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ORIGINAL ARTICLE

Cross-category adaptation: exposure to faces produces gender aftereffects in body perception

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Abstract Prolonged exposure to a stimulus results in a subsequent perceptual bias. This perceptual adaptation aftereffect occurs not only for simple stimulus features but also for high-level stimulus properties (e.g., faces' gender, identity and emotional expressions). Recent studies on aftereffects demonstrate that adaptation to human bodies can modulate face perception because these stimuli share common properties. Those findings suggest that the aftereffect is not related to the physical property of the stimulus but to the great number of semantic attributes shared by the adapter and the test. Here, we report a novel cross-category adaptation paradigm with both silhouette face profiles (Experiment 1.1) and frontal view faces (Experiment 2) as adapters, testing the aftereffects when viewing an androgynous test body. The results indicate that adaptation to both silhouette face profiles and frontal view faces produces gender aftereffects (e.g., after visual exposure to a female face, the androgynous body appears as more male and vice versa). These findings confirm that high-level perceptual aftereffects can occur between cross-categorical stimuli that share common properties.

Introduction

Visual perception is a process that allows the human brain to construct a vivid representation of the external world but sometimes the visual system suffers from distortions and illusory effects that can be used as helpful tools to understand the neural architecture of vision.

For example, if we look at a waterfall for about 1 min and immediately after we look at stationary objects (e.g., rocks or trees) at the side of the waterfall, these objects appear to be moving upwards slightly. This effect is called motion aftereffect (Barlow & Hill, 1963) and is one instance in a family of phenomena known as aftereffects (Mather, Verstraten, & Anstis 1998). Aftereffects strongly influence perception and "reveal a gap between appearance and reality, reminding us that what we see is determined by how visual information is coded in the brain, and not simply by how things really are" (Georgeson, 2004). They generally imply exposure to a first stimulus possessing one given property (the adapter), followed by presentation of a stimulus bearing a neutral value of that property (the test stimulus). The aftereffect consists in a change in appearance of the test stimulus following the adapter, compared to the appearance of the test stimulus when it is observed without any previous exposure to the adapter.

Many studies have shown that aftereffects do not occur just in the domain of motion perception as in the waterfall illusion, but they occur for a host of low-level stimulus properties such as color (McCollough, 1965), orientation (Gibson & Radner, 1937), shape (Suzuki & Cavanagh, 1998) or visual numerosity (Burr & Ross, 2008). They have also been demonstrated for high-level stimulus properties, such as facial attributes (Webster, Kaping, Mizokami, & Duhamel, 2004). Indeed, it has been shown that the appearance of faces is strongly affected by the features of faces viewed previously. Most cases of face adaptation effects involve negative or contrast aftereffects because the neutral test stimulus appears less like the adapting image and thus in the complementary direction. For instance, Webster et al. (2004) showed a change in gender

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perception of an androgynous face after adaptation to a male or a female face: an androgynous face appears as more female after exposure to a male adapter, and vice versa. Studies on face adaptation have been carried out to investigate several high-level properties of face perception such as sex and gender (Kloth, Schweinberger, & Kovacs, 2010; Kovács et al., 2006; Webster et al., 2004), identity (Leopold, O'Toole, Vetter, & Blanz, 2001), emotional expression (Webster et al., 2004), ethnicity (Webster et al., 2004) and age (Schweinberger et al., 2010). Faces are not the only 'social entities' investigated in aftereffect studies: bodies, for instance, have been investigated recently. Winkler and Rhodes (2005), using narrowed and widened bodies' photographs, found that participants rated thin bodies as more normal after adaptation to thinner bodies. In contrast, participants rated fat bodies as more normal after adaptation to fatter bodies. Recently, Palumbo, Laeng, and Tommasi (2013) showed that after a prolonged exposure to a male or a female human silhouette, participants judged an androgynous silhouette, respectively, as more female or more male. These results show that body perception can be manipulated using the adaptation paradigm.

