



Face-based categorization, context-based categorization, and distortions in the recollection of gender ambiguous faces ☆

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Abstract

In three studies, we examined the impact of face-based and context-based categorization in the recollection of gender ambiguous faces. Gender ambiguous faces were created by morphing male and female source faces. In Study 1, the recollection of moderately ambiguous faces (i.e., 70% male–30% female faces and 70% female–30% male faces) was accentuated towards face distracters that were more typical of the spontaneous (i.e., face-based) categorization of these faces. In Study 2, the recollection of extremely ambiguous faces (50% male–50% female faces) was accentuated towards face distracters that were more typical of the gender category suggested by context cues attached to these faces prior to the face presentation. Study 3 relied on the same design as Study 2, but this time context cues were provided after face encoding. In line with predictions, no accentuation effect emerged under the latter conditions. The theoretical and practical implications of these findings are discussed.

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Introduction

Face memory is of utmost importance in everyday life. Accurate face memory allows individuals to recognize their relatives, friends, and colleagues, the people they like and those they would rather avoid. In sum, face memory is a prerequisite for individuals to behave appropriately in their social environment. Face memory, however, is not immune to biases, whose consequences may be disastrous, in particular in the context of eyewitness testimonies. Mistaken identification

seems to be responsible for more wrongful convictions of innocent people than all other causes combined (Wells et al., 1998). As a matter of fact, the recent use of DNA analyses by forensic scientists exonerated numerous innocents who had been jailed on the basis of inaccurate eyewitness testimonies. The consequences of face memory for people's social adjustment point to the necessity of better understanding the biases that impair face recollection and identification. In the present research, we focused on the impact of categorization on the recollection of gender ambiguous faces. We hypothesized that the recollection of gender ambiguous faces would be distorted towards faces more typical of the female (male) category when considered as belonging to the female (male) category. We also investigated the impact of both face-based and context-based categorization of the faces in driving memory distortions. Finally, we examined the impact of context cues provided before and after face encoding.

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Accentuation effects in perception, judgment, and memory

Accentuation effects due to categorization have received extensive attention in cognitive and social psychology. Overall, this literature shows that the categorization of stimuli that vary from each other by constant amounts on a given continuum enhances the perception of differences for cross-category stimuli and the perception of similarities for within-category stimuli. Classic work on categorical perception (e.g., Harnad, 1987) has shown that people discriminate better between cross- than within-category stimuli. For instance, keeping constant the physical differences that exist between two hues, people discriminate better between two hues that belong to two different colors than to a same one (e.g., Bornstein & Korda, 1984).

Earlier work in social psychology provided converging findings at the level of physical estimates (Tajfel & Wilkes, 1963; see also Corneille, Klein, Lambert, & Judd, 2002). This general accentuation principle was applied to a host of physical and social judgments, including body weight (Krueger, Rothbart, & Sriram, 1989), personality traits (Krueger & Rothbart, 1990), and attitudes (Eiser & Stroebe, 1972; Eiser & Van-der-Pligt, 1982; McGarty & Penny, 1988). As a whole, this literature suggests that categorization not only derives from, but also alters the perception of similarities and differences between objects (e.g., Corneille & Judd, 1999; Goldstone, 1994, 1995; Livingston, Andrews, & Harnad, 1998).

Surprisingly, only a few studies investigated the impact of categorical accentuation on memory in general, and face memory in particular. As an exception, Krueger and Clement (1994) found that people overestimate temperature variations between different months of the year and underestimate those variations within a same month. Studies conducted under the 'Who-saidwhat' paradigm (Taylor, Fiske, Etcoff, & Ruderman, 1978) also revealed that people are more likely to misattribute a statement to within- than to cross-category individuals. For example, one would more readily misattribute a statement issued from a male speaker to another male than from a male speaker to a female speaker (and the opposite for a female speaker). This literature, however, did not examine face memory effects per se, and did not provide either evidence for accentuation effects in face memory.

Accentuation effects in face memory

Recently, however, a few studies have started to examine accentuation effects in the context of face memory. For instance, Halberstadt and Niedenthal (2001) investigated accentuation effects in the memory of facial expressions and showed that faces conceptualised in terms of anger or happiness are later remembered as displaying these emotions more widely than they actually

did. Closer to our present research interest, using a morphing procedure, Corneille, Huart, Béquart, and Brédart (2004) showed that race ambiguous faces are recollected as more typical of their race category than they actually are. Specifically, these authors generated target faces lying at 30, 50, and 70% on continua involving face endpoints from two different ethnic categories (e.g., ethnic categories A and B). In a recollection task, participants were then presented with the previously seen target faces along with face distracters that were located closer to the A and B endpoints of the continua (i.e., faces that were more typical of the A and B categories than the target faces were). The task of the participants was to select the previously seen target faces among the distracters. The findings revealed that, when initially presented with a 30% target face (i.e., a face mostly composed of the A source face), participants were more likely to select distracters that were closer to the A source face (i.e., a 20% morphing distracter) than distracters that were closer to the B source face (i.e., a 40% morphing distracter). Conversely, when initially presented with a 70% target face (i.e., a face mostly composed of the B source face), participants were more likely to select distracters that were closer to the B source face (i.e., an 80% morphing distracter) than distracters that were closer to the A source face (i.e., a 60% morphing distracter).

