition-bias for combinations that included attractive-positive and unattractive-negative, than for combinations that included attractive-negative and unattractive-positive. Subjective experience at retrieval also varied as a function of BIG-congruence; correct and false recognition of BIG-congruent combinations was connected with more remember-responses than correct and false recognition of BIG-incongruent combinations. Like the results from experiment 1, this excludes a conscious guessing explanation for the recognition-bias.

There are a number of potential explanations for why BIG-congruent information was remembered better in experiments 1 and 2. One important explanation is that a memorial advantage for BIG-congruent information only occurs under particular, theoretically irrelevant conditions, and that these conditions were in place in experiments 1 and 2. Experiments 1 and 2, for example, used certain study-instructions, certain test-instructions, certain types of responses, etc. Perhaps, one or more of these conditions have to be present to observe that BIG-congruent information is more memorable than BIG-incongruent information. If this is the case, the phenomenon is not particularly general in nature and the findings of experiments 1 and 2 only have limited applicability; e.g. it would be difficult to use them as one source of information in theory-building (unless a theory contained a complicated web of irrelevant premises). The generality of the conclusions that can be drawn from the present research would be greater if the memorial advantage for BIG-congruent information is found even when testing conditions are very different from the conditions that characterized experiments 1 and 2. With this in mind, we designed experiment 3 to be dissimilar to experiments 1 and 2.

EXPERIMENT 3

Experiments 1 and 2 showed that BIG-congruent information was more memorable than BIG-incongruent information using two measures of explicit memory. The aim of experiment 3 was to examine if BIG-congruent information has a memorial advantage over BIG-incongruent information in a test of *implicit* memory. If so, we would be in the position to make a more general conclusion regarding how the physical attractiveness stereotype influences the memorability of congruent and incongruent information. Tests of implicit memory are superficially very dissimilar to tests of explicit memory, but both types of tests measure the ability to discriminate between old and new information.

Implicit memory retrieval is observed when an earlier episode affects performance on a test of implicit memory, even if participants are not explicitly asked to remember the original episode (Graf & Schacter, 1985; Toth, 2000). An implicit memory measure might, for example, consist of the ability to identify studied and non-studied words presented very rapidly in a test phase; implicit memory would be indicated by higher accuracy on studied than on non-studied words (e.g. Jacoby & Dallas, 1981). Our measure of implicit memory was modelled after a task used by Logan and Etherton (1994). In their task, participants searched word-pairs for members of a given category (e.g. copper given the category metals) responding present or absent as fast as possible. On target present trials each pair consisted of a word that belonged to the target category and a distracter word. On target absent trials each pair consisted of a word that did not belong to the target category and a distracter word. Targets and non-targets appeared equally often in the top position and in the bottom position on a computer screen. At study each pair was repeated 16 times; specific combinations of words were thus maintained throughout the study phase. The test phase consisted of old pairings of old words (the pairs that were presented at study) and of new pairings of old words (in which study pairs were recombined). Reaction-times were faster for old pairings of old words than for new pairings of old words, indicating that relations between targets and distracters and relations between non-targets and distracters had been encoded in memory.

The present measure of implicit memory is similar to the priming techniques that have been used in research on implicit attitudes and stereotypes, with the important exception that reaction-time is used to measure implicit (episodic) memory (e.g. Bargh, Chaiken, Govender, & Pratto, 1992; Bargh, Chaiken, Raymond, & Hymes, 1996; Chaiken & Bargh, 1993; Fazio, Sanbonmatsu, Powell, & Kardes, 1986). At study, participants viewed repetitions of face-word combinations, deciding on the valence of each word as fast as possible in each trial. The test phase consisted of old combinations of old faces and old words (the combinations that were presented at study) and of new combinations of old faces and old words (in which study-pairs were recombined). Here as well, participants had to categorize each word for valence. If BIG-congruence causes higher implicit memory descriminability, reaction time should be shorter on old BIG-congruent combinations than on new BIG-congruent combinations; the difference between old and new BIG-incongruent combinations should be smaller.

Method

Participants

The experiment included 47 subjects; 57.45% were female and 42.55% male. Mean age was 26.15 with a standard deviation of 8.22.

Materials

As in experiment 1 and 2 stimuli consisted of face-word pairs. To increase the likelihood that participants would encode face-word combinations, experiment 3 only included half of the 40 faces and half of the 40 words used in experiment 1 and 2 (i.e. 10 attractive faces, 10 unattractive faces, 10 negative words, 10 positive words). Selection of this subset was made anew and randomly for each participant. Faces measured about 7 x 8 cm and words about 0.5 x 2-6 cm (as in experiments 1 and 2).

Old and new congruent and incongruent face-word combinations were then constructed using the scheme that is described in the introduction, anew for each participant. Ten old BIG-congruent and 10 old BIG-incongruent combinations were created by: (1) Randomly dividing each of attractive faces, unattractive faces, negative words, and positive words into two equally large sets; (2) combining attractive faces from set 1 with positive words from set 1 and combining unattractive faces from set 1 with negative words from set 1; (3) combining attractive faces from set 2 with negative words from set 2 and combining unattractive faces from set 2 with positive words from set 2. Ten new BIG-congruent and 10 new BIG-incongruent combinations were created by randomly recombining words and faces within old attractive-positive, old unattractive-negative, old attractive-negative, and old unattractive-positive categories. As in experiment 1 and 2 new combinations thus retained the same BIG-congruence (or incongruence) as old combinations.

A Macintosh computer with a 15’’ monitor running custom software presented stimuli and collected responses. Faces and words were about 7 x 8 cm and 0.5 x 2-6 cm large, respectively.

Procedure

Experiment 3 included a study phase and a test phase, in which trials were presented in one sequence without distraction phase or pauses. At study participants saw 10 blocks each consisting of 10 old BIG-congruent and 10 old BIG-incongruent combinations, the order of combinations varying randomly within blocks. At test, participants saw 4 blocks each consisting of 10 old BIG-congruent, 10 old BIG-incongruent, 10 new BIG-congruent and 10 new BIG-incongruent combinations, presented in random order within each block. Each block in the test phase also included 20 filler trials (see the introduction). The study and test phases thus involved a total of 440 trials in one long coherent sequence. The task was to categorize the word in a face-word pair as positive or negative.