Perceptual aftereffects are believed to depend on the activation of neuronal populations that respond selectively to a certain property of the stimulus (Barlow & Hill, 1963). One of the accepted explanations of aftereffects is that neurons tuned to a given property of a stimulus, reduce their activity and/or change their tuning after a prolonged exposure to that specific property (Thompson & Burr, 2009; Huk, Ress, & Heeger, 2001). Several studies have tried to investigate whether aftereffects are not merely related to the physical properties of the stimulus but to the semantic attributes shared by the adapter and the test. Since previous evidence suggested that high-level aftereffects may ultimately depend upon earlier cortical processing of local features embedded in more complex information (Dickinson & Badcock, 2013), the discovery of novel cross-category aftereffects that cannot be ascribed to local features but instead invokes the effect of the semantic content shared by adapters and test stimuli, could offer stronger evidence in favor of higher level neural populations encoding complex representations of our sensory world. In the domain of person perception, Golle, Lisibach, Mast, and Lobmaier (2013) found that the adaptation to cute and less cute puppy faces affected the perception of facial cuteness in human infant faces, demonstrating that effects of facial cuteness adaptation transfer across species. Even cross-modal aftereffects have proven that adaptation effects can manifest themselves across different formats; aftereffects on familiar identity (Zäske, Schweinberger, & Kawahara, 2010; Hills, Elward, & Lewis, 2010) or on emotion (Skuk & Schweinberger, 2013) have been found in face-voice adaptation studies. On the other hand, other evidence runs against cross-category effects: Schweinberger et al. (2008), for instance, failed to show face-to-voice aftereffects in gender judgement, and Hayn-Leichsenring, Kloth, Schweinberger, and Redies (2013), found no cross-category adaptation on attractiveness of painted or photographed faces. Cross-category adaptation effects offer thus a rich research scenario populated by controversial results, in which the issue of whether (and which) nodes in the network underlying person representation can effectively modulate perception, still remains a matter of debate.

A number of studies about adaptation and aftereffects have recently tried to investigate whether specific neural populations code gender. For this reason, different cross-category adaptation studies have been carried out. Javadi and Wee (2012) investigated how objects highly associated with one gender can produce a gender aftereffect on ambiguous faces. In this study, the authors suggest that the aftereffect they found can only be attributed to the higher order feature of gender, since the test stimuli did not share the same perceptual features of the adapters.

Furthermore, Ghuman, McDaniel, and Martin (2010), using human bodies as adapters and androgynous faces as tests, showed that the adaptation to human bodies influenced the following perception of androgynous faces. With this study, the authors demonstrated that bodies alone can activate the network that codes for the visual information used to determine the gender and identity of faces. Analogous results were obtained even when bodies and faces were presented (in the role of adapters and tests, respectively) in an orthogonal study design that involved both upright and inverted orientation (Kessler, Walls, & Ghuman, 2013). All of these results suggest that gender is not only bound to physical proprieties of the stimuli but is a high-level concept encompassing several perceptual aspects.

Davidenko (2007) showed that silhouette face profiles provide us with a useful methodology for studying face perception, since they carry a rich amount of information including gender, age, and attractiveness, and they seem to exploit mechanisms in common with front-view faces as regards gender processing. Furthermore, a study by Davidenko, Witthoft, and Winawer (2008) found that aftereffects occur even when using silhouette face profiles as adapters and front-view faces as test stimuli. These findings suggest that the aftereffect is insensitive to image transformations that preserve the face percept, supporting the hypothesis that gender processing and adaptation occur at a high level of visual representation.

Although cross-category aftereffects have been already demonstrated, as far as we know, no study on cross-category adaptation ever attempted to assess whether the perception of gender of bodies can be modulated by the prolonged exposure to faces. To this purpose, in

Experiment 1.1 we collected the participants' judgments about gender of androgynous bodies after the exposition to male or female silhouette face profiles. We aimed at testing whether the prolonged exposure to a male or a female silhouette face profile can produce aftereffects upon presentation of androgynous human bodies. We expected to observe contrastive aftereffects, i.e., participants who are exposed to male silhouette face profile should more likely perceive a subsequent androgynous body as female, and vice versa. To further support the idea that gender aftereffects are not related to the physical features of the stimuli involved, but rather to a higher order visual representation of gender, in Experiment 2 we used male and female faces in front-view as adapters and androgynous bodies as tests, expecting to observe aftereffects running in the same direction as in Experiment 1.1.