The memory distortion effect reported by Corneille and colleagues (2004) was obtained on ambiguous Caucasian, Asian, and North African faces. This effect emerged with high levels of confidence and lasted over a period of one week. Additional findings confirmed that this accentuation effect related significantly to the participants' categorization of these faces. Hence, faces categorized as either Caucasian, Asian or North-African were recollected as being, respectively, more Caucasian, Asian or North-African than they actually were. Finally, this effect was shown to be independent from a mere distortion of memory towards distinctive or unmorphed faces. Indeed, recollections could have been distorted towards faces more extreme on the continua not because of accentuation effects, but because those faces were somewhat more distinctive (Rhodes, Byatt, Tremewan, & Kennedy, 1997), or simply because of morphing artefacts. Two studies, comparing recollections of faces morphed on continua that involved source faces from either different categories or from a same one, allowed ruling out these alternative accounts of data. Indeed, stronger memory distortions were obtained when the source faces were from two different ethnic categories than when they were from a same one.

The prediction that face recollection may be distorted towards more typical ethnic faces was based on the general idea that people rely on category and schematic information in the recollection process. In particular,

Huttenlocher and her colleagues (Huttenlocher, Hedges, & Duncan, 1988; Huttenlocher, Hedges, & Vevea, 2000; see also Bartlett, 1932; Brewer & Nakamura, 1984) proposed a model of episodic memory according to which two kinds of information are encoded when presented with a stimulus: fine-grained information inherent to the stimulus and categorical information self-generated by the perceiver. The poorer the encoding or storage of the fine-grained information, the more likely people are to combine this information with category information at recollection (categorical information will suffer of a slower rate of forgetting than item information; see Dorfman & Mandler, 1994). This process was coined “weighting with a prototype” by Huttenlocher and colleagues.

As just explained, the general notion conveyed by this model is that categorical information is spontaneously attached to a stimulus at the encoding stage, which will be combined to fine-grained information at recollection, resulting in recollection distortions towards exemplars more typical of the category. This model was applied to basic stimuli so far (e.g., the localization of dots in a circle), but it is defined as a general model of episodic memory, and there is therefore no reason why it should not apply to more complex stimuli (Corneille et al., 2004), and to other kinds of percepts (Stern, Corneille, Huart, & Mullennix, 2004).

Face-based and context-based accentuations in face memory

In studies by Corneille and colleagues (2004), accentuation effects were expected to emerge as a function of face-based categorization for moderately ambiguous faces (i.e., 70% Caucasian, Asian, and North African faces), and as a function of context-based categorization for extremely ambiguous faces (i.e., 50% Caucasian–Asian faces and 50% Caucasian–North African faces). Specifically, the authors predicted that participants would spontaneously categorize *moderately ambiguous* race faces according to the features *inherent* to these faces. In contrast, they predicted that participants would actively seek out *context* cues, such as social information externally associated with a face, to figure out the race of an *extremely ambiguous* race face. Whatever the cues used for categorizing, in both cases categorization was expected to result in recollection distortions consistent with the category assigned to the stimuli (i.e., an accentuation effect).

Whereas strong empirical support was obtained for the first prediction (i.e., accentuation effects due to face-based categorization of moderately ambiguous faces), the authors repeatedly failed to obtain any support for the second prediction (i.e., accentuation effects due to context-based categorization of extremely ambiguous faces). For instance, participants who were exposed to a

50% Caucasian–North African face were insensitive to social information suggesting that this face was that of a Caucasian (e.g., François) or North African (e.g., Mohammed) person. The context information associated with these extremely ambiguous faces had no impact on the categorization and later recollection of this face, irrespective of whether this information was delivered before, during, or after the face presentation, and irrespective of the nature of this information (e.g., stereotypic information, ethnic label attached to the face).

To explain the absence of effect of context information, Corneille et al. (2004) speculated that the extremely ambiguous race faces they used may have been spontaneously assigned to a *third* race category that appeared inconsistent with the context information associated with these faces. For instance, participants may have been reluctant to categorize a 50% Caucasian–50% North African face in any of these two categories, simply because these had spontaneously assigned these faces to a *third* ethnic category (e.g., Hispanic, South Italian) which had little to do with the social information provided about it.