Study trials and test trials included the following events: (1) A fixation cross that appeared in the centre of the screen for 0.5 sec; (2) a face-word pair that remained visible until a response had been made, the face occupying the same position as the fixation cross and the word appearing randomly to the left or to the right of the face; (3) a speeded categorization of the word as negative or positive; (4) a random-length inter-trial interval ranging from 0 to 1 sec.

The experiment started with a written instruction on the computer monitor. Participants were informed that they would see a fixation cross followed by a face-word pair several times and that their task was to look at the fixation cross and to categorize the word as positive or negative by pressing one of two buttons on the computer keyboard as rapidly and accurately as possible. The instruction also explained that the task was rather long, and that they had to try to be attentive throughout the experiment.

Data analysis

Responses to individual trials in the test phase were inspected for errors and outliers. Trials with errors were discarded from all further computations; this resulted in removal of observations from 8.12% of trials on average (*SD* = 11.82). Outliers were then corrected on individual trials by applying the algorithm described in the General methods section (using each participant’s mean and standard deviation); on average 2.72% (*SD* = 0.86) of trials were corrected in this way. Next, means were formed for each participant and condition; these variables were corrected for outliers by applying the standard algorithm (using the group's mean and standard deviation this time). The variable that had the highest number of outliers had 6.38% outliers.

Results and Discussion

Mean RTs from the test phase were entered in a repeated measures ANOVA with test-block (4), material (2: old, new) and congruence (2: congruent, incongruent) as factors. This analysis showed a significant main effect of test-block, F (2.19, 100.87) = 5.21, $p < 0.05$, $\eta^2 = 0.10$, indicating that RTs decreased towards the end of the test phase; see Figure 3. More importantly, there was a significant main effect of material, F (1, 46) = 24.30, $p < 0.05$, $\eta^2 = 0.37$. Reaction-times were longer on new than on old combinations, suggesting that face-word relations had been encoded in memory; see Figure 3. Test block x material did not reach significance, F (3.00, 137.39) = 1.60, $p = 0.19$, $\eta^2 = 0.03$, indicating that memory was more or less preserved across test-blocks.

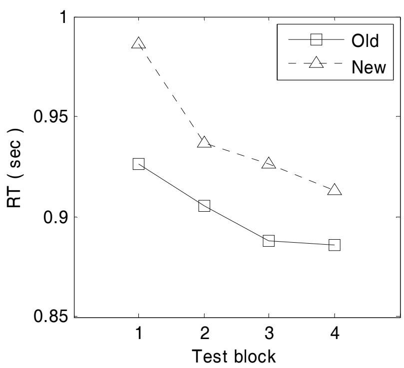

Figure 3. Experiment 3. Difference in RT as a function of material and test-block.

If the main hypothesis is correct, BIG-congruence should cause higher implicit discriminability. The ANOVA in fact yielded a near significant interaction between material and congruence, F (1, 46) = 3.37, $p = 0.07$, $\eta^2 = 0.07$, reflecting a larger difference between old and new congruent combinations than between old and new incongruent combinations; see Figure 4A. Follow-up analyses revealed that latencies on old congruent stimuli were shorter than latencies on old incongruent stimuli, F (1, 36) = 7.94, $p < 0.05$, $\eta^2 = 0.15$, there being no significant difference between new congruent and new incongruent stimuli, F (1, 36) = 0.01, $p = 0.92$, $\eta^2 = 0.00$; see Figures 4C and 4D.

The factorial ANOVA also showed a near significant main effect of congruence, F (1, 46) = 4.04, $p = 0.05$, $\eta^2 = 0.08$. Averaged across the levels of material and test-block, responses were faster on congruent than on incongruent combinations as shown in Figure 4B. Test-block x material x congruence did not reach significance, F (2.47, 113.39) = 0.41, $p = 0.71$, $\eta^2 = 0.01$; neither did test block x congruence, F (2.31, 106.12) = 1.31, p = 0.27, $\eta^2 = 0.03$.

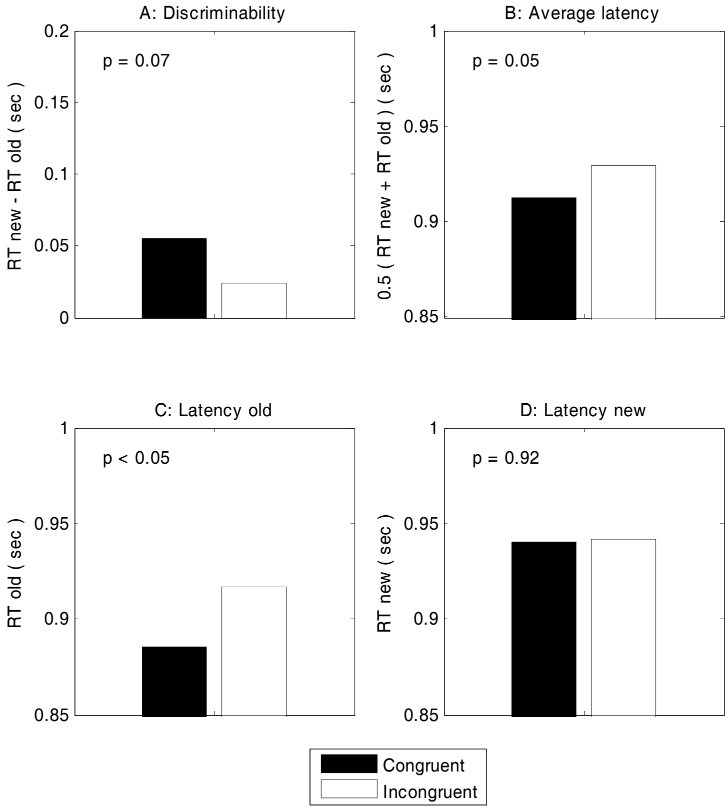

Figure 4. Experiment 3. RTs as a function of material and BIG-congruence.