Experiment 1.1

Methods

Participants

Twenty-four volunteers (12 females, mean age 20.12, SD 1.25) were recruited at the University of Chieti to take part in the experiment. All of the participants had normal or corrected-to-normal vision.

Stimuli

Images selected as adapters consisted in 16 black silhouetted face profiles on a white background (8 male and 8 female). The stimuli were obtained by converting grayscale photographs of face profiles to two-tone black and white images that were then cropped at the forehead, below the chin, and down the ear line (see Davidenko, 2007; Davidenko et al., 2008).

We used eight androgynous human body silhouettes as test stimuli selected from a set of stimuli created in a previous study (Palumbo et al., 2013). 3D graphical software was used to generate a set of 104 black silhouettes of human bodies on a white background with sexual dimorphism features associated to build varying in steps along separate continua: waist-to-hip ratio, weight and musculature (no internal features were apparent). Each body thus generated was rated by 24 naïve judges who evaluated gender. The judges used a slide on an adjustable analog scale to make their judgments. The ends of the scale represented "extreme masculinity" (+100) and "extreme femininity" (−100). The center of the scale represented neutrality (0). The eight most androgynous bodies were extrapolated from the silhouette set, as those whose mean judgment was nearest to zero ($M = 3.35 \pm 2.93$).

Procedure

In a representative trial of the experiment, a fixation cross (subtending $0.5° \times 0.5°$ at a viewing distance of 60 cm) was presented in the center of the screen for 250 ms. The fixation cross was followed by the presentation of the adapter silhouette face profile (subtending $19° \times 26.7°$) in the center of the screen for 10 s. The adapter was followed by the presentation of a fixation cross (duration 250 ms). Subsequently, an androgynous test silhouette (subtending $11° \times 16.5°$) was presented in the center of the screen for 500 ms. Afterward, the participant could evaluate the femininity or masculinity of the silhouette just presented by providing the response on a visual analog scale, i.e., a line (length 31°, thickness 0.2°) presented horizontally in the center of the screen, by moving a slider on the line with a mouse. The line represented a double-ended continuum where the two edges indicated the maximum value of masculinity on one side and the maximum value of femininity on the opposite side. The direction of the continuum femininity/masculinity or masculinity/femininity was balanced across subjects. In total, each adapter stimulus (16 silhouette face profiles: 8 female, 8 male) was presented 8 times in random order, each time followed by a different androgynous test silhouette, for a total of 128 trials (Fig. 1). The experiment lasted approximately 40 min overall.

Data analysis

Scores were converted to percentage values on a continuum from −100 % (female) to +100 % (male). Within-subject statistical analyses were carried out on the percentage scores by means of repeated-measure ANOVA using Sex of Adapter as a within-subject factor and Sex of Participant as a between-subjects factor. The level of statistical significance was set at 5 % ($p < 0.05$). Single-sample exact t tests were performed to determine whether the judgments given to the test silhouettes following adaptation differed from the neutrality value.

In addition, a Pearson correlation analysis was computed to assess the relation between serial trial number (interpreted as time) and the magnitude of the aftereffect, coding contrast aftereffect as positive value and assimilation as negative value, to exclude possible carryover effects or subjective biases due to the fact that the length of the experiment could allow participants to guess the experimental hypothesis.