If this reasoning is correct, then social information externally attached to extremely ambiguous faces may influence the categorization and recollection of these faces in the context of continua that exclude the presence of intermediate categories. We thought that gender was a good candidate here as gender obviously involves only two exclusive categories.

Overview of the studies

The assumption that continua of gender ambiguous faces would elicit more category exclusivity than the continua of race ambiguous faces examined in Corneille et al. (2004) was tested in the pilot study of the present paper. This was a prerequisite for investigating accentuation effects due to context-based categorization in face memory (Studies 2 and 3), since we reasoned that context-based accentuation towards face continua endpoints should be observed for faces varying on dimensions that exclude intermediate categories. Then, we report three studies concerned with the impact of face-based (Study 1) and context-based (Studies 2 and 3) categorization in the recollection of gender ambiguous faces.

In Study 1, we sought to test for the generality of Corneille and colleagues (2004)’s findings in the context of new, socially relevant, and highly familiar, face categories, i.e., gender faces. Participants were exposed to moderately or extremely ambiguous faces created by a morphing program. We predicted that moderately male faces (i.e., 30% female–70% male faces), and moderately female faces (i.e., 30% male–70% female faces), would be spontaneously categorized on the basis of their prevalent

gender features. Hence, we anticipated that the recollection of moderately female (male) faces would be accentuated towards faces more typical of the female (male) category. No systematic classification, and therefore no systematic distortion, was expected for extremely ambiguous faces (50% male–50% female faces) in these conditions.

In Study 2, we sought to test for the possibility of context-based distortion effects in the recollection of gender ambiguous faces. We predicted that the categorization of an extremely ambiguous face would reveal assimilation to the gender information communicated prior to the face presentation. As classically shown in priming studies, people are known to rely on relevant cues that are accessible to them when facing uncertain categorization tasks (for a review, see Higgins, 1996). In turn, we anticipated that an extremely ambiguous gender face would be recollected as more male (female) than it actually was, when previously associated with a male (female) gender information.

In Study 3, we aimed to test for the idea that accentuation effects due to context-based categorization operate only when the context information is presented at the pre-encoding stage. As explained before, Huttenlocher and colleagues' model posits that people *spontaneously* generate categorical information at the encoding. If so, context information that comes after the face encoding should have little impact on the categorization/recollection of a face. Indeed, people may have a very difficult time challenging retrospectively the category information they spontaneously attached to the face as they first saw it (a self-generated categorization of the face which may, in addition, have little to do with gender in the case of extremely ambiguous gender faces).

Study 3 relied on the exact same design as Study 2, except that gender information was this time delivered *after* exposure to the face. If we correctly assume that self-generated categorization takes place spontaneously at face encoding, then no impact of context information delivered after face encoding should be observed on face categorization and recollection measures. Because Study 3 basically tested for a null hypothesis, we increased the *N* size by 60% between Studies 2 and 3. Direct comparisons were also made between the two studies, in which we examined the impact of context information timing in the categorization and recollection of extremely ambiguous faces.

Pilot study

Participants, procedure, and materials

Thirty-six undergraduate students at the Catholic University of Louvain, Louvain-la-Neuve, were contacted on an individual basis. They were presented with one extremely ambiguous race face and one extremely ambiguous gender face (in a counterbalanced order).

They were asked to report what they thought was the gender and nationality (or origin) of each of these two faces. The materials consisted in the extremely ambiguous race faces created by Corneille et al. (2004; i.e., four 50% Caucasian–50% North African faces, and four 50% Caucasian–50% Asian faces), as well as the four extremely ambiguous gender faces (i.e., 50% Female–50% Male faces) used in the studies of the present paper, which are described in details in Study 1.

Results and discussion

Depending on participants' response profile, we assigned them into one of three categories. In the first one, participants could assign both gender and race ambiguous faces to one of the source faces categories (e.g., the gender ambiguous face categorized as female, and the Caucasian–North African face categorized as North African). In the second, the gender ambiguous face could be attributed one of the source faces categories, whereas the race ambiguous face could be attributed a new face category (e.g., the gender ambiguous face categorized as female, and the ambiguous Caucasian–North African face categorized as Hispanic). Finally, in the third, the race ambiguous face could be assigned to one of the source faces categories, whereas the gender ambiguous face could be assigned to a new face category. The observed frequencies for these three categories of responses were respectively 22, 14, and 0, $\chi^2(2) = 20.67$, $p < .01$. Thus, in line with predictions, the extremely ambiguous race faces used by Corneille and colleagues (2004) were frequently assigned to an intermediate category (i.e., Caucasian–North African faces were sometimes categorized as South Americans, Poles, Spanish, or Italians; Caucasian–Asian faces were sometimes categorized as South Americans, North Africans, Spanish, or Italians), whereas extremely ambiguous gender faces were always (not surprisingly) categorized either as male or female.