Experiment 3 thus revealed that combinations consisting of attractive-positive and of unattractive-negative produced more implicit memory than combinations consisting of attractive-negative and of unattractive-positive. We also observed the typical speeding of RT that is seen for stereotype-congruent information in research on implicit attitudes and stereotyping (see Fazio & Olson, 2003 for an overview of such measures). Responding to an attribute-stimulus (e.g. a positive word) is facilitated if a target stimulus (e.g. and attractive face) is presented simultaneously or just before, and if a person has a stereotype that links the attribute to the target.

Despite large differences in how stimuli were encoded and in how memory was measured, experiment 3 thus showed the same pattern of results as experiments 1 and 2. Participants had better memory for positive information about attractive targets and negative information about unattractive targets independently of whether subjective reports or reaction-times were used to measure memory. This finding extends the generality of the conclusions that can be drawn from the present research; i.e. the memorial advantage for information congruent with the physical attractiveness stereotype is not limited to the specific conditions that characterized experiments 1 and 2.

The results of experiments 1, 2 and 3 match the findings from meta-analysis on other stereotypes in showing higher discriminability for evaluatively congruent information than for evaluatively incongruent information. Still, it might turn out that there are particular conditions in which BIG-incongruent information is recognized more accurately than BIG-congruent information, even if this information is evaluatively congruent or incongruent (as opposed to being descriptively congruent or incongruent). If so, this would weaken the induction that information congruent with the physical attractiveness stereotype is more memorable than information incongruent with the physical attractiveness stereotype. Experiments 4 and 5 were thus designed to further challenge the conclusions that we drew from experiments 1, 2 and 3.

EXPERIMENT 4

In experiment 4 we examined if the memorial advantage for BIG-congruent information is affected by the direction of attention at study. When they occur, memorial advantages for stereotypically incongruent information are thought to arise because of an attentionally demanding inconsistency resolution process, whereby perceivers engage in elaborative processing of incongruent information in an attempt to resolve the inconsistency between the information and their beliefs about a target's social group (Crocker, Hannah, & Weber, 1983; Hastie & Kumar, 1979; Klein & Loftus, 1990; Macrae, Bodenhausen, Schloerscheidt, & Milne, 1999; Smith, 1998; Srull, Lichtenstein, & Rothbart, 1985; Srull & Wyer, 1989; Weber & Crocker, 1983; Wyer, Bodenhausen, & Srull, 1984). Congruent information is easily comprehended and does therefore not demand the same amount of elaborative processing. Elaboration, in turn, increases the likelihood that information is encoded into long-term memory.

Attention is a necessary pre-condition for inconsistency resolution; i.e. the cognitively demanding elaborative processing that is connected with inconsistency resolution cannot take place if cognitive capacity is allocated to another task (see Brewer, 1988 for example). Macrae and colleagues (Macrae et al., 1999), for instance, found that articulatory suppression at study (which is less cognitively demanding) led to a memorial advantage for stereotypically incongruent information, but that random digit generation at study (which is more cognitively demanding) led to a memorial advantage for stereotypically congruent information.

Experiments 1 and 2 both used an encoding task that focused attention on the sex of stimulus-persons (and away from the physical attractiveness dimension): participants had to decide whether positive and negative words were applicable to men or women. This might have prevented them from paying attention to the attractiveness-dimension (even if this information was presented in the same spatial position as the information about sex). Similarly, experiment 3 focused attention on the positive and negative attributes that had to be categorized for valence as rapidly as possible. I.e. cognitive resources were directed towards other aspects than BIG-congruence and BIG-incongruence in all experiments. In experiment 4 we manipulated the direction of attention, towards sex or towards the attractiveness-dimension. Attention moderates inconsistency resolution (Brewer, 1988); if inconsistency resolution mediates the effect of BIG-congruence on recognition-sensitivity, then we should find that attention to attractiveness (and valence) leads to higher recognition-sensitivity for BIG-*in*congruent information. That is, when attention is directed towards stimulus aspects that indicate whether information is congruent or incongruent with the physical attractiveness stereotype, inconsistency resolution should be more likely in relation to BIG-incongruent information. Experiment 4 also involved remember and know responses; if a recognition-bias towards BIG-congruent information depends on conscious guessing, correct and false recognition of congruent information should be associated with a higher proportion of know-responses.

Method

Participants

Participants were 40 university students; 70.00 % female and 30.00% male. Mean age was 23.78 with a standard deviation of 5.43.

Materials

Experiment 4 included the BIG-congruent and BIG-incongruent face-word combinations that are described in the introduction. Faces were about 7 x 8 cm large and words about 0.5 x 2-6 cm. A Macintosh computer with a 15’’ monitor running custom software presented stimuli and collected responses.

Procedure

Participants were randomly allocated to receive one of two study-instructions (50.00% in each group) designed to manipulate the direction of attention. In the *attend to sex* condition, they were told that men and women have different traits and that the task was to find out if a given trait is characteristic of men or characteristic of women by deciding if a trait word was compatible with a face or not. In the *attend to attractiveness* condition they were told that attractive and unattractive individuals have different traits and that the task was to find out if a given trait is characteristic of attractive individuals or characteristic of unattractive individuals by deciding if a trait word was compatible with a face or not. At study, participants then saw 20 old BIG-congruent and 20 old BIG-incongruent combinations, one at a time, in random order. Face-word combinations were shown centrally on the computer monitor (randomly face to the left and word to the right or face to the right and word to the left). Response alternatives marked “Yes” and “No” appeared below face-word combinations and participants responded by clicking with the computer mouse at the locations of response buttons.

The distraction phase comprised the 14-item multiple choice vocabulary test described in the introduction.

The test-phase consisted of the same RK task that was used in experiment 2. Instructions informed participants that they should respond “new” if they did not recognize a face-word combination, to respond “remember” if they recognized a combination and could remember what they thought when they saw that combination at study, and to respond “know” if they recognized a combination but could not remember what they thought when they saw that combination at study (Gardiner & Richardson-Klavehn, 2000). Like in experiment 1 and 2 instructions underscored the importance of categorizing combinations and not faces or words as old or new. Participants then saw 20 old BIG-congruent combinations, 20 old BIG-incongruent combinations, 20 new BIG-congruent combinations, 20 new BIG-incongruent combinations and 40 filler trials, one at time, in random order. Face-word combinations appeared centrally (again randomly left-right or right-left) and the response alternatives “new”, “remember” and “know” were shown below face-word combinations. Participants responded with the computer mouse, there being no time-limit.