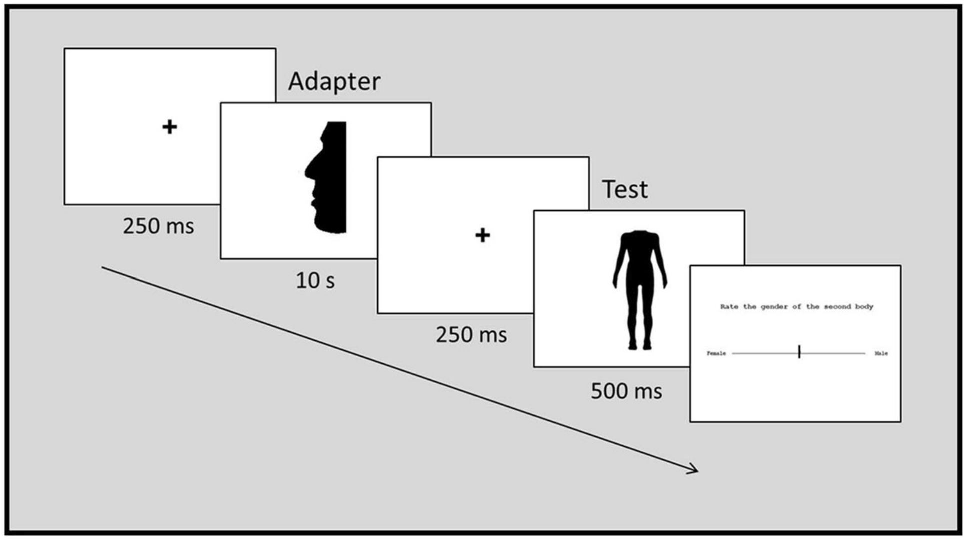

Fig. 1 A representation of the visual events constituting the structure of a single trial in Experiment 1.1

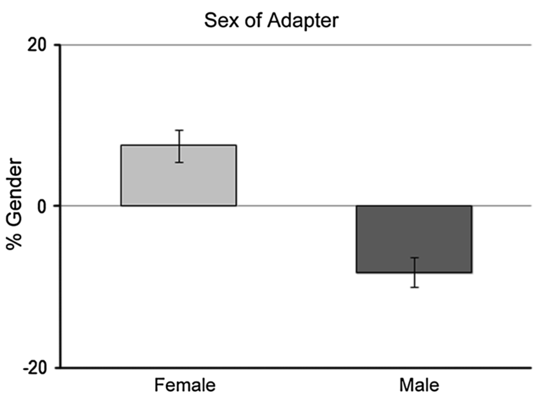

Fig. 2 Plot of the aftereffect as a function of Sex of the Adapter (positive percentages represent perceived masculinity, negative percentages represent perceived femininity). *Error bars* represent standard errors of the mean

Results

The ANOVA showed a significant effect of the factor Sex of Adapter ($F_{(1,22)} = 26.031$; $p < 0.001$; $\eta^2 = 0.99$; Fig. 2).

Single-sample t tests showed that after exposure to a female face profile the androgynous silhouettes were judged as more male ($M = 7.48$ %; $t_{(23)} = 2.90$; $p < 0.01$) and after exposure to a male face profile the androgynous silhouettes were judged as more female ($M = -8.20$ %; $t_{(23)} = -3.86$; $p < 0.005$). No main effect of Sex of Participant ($F_{(1,22)} = 0.326$; $p = 0.574$; $\eta^2 = 0.08$), nor the interaction Sex of Adapter × Sex of Participant ($F_{(1,22)} = 2.083$; $p = 0.163$; $\eta^2 = 0.28$), were found.

The correlation analysis revealed no relationship between the percentage of aftereffect (obtained by averaging participants' results on each trial) and the trial number ($r = 0.102$, $n = 128$, $p = 0.253$). A scatterplot summarizes the result (Fig. 3).

The correlation analysis allows us to exclude a possible carryover bias because its results show that along the entire duration of the experiment the magnitude of the aftereffect did not change.

However, to fully fathom the possible effects of subjective biases concerning the guessing of the experimental hypothesis by participants, we carried out a shorter replication of the same experiment with new participants; after completion of the experiment participants filled out a questionnaire in which they were asked about the purpose of the experiment.

Experiment 1.2

Methods

Participants

Twenty new volunteers (11 females, mean age 20, SD 1.4) were recruited at the University of Chieti to take part in the experiment. All of the participants had normal or corrected-to-normal vision.