Study 1

Study 1 examined the possible emergence of accentuation effects due to face-based categorization in the recollection of extremely ambiguous faces. Participants were exposed to faces that were 30, 50, or 70% composite of male and female source faces. Our prediction was that participants' recollection of the face would be accentuated towards distracters more typical of the gender category self-generated about the face. That is, a moderately female face (i.e., a 30% male composite) should be recollected as more female-like than it was, whereas a moderately male face (i.e., a 70% male composite) should be recollected as more male-like than it was. No systematic distortion was expected for the most ambiguous gender faces.

Method

Participants and design

Sixty-nine undergraduate students at the Catholic University of Louvain, Louvain-la-Neuve, took part in the experimental session in return for partial course credit. They were run in collective sessions (maximum eight people) and were randomly assigned to one of the three conditions defined by degree of Morphing (faces were lying at 30, 50, or 70% on a female-male continuum) as a between-subjects factor.

Materials

Four different continua of faces, going from a female source (0% face) to a male source face (100% face), were created using a morphing program (i.e., Morphman). The source faces were borrowed from Baudouin and Tiberghien (2002). The background of the images was white and their size was equalized. The faces, whose hair was yet removed, were cleaned for each visible characteristic that may attract participants' attention such as beauty spots. The target faces were located either at 30% (faces moderately typical of the female category), 50% (extremely ambiguous faces), or 70% (faces moderately typical of the male category) on the four different female-male continua. Four distracters were used in the identification task, which were located 10 and 20% closer to the female source face, and 10 and 20% closer to the male source face, than the target face was. Thus, the distracters in the 30% condition (i.e., moderately female face) lay at 10, 20, 40, and 50% of the female-male continua. The distracters in the 50% condition (i.e., extremely ambiguous face) lay at 30, 40, 60, and 70% of the female-male continua. Finally, the distracters in the 70% condition (i.e., moderately male face) lay at 50, 60, 80, and 90% of the female-male continua. The distracters and the target faces were printed out in a grey mode and were used in card formats, which could be randomly presented during the recognition task. An example of female-male continuum is attached to the present paper (see Appendix A).

Procedure

Participants were presented with an experimental booklet and were asked to proceed without going back and forth in the booklet. The procedure consisted of a learning task, a distraction task, and an unexpected identification task followed by a categorization task.

Learning task. The study was presented as an investigation on impression formation. Participants were presented with one target face that they were instructed to examine attentively. They were asked to form an impression about the person on the basis of the face.

Distraction task. Participants read an article about city traffic, and filled out a questionnaire on this article.

Then, they completed an impression formation task, in which they were asked to describe a typical day in the target's life. At this point, participants did not expect any recollection task.

Unexpected identification task. Participants were presented with five faces, the original face and the four distracters. The faces were presented simultaneously in a random pattern. Participants were asked to single out the face they had previously seen, and to report how confident they were in their choice (from 0% = Not at all confident, to 100% = Totally confident).

Categorization task. We asked participants to report how they had spontaneously categorized the face. They had first to select a general category (male or female). Then they were asked to refine their judgment by selecting one of the four following propositions: masculine male-feminine male-masculine female-feminine female.

Results and discussion

First, as a manipulation check, we examined the impact of the Morphing factor on the categorization of the faces. This effect was significant, $Chi_2(2) = 29.54$, $p < .01$. Specifically, 30% faces were categorized more frequently as female than as male faces, $Chi_1(1) = 9.78$, $p < .01$, the reverse was true for 70% faces $Chi_1(1) = 20.16$, $p < .01$, and categorizations were balanced for the 50% faces $Chi_1(1) = 0$, *ns*.

Forty-two participants failed to select the correct face during the identification task. Participants' responses were recoded into an index indicating the direction and the importance of their distortion. Selections of 20% female, 10% female, 20% male, and 10% male distracters were respectively given a -2, -1, +2, and +1 value on this distortion index. Correct identifications of the target face were given a 0 value.

As predicted, we found a main effect of the Morphing factor on the distortion index, $F(2, 68) = 9.89$, $p < .01$, with distortions towards the female source face in the 30% condition ($M = -1.04$, $SD = 0.88$), towards the male source face in the 70% condition ($M = 0.29$, $SD = 1.08$), and intermediate distortions for the 50% faces ($M = -0.27$, $SD = 1.12$). Additional analyses confirmed that the distortions depended on participants' self-reported categorization of the faces. Faces categorized as feminine female, masculine female, feminine male, and masculine male were respectively given a score of 1, 2, 3, and 4. This categorization index was strongly associated with the distortion index, $r = .49$, $p < .01$.