Data analysis

Outliers were corrected with the algorithm that is described in the introduction. The variable that had the highest number of outliers had 2.50% outliers.

Results and Discussion

A repeated measures ANOVA with material (2: old, new) and congruence (2: congruent, incongruent) as within subjects factors, and instruction (2: attend to sex, attend to attractiveness) as a between subjects factor was performed on proportions of ”old”-responses (i.e. “remember” or “know”). This analysis failed to show a significant interaction between instruction, material and congruence, F (1, 38) = 0.48, $p = 0.49$, $\eta^2 = 0.01$; see Figure 5A. There was, however, a significant interaction between material and instruction, F (1, 38) = 5.76, $p < 0.05$, $\eta^2 = 0.13$. Participants who received the attend to sex instruction generally had higher recognition-sensitivity than participants who received the attend to attractiveness instruction, as shown in Figure 5A.

The ANOVA also revealed a significant interaction between material and congruence, F (1, 38) = 5.46, $p < 0.05$, $\eta^2 = 0.13$. As shown in Figure 5A recognition sensitivity was higher for congruent than for incongruent combinations. Congruence also showed a significant main effect, F (1, 39) = 6.80, $\eta^2 = 0.15$, $p < 0.05$, indicating a recognition-bias towards congruent information; see Figure 5B. Follow up analyses produced a significant main effect of congruence for hits, F (1, 39) = 10.83, $p < 0.05$, $\eta^2 = 0.22$, but not for false alarms, F (1, 39) = 0.52, $p = 0.47$, $\eta^2 = 0.01$; see Figures 5C and 5D.

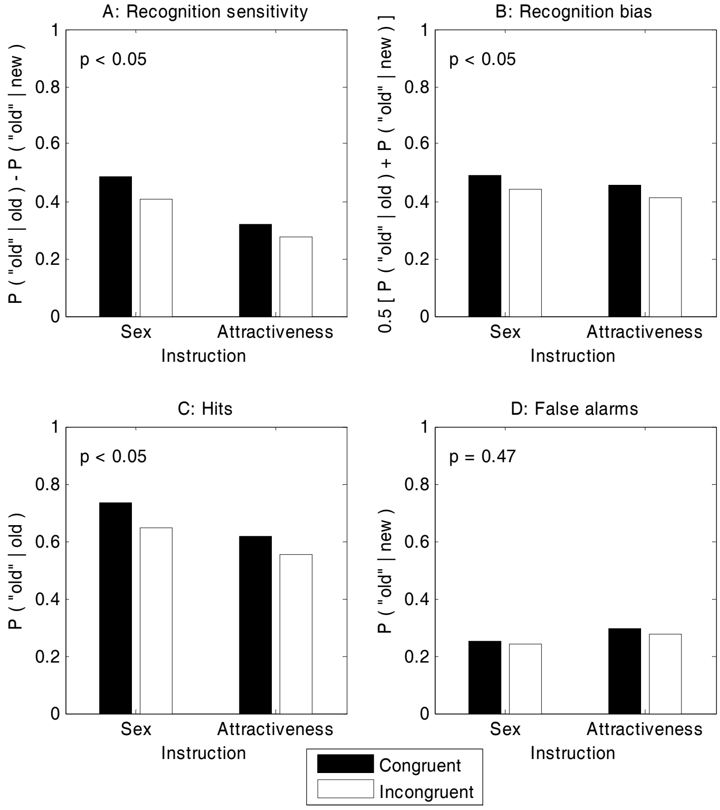

Figure 5. Experiment 4. Recognition sensitivity, hits and false alarms on BIG-congruent and BIG-incongruent stimuli. *Note. P*-values refer to comparisons between BIG-congruent and BIG incongruent combinations on paired samples *t*-tests (two-tailed probability).

We then calculated the proportion of “remember”-responses separately for hits and false alarms as P (“remember”) / [P (“remember”) + P (“know”)]. An ANOVA with material, congruence and instruction as factors only revealed a significant main effect of material, F (1, 33)[11] = 60.04, $p < 0.05$, $\eta^2 = 0.65$. Participants had a higher proportion of remember responses to hits ($M = 0.46$) than to false alarms ($M = 0.21$). There were no significant effects involving material x congruence x instruction, material x congruence, or congruence; F (1, 33) = 1.01, $p = 0.30$, $\eta^2 = 0.03$, F (1, 33) = 2.03, $p = 0.16$, $\eta^2 = 0.06$, and F (1, 33) = 2.16, $p = 0.15$, $\eta^2 = 0.06$, respectively.

Combinations involving attractive-positive and unattractive-negative produced higher recognition sensitivity than combinations involving attractive-negative and unattractive-positive, replicating the results of experiments 1 and 2. Focusing attention on physical attractiveness, rather than sex, at study did not result in higher-recognition sensitivity for BIG-incongruent information[12]. As in experiments 1 and 2, participants showed a recognition-bias favouring information containing

[11] Missing values because of division by zero.

[12] It seems unlikely that adding more participants could render this effect significant given its small magnitude (i.e. $\eta^2 = 0.01$).

attractive-positive and unattractive-negative rather than information containing attractive-negative and unattractive-positive. The recognition-bias was unrelated to the frequency of know-responses; again this excludes the possibility that the bias came about because of conscious guessing. The results of experiment 4 further increase the plausibility of the induction that BIG-congruence is positively related to recognition-sensitivity and the induction that BIG-congruence is positively related to recognition-bias. The memorial advantage for congruent information was obtained even when participants directed their attention towards the attractiveness dimension. Attending to attractiveness should, if anything, maximize the chances for inconsistency resolution. Note, also, that experiment 4 did not contain any secondary task that could have prevented elaborative processing.