Stimuli

Images selected as adapters and tests were the same as those described in Experiment 1.1, with the exception that only eight stimuli were used as adapters.

Procedure

The experimental task was the same as that described in Experiment 1.1. In total, each adapter stimulus (8 silhouette face profiles: 4 female, 4 male) was presented 8 times

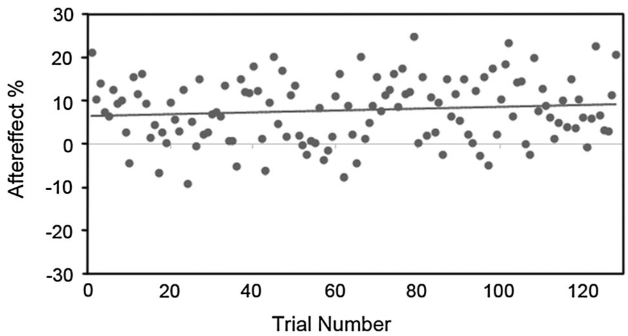

Fig. 3 Correlation analysis plotting serial trial number vs percentage of the aftereffect

in a random order, each time followed by a different androgynous test silhouette, for a total of 64 trials (see Fig. 1). At the end of the experiment participants were asked to fill out a questionnaire in which they first had to report whether they had realized the hypothesis behind the experiment. Furthermore, participants who answered positively to this question were invited to write down which was the hypothesis behind the study, according to their guessing. The experiment lasted approximately 20 min overall.

Data analysis

The same statistical analyses were carried out as described in Experiment 1.1. Moreover, we also considered the responses to the questionnaire and divided up the sample into two subgroups according to the answer given to the first question: 'aware' and 'unaware' (as regards to the purpose of the experiment).

Results

'Unaware' subgroup

16 out of 20 participants (6 males, 10 females) reported that they were unaware of the purpose of the experiment.

The ANOVA showed a significant effect of the factor Sex of Adapter ($F_{(1,14)} = 5.577$; $p < 0.05$; $\eta^2 = 0.59$).

Single-sample t tests showed that after the exposure to a female face profile the androgynous silhouettes were judged as more male ($M = 12.90$ %; $t_{(15)} = 2.86$; $p < 0.01$) and after the exposure to a male face profile the androgynous silhouettes were judged as more female ($M = -12.29$ %; $t_{(15)} = -1.66$; $p = 0.12$). No main effect of Sex of Participant ($F_{(1,14)} = 0.111$; $p = 0.743$; $\eta^2 = 0.06$), or the interaction Sex of Adapter × Sex of Participant ($F_{(1,14)} = 0.001$; $p = 0.965$; $\eta^2 = 0.05$), was found.

'Aware' subgroup

4 out of 20 participants (3 males, 1 female) self-reported they had understood the purpose of the experiment. All four subjects hypothesized an influence of face on bodily gender. Furthermore, all of them supposed that bodies would have to seem more female after a prolonged exposure to female profiles and more male after a prolonged exposure to male profiles (assimilation effect).

The ANOVA did not show any significant effect. No main effect of Sex of Adapter ($F_{(1,2)} = 2.72$; $p = 0.240$; $\eta^2 = 0.17$), neither main effect of Sex of Participant ($F_{(1,2)} = 0.008$; $p = 0.935$) or the interaction Sex of Adapter × Sex of Participant ($F_{(1,2)} = 2.589$; $p = 0.249$; $\eta^2 = 0.16$), was found.

Although we did not document any significant effect in this subgroup it is interesting to note that participants that self-reported to have guessed an assimilation effect, actually showed a contrast effect in their responses, even if their results did not attain statistical significance, probably due to sample size. Specifically, after the exposure to a female face profile the androgynous silhouettes were judged as more male ($M = 3.03$ %;) and after the exposure to a male face profile the androgynous silhouettes were judged as more female ($M = -8.78$ %).