Finally, participants appeared to be very confident in their identifications ($M = 73.63$, $SD = 13.61$). Confidence was higher for correct ($M = 78.037$, $SD = 11.51$) than incorrect identifications ($M = 70.731$, $SD = 14.22$), $t(66) = 2.23$, $p < .03$, and participants were more

confident when erroneously selecting a female ($M=74.96$, $SD=10.02$) than a male ($M=62.57$, $SD=7.68$) distracter, $t(39)=2.876$, $p<.01$.

Thus, the findings obtained in Study 1 offer an original demonstration for the impact of face-based categorization effects in the recollection of gender ambiguous faces. As in Corneille and colleagues (2004), the high levels of confidence obtained in the present study suggest that memory distortion occurred rather than mere recollection guessing.

Study 2

Study 2 examined the possible emergence of accentuation effects due to context-based categorization in the recollection of extremely ambiguous faces. Participants were exposed to one morphed face (50% male–50% female) along with a first name. According to recent work by Baudouin and Tiberghien (2002), this information is sufficient to manipulate the categorization of a gender ambiguous face. Our prediction was that participants' recollection of the face would be accentuated towards a face more typical of the gender category suggested by the first name.

Method

Participants and design

Thirty undergraduate students at the Catholic University of Louvain, Louvain-la-Neuve, took part in the experimental session in return for partial course credit. They were run in collective sessions of 10 people and were randomly assigned to one of the two conditions defined by the gender of the first name (feminine versus masculine) as a between-subjects factor.

Materials and procedure

We used the pictures created for the 50% (half male/half female) condition in Study 1. The first name were those used by Baudouin and Tiberghien (2002), namely "Jean" (i.e., John in English) and "Marie" (i.e., Mary in English). The procedure was the same as in Study 1, except that a first name was associated with the face prior to the face presentation. Specifically, participants were told that they would be presented with a picture of Jean or Marie, depending on the name condition, and they were then exposed to a face. As in Study 1, participants had to single out the original face among four distracters in the unexpected identification task.

Results and discussion

The categorization of the faces was sensitive to the first name factor, $Chi_2(1) = 16.13$, $p<.01$. The results are perfectly symmetric: 13 out of the 15 Ps presented with a target face called 'Jean' categorized it as male, and 13

out of the 15 Ps presented with a target face called 'Marie' categorized it as female. In both cases $Chi_2(1) = 8.067$, $p<.01$.

Twenty-four of the 30 participants failed to select the correct face among the four distracters. As in Study 1, participants' identifications were recoded into an identification score. Selections of 20% female, 10% female, 20% male, and 10% male distracters were respectively given a value of -2 , -1 , $+2$, and $+1$ on this distortion index. Correct identifications of the target face were given a 0 value. As predicted, this score was smaller for a female first name ($M=-0.73$, $SD=0.96$) than for a male first name ($M=0.93$, $SD=1.28$) associated with the face, $t(28)=4.03$, $p<.001$. As in Study 1, additional analyses confirmed that participants' categorization and identification of the faces were significantly associated with each other, $r=0.48$, $p<.01$. Also, participants were quite confident in their identifications ($M=74.87$, $SD=16.78$), and confidence was neither influenced by the accuracy of the identifications nor by the nature of the distracter selected, $F_s < 1$.

The data obtained in Study 2 offer an original demonstration for the impact of context-based categorization effects in the recollection of gender ambiguous faces. As in Study 1, the high levels of confidence obtained in this study suggest that memory distortion occurred rather than mere recollection guessing.

Study 3

The aim of Study 3 was to provide preliminary evidence that accentuation effects due to context-based categorization operate when the context information is presented before face encoding. Context information indicative of gender, when made accessible, may influence the categorization and later recollection of a gender ambiguous face (Study 2). In contrast, assuming people spontaneously categorize the face stimuli at encoding, then context information delivered after face encoding should play little role in the categorization and recollection process. This is because people should have a hard time revising and cancelling their spontaneous categorization of the face, and should generally feel more confident about self-generated than context-generated information related to ambiguous stimuli (Mussweiler & Neumann, 2000).

The reasoning for Study 3 was straightforward. We replicated the Study 2 design, but this time we communicated the first name of the face after the face exposure. If we correctly assume that the gender information exercises its influence on categorization at the encoding stage, no systematic effect should be obtained when gender information is delivered after participants' exposure to a face, when automatic categorization has already taken place.

Because we basically predicted the null hypothesis in Study 2, we thought it was important to rely on a larger sample size than that in Study 2. Therefore we increased the N size by 60%. Direct comparisons between Studies 2 and 3 are also reported in the Results.

Method

Participants, design, procedure, and materials

Forty-nine undergraduate students at the Catholic University of Louvain, Louvain-la-Neuve, took part in the experimental session in return for partial course credit. They were run in collective sessions of eight people and were randomly assigned to one of the two conditions defined by the first name (feminine versus masculine) as a between-subjects factor. The materials and procedure were the same as in Study 2, except that the first name was mentioned to the participants after the presentation of the target face.