Four experiments with a total of more than 100 participants now showed a memorial advantage for BIG-congruent information, using different measures of memory and different encoding-conditions. In experiments 1, 2 and 4 participants also showed more recognition-bias towards BIG-congruent information. Both of these findings mirror the results from meta-analysis which has shown better recognition-sensitivity and more recognition-bias for other evaluatively congruent information (Stangor & McMillan, 1992).

EXPERIMENT 5

In experiment 5 we wanted to examine additional moderators of the effect of BIG-congruence on memory in a further attempt to test the accuracy of the inductive conclusions that BIG-congruent information is more memorable and that BIG-congruent information produces more recognition-bias. Of course, we are painfully aware of the fact that the best inductive conclusions can only be made when a phenomenon is found in an infinite number of conditions. Still, we felt that there were three theoretically important candidate variables that we had left out in experiments 1, 2, 3 and 4.

1) The inconsistency-resolution explanation suggests that people engage in elaborative processing of stereotype-inconsistent (incongruent) information in an attempt to reconcile this information with their pre-existing beliefs (Crocker et al., 1983; Hastie & Kumar, 1979; Klein & Loftus, 1990; Macrae et al., 1999; Smith, 1998; Srull et al., 1985; Srull & Wyer, 1989; Weber & Crocker, 1983; Wyer et al., 1984). This, in turn leads to a memorial advantage for inconsistent information. Even if, in the present experiments, combinations with attractive-positive and unattractive-negative were categorized as congruent, and combinations with attractive-negative and unattractive-positive as incongruent, participants might not have experienced these combinations as congruent respectively incongruent. It seems possible that the elaborative processing that is connected with inconsistency resolution only occurs for information that produces a subjective experience of incongruence. I.e. it might turn out that subjective incongruence leads to more recognition, by causing more elaborative processing, even if (our) a priori BIG-incongruence leads to less recognition. In experiment 5 participants rated the compatibility between faces and words in each trial in the study phase; we examined whether (subjective) compatibility ratings could predict the

probability of hits in the test phase. If subjective incongruence is connected with better memory, subjective incongruence should be positively correlated with the probability of making hits (which is a necessary but not sufficient condition for claiming that something is memorable).

2) The specific rating task that we used in the study phases of experiments 1, 2, and 4 may have had an impact on how long participants studied congruent and incongruent combinations. Participants might have spent longer time encoding congruent combinations for various reasons, which may explain why these combinations were more memorable. In experiment 5 we examined if BIG-congruent information is more memorable even when differences in encoding-time are statistically controlled.
3) Studies that have found a memorial advantage for incongruent information have often used impression-formation instructions (Belmore & Hubbard, 1987; Hastie & Kumar, 1979; Higgins & Bargh, 1987; Macrae et al., 1999; Srull et al., 1985; Stangor & Duan, 1991; Wyer & Gordon, 1982). Experiments 1, 2, 3 and 4 involved other study-goals and this may explain why the present results show an advantage for congruent information. In experiment 5 one group of participants thus received impression-formation instructions.

Method

Participants

Sixty individuals participated in the experiment, 70.00% were female and 30.00% male. They had a mean age of 26.05 years with a standard deviation of 5.96 years.

Materials

As in experiments 1, 2, 4 and 5 stimuli consisted of the BIG-congruent and BIG-incongruent face-word combinations (see the introduction). Faces measured about 7 x 8 cm and words about 0.5 x 2-6 cm. A PC computer with a 17’’ monitor running custom software presented stimuli and collected responses.

Procedure

Participants were randomly allocated to receive one of two instructions (50.00% of subjects in each group). Those in the *baseline* condition were told that people have different traits and that the task was to evaluate if a given trait word was compatible with the individual shown in the image. This information was also repeated once at the end of the instruction text. Those in the *impression-formation* condition were told that people have different traits and that the task was to (1) form an impression of the person in the image by looking at the word, and (2) to evaluate if the trait word was compatible with the individual shown in the image. Here as well, this information (i.e. 1 and 2) was repeated once at the end of the instruction text. At study all participants then saw 20 old BIG-congruent and 20 old BIG-incongruent combinations presented in random order, one by one (see the introduction). Each trial showed one face-word pair centrally together with four response buttons just below, marked with "Very incompatible", "Slightly incompatible", "Slightly compatible" and "Very compatible". These alternatives were coded as 1, 2, 3 and 4, respectively. The position of faces and words was randomized from trial to trial (left-right or right-left). Participants responded by clicking with the computer mouse, taking as much time as they needed.

In the distraction phase, participants went through the 14 item vocabulary test (see the introduction).

For the test-phase participants received the RK-instruction that was used in experiments 2 and 4. They were told to respond "new" if they did not recognize a face-word pair, to respond "remember" if they recognized a pair and could remember what they thought when they saw the pair at study, and to respond "know" if they recognized a pair but could not remember what they thought when they saw the pair at study (Gardiner & Richardson-Klavehn, 2000). The instruction again emphasized that this classification had to be made in relation to face-word pairs and not in relation to individual faces or words. In the test phase participants viewed 20 old BIG-congruent combinations, 20 old BIG-incongruent combinations, 20 new BIG-congruent combinations, 20 new BIG-incongruent combinations and 40 filler trials, one at time, in random order. Face-word pairs were shown centrally on the screen and the position of faces and words (left-right or right-left) was determined by chance in each trial. Response-alternatives ("new", "remember" and "know") appeared below face-word combinations and participants marked one of them with the computer-mouse, taking as much time as they needed.

Data analysis

Outliers were corrected with the algorithm that is described in the introduction. The variable that had the highest number of outliers had 5.00% outliers.

Results

Effects of congruence on time and compatibility-ratings at study

An ANOVA revealed that congruence affected compatibility ratings at study, F (1, 58) = 167.74, $p <$ 0.05, $\eta^2 = 0.74$. Participants rated congruent combinations as more compatible than incongruent combinations (M = 2.70 and M = 2.18, respectively). Congruence also had an impact on how long participants took to make their ratings at study, F (1, 59) = 4.22, $p < 0.05$, $\eta^2 = 0.07$, with congruent combinations taking less time than incongruent combinations (M = 7.02 seconds and M = 7.38 seconds). None of these effects were significantly moderated by type of instruction (form impression or not).