Results and discussion

We anticipated no impact of the gender information in this study. Consistent with this expectation, the first name associated with the face had no impact on the face categorization, $Chi(1) = 0$, $p = 1$ (one participant gave no categorization). In each name condition, faces were significantly more often categorized as males ($N = 17$) than as females ($N = 7$), $Chi(1) = 4.16$, $p < .05$. Twenty-nine out of 49 participants failed to select the correct face among the four distracters. As in Studies 1 and 2, participants' identifications were recoded into an identification score. Selections of 20% female, 10% female, 20% male, and 10% male distracters were respectively given a value of -2 , -1 , $+2$, and $+1$ on this distortion index. Correct identifications of the target face were given a 0 value. As predicted, this score does not differ when a female first name ($M = -0.25$, $SD = 0.79$) or when a male first name ($M = -0.12$, $SD = 1.01$) was associated with the face, $t < 1$.

Contrary to Studies 1 and 2, participants' gender categorization and recollection of the faces were not associated with each other, $r = .09$, $p = .51$. This should not be interpreted as evidence that categorization effects played no role in the recollection of the faces in this study. Rather, and as aforementioned, we may reasonably assume that participants in the present study used gender-unrelated categorization basis when encoding these gender ambiguous faces (e.g., attractiveness, skin appearance, or general head shape may have driven the categorization process). Consistent with this reasoning is the large number of errors obtained in Study 3, as well as the level of confidence participants had in their recollection. As in Studies 1 and 2, participants were confident in their identifications ($M = 76.33$, $SD = 15.54$), and confidence was neither influenced by the accuracy of the

identifications nor by the nature of the distracter selected, $F_s < 1.47$, *ns*.

Finally, because Studies 2 and 3 differed only in the timing of the context information manipulation, and to the extent both studies were run in close lab and time conditions, we thought it was informative to use a study factor as a proxy for the effect of the timing of the context information (before versus after the face presentation) on categorization and recollection measures. In line with our reasoning, timing moderated the impact of the first name on the categorization of the faces. The categorization of the faces was more likely to be consistent with the first name attached to it when this name was communicated before (i.e., 26 categorizations consistent with the name out of 30 judgments) than after (i.e., 24 categorizations consistent with the name out of 48 judgments) face exposure, $Chi(1) = 10.78$, $p < .01$. Also consistent with predictions, timing moderated the impact of the face name factor on the face recollection distortion score, $F(1, 78) = 10.98$, $p < .01$. Thus, in full support to our predictions, context information externally attached to an extremely ambiguous face was more likely to impact on the categorization/recollection of this face when presented before than after face encoding.

Interestingly, misidentifications turned out to be marginally less frequent in Study 3 (i.e., 29 mistakes out of 49 identifications) than in Study 2 (i.e., 24 mistakes out of 30 identifications), $Chi(1) = 3.65$, $p = .056$. Thus, categorical information delivered prior to face encoding not only biases face recollection towards more typical category exemplars: it also tends to increase the overall number of misidentifications. This finding points to the detrimental impact of context information on face memory.

General discussion

In the three studies reported here, we provided evidence for accentuation effects in the recollection of gender ambiguous faces. Study 1 generalized the accentuation effects due to face-based categorization reported by [Corneille and colleagues \(2004\)](#) from races to the recollection of moderately ambiguous gender faces. This generalization represents a first noticeable outcome of the present research, as people have high expertise in processing faces from different genders. A second important message from the present research is that the categorization and recollection of extremely ambiguous gender faces proves sensitive to context information. Specifically, a same face can be misrecalled either as more male or more female, depending on the gender information attached to it (Study 2). Importantly, however, and this represents a third original outcome from this research, context information will influence the categorization and subsequent recollection

of extremely ambiguous gender faces when communicated prior to (Study 2), but not after (Study 3), face encoding. The later finding provides support to the view that people's recollection is biased towards the more typical exemplars of the categories that are elicited at the encoding stage, which seems consistent with the model by Huttenlocher et al. (1988, 2000) and with recent work on face recollection by Halberstadt and Niedenthal (2001), and Eberhardt and colleagues (2003).

Incidentally, the later finding also allows ruling out an experimental demand account of the accentuation effects due to context-based categorization obtained in Study 2. Indeed, a careful reader may have argued that the procedure used in Study 2 was so transparent that participants selected a distracter which they thought conformed to the experimental demands. If this had been the case, then the findings obtained in Study 2 should have been replicated when the first name was communicated after the exposure to the face. As we have seen, this clearly was not the case.

Finally, our results indicate that categorical information delivered prior to face encoding not only biases face recollection towards more typical category exemplars but also increases the overall number of misidentifications, revealing the detrimental impact of context information on face memory. Below, we discuss the theoretical and practical implications of this set of findings.