The probability of hits as a function of time and compatibility-ratings

We then examined if the probability of making hits co-varied with compatibility-ratings and study-latencies, and whether congruence affected the probability of making hits when compatibility-ratings and study-latencies were held constant. For each participant we fitted a set of generalized linear models (GLZ, logit-links and binomial distributions) in which individual stimuli (i.e. specific old face-word combinations), rather than participants, constituted cases. A set of regression-coefficients was thus computed for each participant, measuring the degree to which compatibility-ratings and study-latencies were related to the probability of making hits for a participant. Averaged (across participants) un-standardized coefficients were then compared to 0.00 with ordinary single sample *t*-tests. A positive relation between two variables (at the group-level) would be indicated if the mean of coefficients was significantly above zero.

Table 2

Logistic regression functions relating the probability of hits to compatibility-ratings and study-latencies

Model	B		C	
	M	*t*	*M*	*t*
1. $p(\text{"}old\text{"} \mid old) = \frac{e^{A+B(congruence)}}{1+e^{A+B(congruence)}}$	0.27	2.39*		
2. $p(\text{"}old\text{"} \mid old) = \frac{e^{A+B(rating)}}{1+e^{A+B(rating)}}$	0.54	7.22*		
3. $p(\text{"}old\text{"} \mid old) = \frac{e^{A+B(latency)}}{1+e^{A+B(latency)}}$	0.11	5.43*		
4. $p(\text{"}old\text{"} \mid old) = \frac{e^{A+B(congruence)+C(rating)}}{1+e^{A+B(congruence)+C(rating)}}$	-0.03	-0.21	0.58	7.19*
5. $p(\text{"}old\text{"} \mid old) = \frac{e^{A+B(congruence)+C(latency)}}{1+e^{A+B(congruence)+C(latency)}}$	0.30	2.51*	0.11	5.52*

Note. * $p < 0.05$

Table 2 shows the logistic regression-functions that were computed for each participant together with the mean(s) of coefficients associated with each function. Note first that congruent stimuli were more likely to receive hits than incongruent stimuli (model 1). Higher compatibility ratings and longer study-latencies were also connected with a higher probability of making hits (models 2 and 3). When congruence was entered together with compatibility-ratings (model 4), however, the effect of congruence vanished. The function involving mean coefficients from model 4 is shown in Figure 6A. This (and the fact that congruence co-varied with compatibility-ratings in the above ANOVA) suggests that compatibility ratings mediated the effect of congruence on hits (see Baron & Kenny, 1986 for example). Congruent combinations were thus recognized more easily because faces and words in these combinations were subjectively experienced as more compatible. Lower compatibility-ratings (indicating subjective incongruence) at study did not lead to a higher probability of recognition at test.

In model 5, congruence had a significant effect on the probability of making hits, even if congruence was entered together with study-latency (see table 2). Congruent stimuli thus caused more hits than incongruent stimuli even when differences in study-latencies were held constant; see Figure 6B (which shows mean coefficients involved in model 5). The amount of time that participants spent encoding congruent and incongruent combination thus could not account for differences in recognition performance between these combinations.

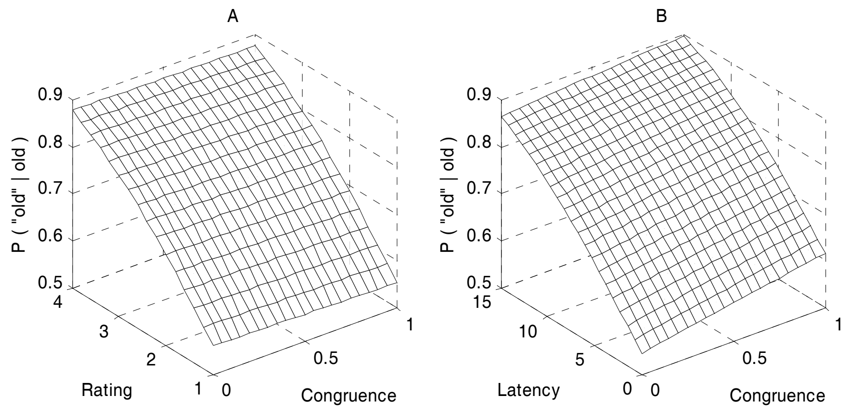

Figure 6. Experiment 5. The probability of hits as a function of compatibility ratings and study-latencies.

Within-subjects effects and impression formation instructions

An ANOVA with material (2: old, new), congruence (2: congruent, incongruent) and instruction (2: form impression, baseline) failed to reveal a significant three-way interaction, F (1, 58) = 0.41, p = 0.53, η^2 = 0.01. Apparently impression-formation instructions did not moderate the effect of congruence on recognition-sensitivity (see Figure 7A). Neither was there a significant interaction involving congruence x instruction, F (1, 58) = 0.07, p = 0.79, η^2 =0.00. Surprisingly, the ANOVA also failed to show a significant interaction between material and congruence, F (1, 58) = 0.40, p=0.53, η^2 =0.01; recognition sensitivity apparently did not vary as a function of congruence. The main effect of congruence was significant however, F (1, 58) = 28.34, p<0.05, η^2 = 0.33; participants had a recognition-bias towards congruent combinations as shown in Figure 7B.

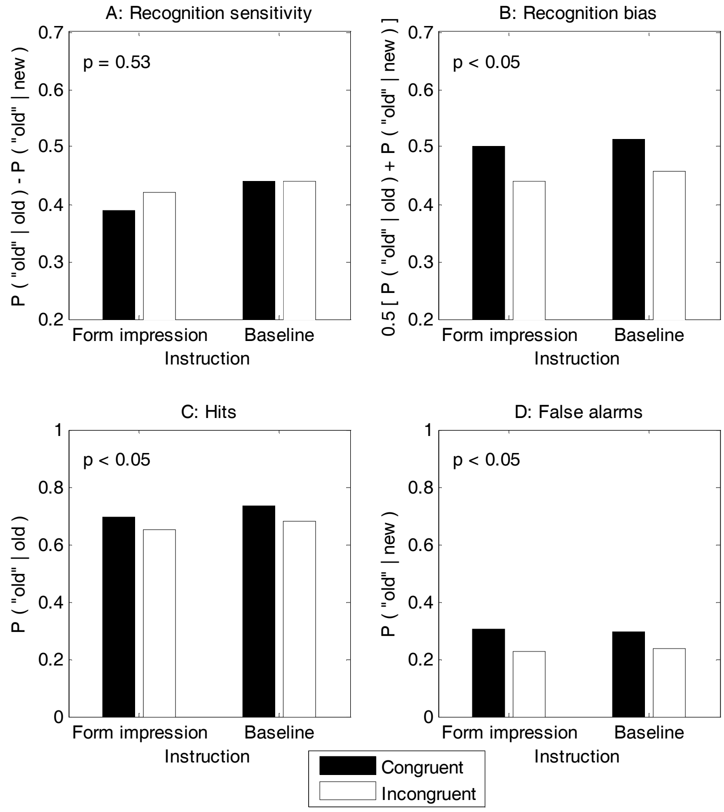

Figure 7. Experiment 5. Recognition sensitivity, hits and false alarms on BIG-congruent and BIG-incongruent stimuli. *Note. P*-values refer to comparisons between BIG-congruent and BIG incongruent combinations on paired samples *t*-tests (two-tailed probability).

Finally, we calculated the proportion of "remember"-responses separately for hits and false alarms: P ("remember") / [P ("remember") + P ("know")]. These proportions were entered in an ANOVA with material and congruence as factors. The ANOVA neither showed an interaction between material and congruence, F (1, 55)[13] = 1.69, p = 0.20, η^2 = 0.03, nor a main effect of congruence, F (1, 55) = 0.61, p = 0.44, η^2 = 0.01. The main effect of material was significant though, F (1, 55) = 166.86, p < 0.05, η^2 = 0.75, indicating that the proportion of remember responses was higher on hits (M = 0.56) than on false alarms (M = 0.23).

Discussion

Experiment 5 revealed the following: (1) Subjective incongruence (as opposed to a priori incongruence) did not lead to a higher probability of recognition; instead, a priori congruence and subjective congruence were both connected with a higher probability of hits. Congruent combinations were rated as more compatible at study and this increased the likelihood that the combinations were recognized at test. (2) A priori congruence led to a higher probability of making hits even if study-

[13] Missing values due to division by zero.

latency was statistically controlled. A memorial advantage for congruent combinations could thus not be accounted for by referring to differences in study-time between congruent and incongruent combinations. (3) Impression formation instructions did not affect memory.

Within-subjects analyses failed to reveal higher recognition-sensitivity for BIG-congruent combinations; information with attractive-positive and unattractive-negative was not more memorable than information with attractive-negative and unattractive-positive. We were surprised by this result, since the effect was reliable in experiments 1-4. Nonetheless, experiment 5 revealed a recognition-bias towards information with attractive-positive and unattractive-negative (rather than towards attractive-negative and unattractive-positive), replicating experiments 1, 2 and 4. Again, the data suggested that the recognition-bias did not result because of conscious guessing, given that the proportion of remember-responses did not vary as a function of BIG-congruence.

GENERAL DISCUSSION

The present studies were designed to address three main questions. (1) How do stereotypes about the goodness of physically attractive people and the badness of physically unattractive people influence the memorability of congruent and incongruent information? (2) How do stereotypes about physical attractiveness affect explicit recognition-bias for congruent and incongruent information? (3) What kind of phenomenological experience is connected with correct and false explicit recognition of congruent and incongruent information?

Regarding 1, the present studies provided mixed results. Experiments 1 - 4 showed a memorial advantage for congruent information; experiment 5, however, failed to show such an effect. To reach a general conclusion we aggregated[14] measures of explicit recognition-sensitivity and implicit discriminability from experiments 1 - 5. This analysis, based on a total of 207 cases, revealed that combinations congruent with the physical attractiveness stereotype were slightly more memorable than combinations incongruent with the physical attractiveness stereotype, F (1, 206) = 16.97, $p < 0.05$, $\eta^2 = 0.08$, $M = 0.16$, $M = -0.16$ respectively. In general then, information that included attractive-positive and unattractive negative was remembered somewhat better than information that included attractive-negative and unattractive-positive.

Regarding 2, we were able to find evidence for an explicit recognition-bias towards information congruent with the physical attractiveness-stereotype in each experiment that examined this variable. Of course, this pattern of results was also evident when we aggregated[15] the data from experiments 1, 2, 4 and 5: F (1, 159) = 60.83, $p < 0.05$, $\eta^2 = 0.28$ ($M = 0.25$ for congruent combinations, $M = -0.25$

[14] Measures of recognition-sensitivity were calculated by subtracting false alarms from hits in experiment 1, 2, 4 and 5. Discriminability, for experiment 3, was computed by subtracting latencies on old combinations from latencies on new combinations. These variables were then transformed to z-scores separately for each experiment before aggregation.

[15] Measures of recognition-bias for experiments 1, 2, 4 and 5 were calculated by taking 0.5 (hits + false alarms). These variables were converted to standard scores separately for each experiment before aggregation.

for incongruent combinations). Combinations with attractive-positive and unattractive-negative thus in general attracted more ”old” responses than combinations with attractive-negative and unattractive-positive, independently of whether the combinations had been shown previously or not. Note that the effect of congruence on recognition-bias was considerably larger (more than 3 times) than the effect of congruence on recognition-sensitivity and discriminability.

Regarding 3, none of the experiments that measured explicit memory showed that correct and false recognition of congruent information was connected with reports of knowing or low confidence. As expected, this conclusion was confirmed by an analysis on aggregated[16] data from experiments 1, 2, 4 and 5. BIG-congruence did not influence confidence and remembering on hits and false alarms, F (1, 148)[17] = 1.52, $p = 0.22$, $\eta^2 = 0.01$ (congruent combinations, $M = 0.07$; incongruent combinations $M = -0.03$). This supports the general conclusion that the recognition-bias towards congruent information did not result because of conscious guessing.