Theoretical implications of the present findings for face memory

Taken as a whole, the present findings do not only point to the powerful impact of categorization in biasing face recollection. They also seem to provide information about how people organize race and gender information in face memory. Specifically, the various findings discussed in this contribution suggest that face representations in memory are more likely to vary in a continuous manner between two faces from different gender than between two faces from different races. In the case of intergender continua, stimuli lying at the category boundaries are clearly associated with one of the two source faces categories (i.e., "Masculine female face" may be evoked upon encountering a face morphed between a Female and a Male face). In the case of interethnic continua, however, stimuli lying at the category boundaries may be associated with a third, intermediate, ethnic category (e.g., "Hispanic" may be evoked upon encountering a face morphed between Caucasian and North African source faces).

This should *not* suggest that representations never evolve continuously between faces from different races. Clearly, faces from different races sometimes exclude intermediate race categories, and evolve continuously between the endpoints of a continuum. Under these

circumstances, context information can be expected to influence face memory at moderate values of the continuum. As a matter of fact, whereas Corneille et al. (2004) failed to obtain evidence for any impact of social information in the recollection of extremely ambiguous Caucasian–North African or Caucasian–Asian faces, recent research suggests that the recollection of Caucasian–African American faces proves sensitive to context information. Eberhardt, Dasgupta, and Banaszynski (2003) associated race labels with Caucasian–African American faces and reported evidence that this race information influenced the encoding and recollection of these faces. More recently, Oliver, Jackson, Moses, and Dangerfield (2004) reported that people overestimate the prevalence of Afrocentric features in recollecting the faces of African American individuals who were thought to be the authors of violent crimes. Thus, both in Eberhardt et al. (2003) and in Oliver et al.'s (2004) work, social information associated with race ambiguous faces influenced people's recollection of these faces.

The apparent discrepancy between these two lines of work and our own may be reconciled if one assumes that the US participants' representations about Caucasian and African American faces varied continuously (i.e., excluded the presence of intermediate race categories). The latter suggestion seems actually consistent with recent work in social cognition showing that US students are sensitive to linear dimensions such as the skin tone (Maddox & Gray, 2002) and the Afrocentric features (Blair, Judd, Sadler, & Jenkins, 2002) of African American faces when drawing social inferences about these faces: The darker the skin tone, the more salient the Afrocentric features, and the stronger the application of stereotypical traits to African American individuals. In any case, the findings reported in the present pilot study suggest that participants indeed referred to intermediate categories in the context of the race continua used by Corneille et al. (2004).

If the work reported here seems fairly consistent with Huttenlocher and colleagues' model of episodic memory, it also seems related to memory work recently reported by Pansky and Koriat (2004). It has long been noted that the basic level of categorization is optimal for perception, categorization and communication (Rosch & Mervis, 1975). Pansky and Koriat (2004) reported original evidence showing that memory is biased towards this basic level as well. That is, both subordinate (e.g., jeans) and superordinate (e.g., clothes) information are likely to be recollected at the basic level (e.g., pants). The convergence of memory towards a basic categorization level is assumed to achieve optimal balance between informativeness and distinctiveness, which are the two competing goals of categorization. Together with the present findings, the work by Pansky and Koriat points to the assimilative influence of prototypical representations in the recollection process. That is, convergence

would be vertical in the case of Pansky and Koriat, whereas it would be horizontal in [Corneille et al. \(2004\)](#) and in the present studies.

Practical implications of the present findings

Despite lay people's expertise in face recognition, face memory is not immune to biases. These biases can have disastrous consequences in the context of eyewitness testimony. We have shown that faces can be recollected as more typical of a category attached to it than it actually was. Relying on morphed faces, our results do not allow concluding that such effects would necessarily induce confusions in identifications involving different individuals. As discussed in [Corneille et al. \(2004\)](#), it seems however important to consider here judicial situations in which a culprit is present or absent in a line-up. When the culprit is present (and assuming a fair encoding), it seems unlikely that distortion effects will dominate the identification process. One may more reasonably assume here that eyewitnesses will match their memory trace for individual face features with the face information available in the line-up. The situation may be more critical in conditions of poor face encoding, or when a culprit is actually absent in the line-up. As noted by [Wells \(1984\)](#), in the latter circumstances, the risk is high that an eyewitness will misidentify the actual culprit for the face in the line-up that resembles most the culprit. This similarity bias may be enhanced when the latter face also appears more representative of the category spontaneously attached with the face as this face is encoded.

Accentuation effects in faces recollection were observed here both when categorization was based on face and context information. In the latter case, the consequences can be even more problematic than in the former case, for two reasons. First, context information appears to increase the overall number of misidentifications. Second, in this case the category is arbitrary, not based on physical cues. That is, people's recollections may be distorted towards arbitrary, context-driven representations, such that a same individual may be misremembered as holding more female or more male features, depending on the gender information that was initially associated with it. Needless to say, this context information may be induced either candidly or purposefully. In any case, however, the influence of the context information will prove optimal when communicated before face encoding takes place.