Previous research suggests that other evaluatively congruent information is more memorable and that other evaluatively and descriptively congruent information produces more recognition-bias (Stangor & McMillan, 1992). Taken together, our results are consistent with this general conclusion as we found a memorial advantage for congruent information and a recognition-bias towards congruent information. We now turn to different explanations of the present findings.

Explaining recognition-sensitivity and discriminability

In the introduction we discussed a number of theoretical perspectives that explain the effects of stereotypes on memory performance. These considered various strategies for dealing with stereotypical information when such information is encountered. The present findings can be accommodated by assuming that people are miserly with their cognitive resources or by assuming that they strive for cognitive consistency (Allport, 1954; Festinger, 1957, 1964; Fiske & Taylor, 1991). Information that violates the physical attractiveness stereotype is more difficult to comprehend than information that matches the stereotype. As a consequence, incongruent information receives less attention and elaborative processing than congruent information. People may have a high threshold for deciding to devote cognitive capacity to a given piece of social information when stakes are low (like they were in the present experiments). Encoding information that contradicts the physical attractiveness stereotype may not require large amounts of cognitive resources; still, such information may require more cognitive resources than people are willing to use. As a consequence, congruent information is prioritized. Avoidance of incongruent information also fulfils a need for cognitive

[16] Confidence, in experiment 1, was calculated as P (“quite certain or very certain old”) / [P (“quite certain or very certain old”) + P (“quite uncertain or very uncertain old”]; remembering in experiments 2, 4 and 5 was calculated as P (“remember”) / [P (“remember”) + P (“know”)]. Estimates of confidence and remembering were then averaged across hits and false alarms; in turn, these variables were converted to standard-scores separately for each experiment before aggregation.

[17] Missing values (due to division by zero) resulted in a lower number of cases and a mean of means that is different from zero.

consistency. Incongruent information challenges beliefs about the goodness of attractive people and the badness of unattractive people, consequently, little attention and elaboration is devoted to such information.

The cognitive miser and cognitive consistency principles provide provisional explanations of the present findings; we do not have the ambition to offer a complete account of why information that matches the physical attractiveness stereotype is remembered slightly better. The present studies were designed to examine *if* and *how* stereotypes about physical attractiveness affect memory, not *why* they might affect memory. Indeed our research highlights the importance of looking for potential moderators of the stereotype-memory relation; on a general level, congruent information only had a small impact on recognition-sensitivity in our data.

Explaining recognition-bias

We were able to show a reliable recognition-bias towards information consistent with the physical attractiveness stereotype; this result is in agreement with other research in the field (Fiske, 1998; Stangor & McMillan, 1992). We considered two explanations for a recognition-bias in the introduction: conscious guessing and misattribution of fluency. Our data excludes the guessing explanation: The analysis of aggregated data failed to reveal that hits and false alarms for consistent information were connected with a lower proportion of remember responses or with lower confidence than hits and false alarms for inconsistent information. The data can be explained by referring to misattributions of fluency as one of different possible accounts. According to this explanation, people have mental representations that link attractiveness to positive information and unattractiveness to negative information. Matching information is processed more fluently; fluency is misinterpreted as a sign of conscious memory, resulting in a response-bias towards information that is consistent with the physical attractiveness stereotype.

Speculations about memory, meta-memory and behaviour

Recognition-sensitivity and recognition-bias can be related in interesting ways to interpersonal behaviour and to whether interpersonal behaviour is contingent on past experience or not. Memory retrieval probably affects behaviour, either by merely activating certain mental content or by informing conscious behavioural decision-making (Bargh, 2005; Dawes, 1998; Dijksterhuis & Bargh, 2001; Prinz, 1997). Assume that this is the case and that behaviour is consistent with the content of recollection (i.e. positive memories produce positive behaviours, etc). Recognition-sensitivity, measuring how accurately past social events are retrieved should, therefore, be indicative of the extent to which present behaviour is contingent on actual past experiences. I.e. the likelihood that present behaviour depends on past experience should increase when recognition-sensitivity increases. If positive information about attractive people and negative information about unattractive people is recognized more accurately and if memory affects behaviour in this way, past positive experiences with attractive people and past negative experiences with unattractive people should be more likely to produce present congruent behaviour than past negative experiences with attractive people and past positive experiences with unattractive people.

Recognition-bias, instead, is by definition recollective experience that is independent of what actually happened. If recognition-bias affects behaviour, by merely activating mental content or by informing conscious decision-making, recognition-bias should be indicative of the extent to which present behaviour is non-contingent on past events. Assume that people have a recognition-bias towards information congruent with the physical attractiveness stereotype and that this results in consistent behaviours (i.e. recognition-biases for positive information produce positive behaviours). A recognition-bias towards positive information about attractive people and negative information about unattractive people, suggests that positive behaviour towards attractive people that is non-contingent on past events is more likely and that negative behaviour towards unattractive people that is non-contingent on past events is more likely; compared to negative behaviours towards attractive people and positive behaviours towards unattractive people.

It is also worthwhile to reflect on how the memory-behaviour relation might be moderated by confidence and remembering (as opposed to knowing). In situations where memory guides conscious behavioural decision-making and overt behaviour, retrieved information should have a stronger impact on behaviour when people are confident about their recollection. I.e. people should be more likely to engage in overt behaviours that they believe are based on accurate decisions and more likely to trust decisions that they believe are based on accurate memory-retrieval. Confidence in memory accuracy probably plays a smaller role when retrieval affects behaviour by mere activation of mental content. Even recollections that people are uncertain about might instigate the priming that is thought to result in automatic behaviour in certain situations.

These hypothetical arguments can be used to understand why attractive individuals are treated more favourably than unattractive individuals. It seems probable that such memory-biases play an important role in interpersonal behaviour.

Conclusions

The present research suggests that people believe that they remember information that matches the physical attractiveness stereotype, independently of whether they encounter such information or not. This can explain why physically attractive individuals are treated more favourably than physically unattractive individuals. Stereotypes involving physical attractiveness may exert their effects on behaviour through biases in person-memory.

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