In the present studies, the context information took the form of a first name. The social context may, however, provide gender information through more subtle

means. For instance, a same individual may be categorized either as male or female depending on whether he or she is involved in male-consistent (e.g., car robbing) or female-consistent (e.g., shoplifting) crime. As we have seen, this categorization may bias reports from memory, but it may also lead to the strengthening of gender stereotypes. Clearly, the maintenance of gender stereotypes may be facilitated if people end up constantly accentuating their face memories towards stereotype-consistent representations (e.g., people who take care of children look extremely feminine, people who rob cars look extremely masculine). When applied to the recollection of race ambiguous faces (and when rather continuous representations are held about the races involved), the latter reasoning may explain why people infer different traits or behaviors in individuals whose Afrocentricity differs ([Blair et al., 2002](#); [Oliver et al., 2004](#)). Indeed, people may repeatedly misremember African American individuals as less Afrocentric when these individuals are engaged in stereotype-inconsistent behaviors, but as more Afrocentric when these individuals are engaged in stereotype-consistent behaviors. These accentuation effects may in turn promote the maintenance and the development of naïve beliefs regarding the covariation of race features with personality traits.

Conclusion

Humans are usually credited with high expertise in face recognition ([Carey, 1992](#)). Even if unseen for 50 years, our ability to recognize familiar among novel faces remains accurate at 90% or more ([Bahrnick, Bahrnick, & Wittlenger, 1975](#)). This expertise, however, does not prevent the occurrence of biases in face recollection, whose consequences may be disastrous, particularly in the context of eyewitness testimony. In this paper, we have provided evidence for accentuation effects due to both face-based and context-based categorization in the recollection of gender ambiguous faces. These findings extend those reported in recent work on face memory (e.g., [Corneille et al., 2004](#); [Eberhardt et al., 2003](#); [Halberstadt & Niedenthal, 2001](#); [Oliver et al., 2004](#)). More research is however needed to better understand the boundary conditions for this bias, and the consequences it may have in judicial and everyday social contexts.

Appendix A

see [Fig. 1](#).

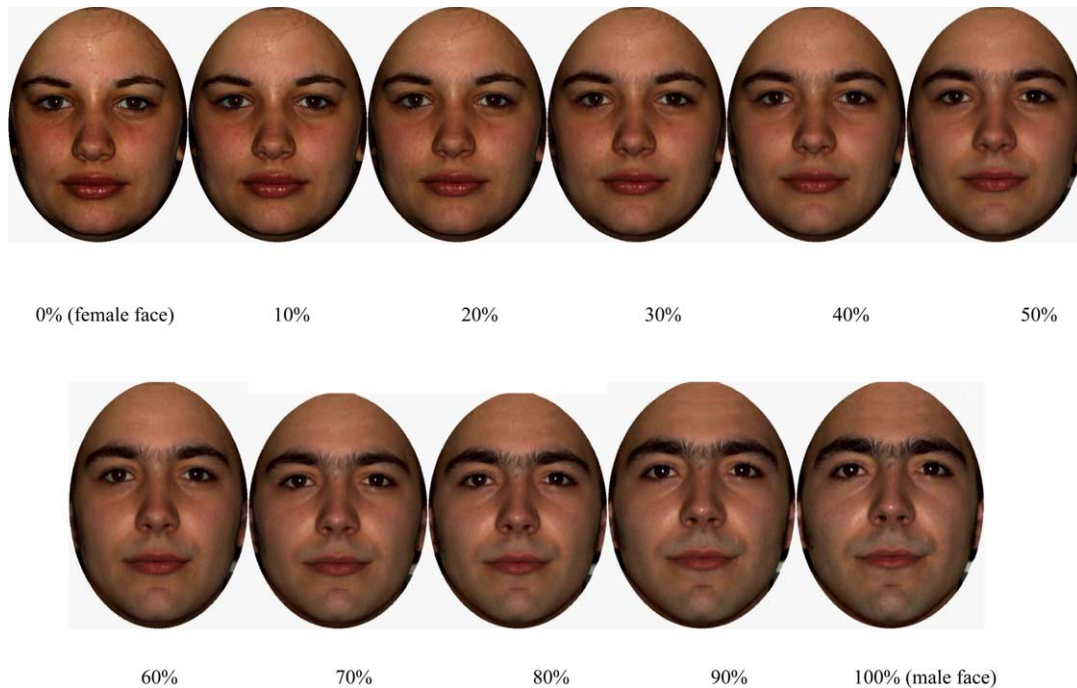


Fig. 1. Example of a female–male continuum.

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