All participants

The ANOVA showed a significant effect of the factor Sex of Adapter ($F_{(1,18)} = 7.218$; $p < 0.05$; $\eta^2 = 0.72$).

Single-sample t tests showed that after exposure to a female face profile the androgynous silhouettes were judged as more male ($M = 10.93$ %; $t_{(19)} = 2.90$; $p < 0.01$) and after exposure to a male face profile the androgynous silhouettes were judged as more female ($M = -11.59$ %; $t_{(19)} = -1.96$; $p = 0.06$). No main effect of Sex of Participant ($F_{(1,18)} = 0.226$; $p = 0.640$; $\eta^2 = 0.07$), or the interaction Sex of Adapter × Sex of Participant ($F_{(1,18)} = 0.001$; $p = 0.991$; $\eta^2 = 0.05$), was found.

These results confirm that adaptation to gender of face silhouettes affects gender ratings of body silhouettes observed subsequently, thus suggesting that gender adaptation can be effective across displays that are a format-unrelated (face profiles and body silhouettes). The quick establishment and time independency of the effect, moreover, qualify it as a robust phenomenon, that also appears to be independent of subjective awareness or expectation biases about its nature and direction.

To test our initial hypothesis further, in the following experiment we exploited the same adaptation paradigm but recurred to a different 'format gap' across adapter and test stimuli (gender still being the common property) and measured whether similar aftereffects occur when frontal view photographs of faces are observed first, and body silhouettes are used as tests.

Experiment 2

The procedure adopted in this experiment was the same as that used in Experiment 1.1, the only difference being that adapters were frontal view photographs of male and female faces.

Methods

Participants

Twenty-four new volunteers (12 females, mean age 21.92, SD 0.44) were recruited at the University of Chieti to take part in the experiment. All of the participants had normal or corrected-to-normal vision.

Stimuli

The face stimuli used as adapters consisted of 16 photographs of faces (8 male and 8 female) selected from the Karolinska Directed Emotional Faces Database (Lundqvist, Flykt, & Öhman, 1998), which were converted to grayscale. Faces all displayed a neutral expression and were presented in the center of the screen (subtending 19° × 26.7°). Stimuli used as tests were the same as those described in Experiment 1.1.

Procedure

The experimental task was the same as that described in Experiment 1.1, except that face silhouettes were replaced by photographs of faces in frontal view (Fig. 4).

The experiment lasted approximately 40 min overall.

Data analysis

The same statistical analyses were carried out as described in Experiment 1.1. An ANOVA was also carried out to compare whether differences were present due to the two formats of stimuli used as adapters.

Results

The ANOVA on the percentage scores revealed a main effect of Sex of Adapter ($F_{(1,22)} = 17.468$; $p < 0.001$; $\eta^2 = 0.98$; see Fig. 5).

Single-sample t tests showed that female adapters shifted the judgment of the androgynous silhouettes towards masculinity ($M = 12.05$ %; $t_{(23)} = 3.31$; $p < 0.005$), and that male adapters shifted the judgment of the androgynous silhouettes towards femininity ($M = -9.32$ %; $t_{(23)} = -3.32$; $p < 0.005$).

No main effect of Sex of Participant ($F_{(1,22)} = 0.629$; $p = 0.436$; $\eta^2 = 0.19$), or the interaction Sex of Adapter × Sex of Participant ($F_{(1,22)} = 0.001$; $p = 0.973$; $\eta^2 = 0.05$), was found.

The ANOVA using Type of Adapter as between-subjects factor and Sex of Adapter as within-subject factor showed a significant main effect of Sex of Adapter ($F_{(1,\ 46)} = 39.332$; $p < 0.001$; $\eta^2 = 0.99$). Single-sample t tests showed that after exposure to a female face photo or silhouetted face profile the androgynous body silhouettes were judged as more male ($M = 9.77$ %; $t_{(47)} = 4.38$; $p < 0.001$) and after exposure to a male face photo or silhouetted face profile the androgynous body silhouettes were judged as more female ($M = -8.76$ %; $t_{(47)} = -5.03$; $p < 0.001$).

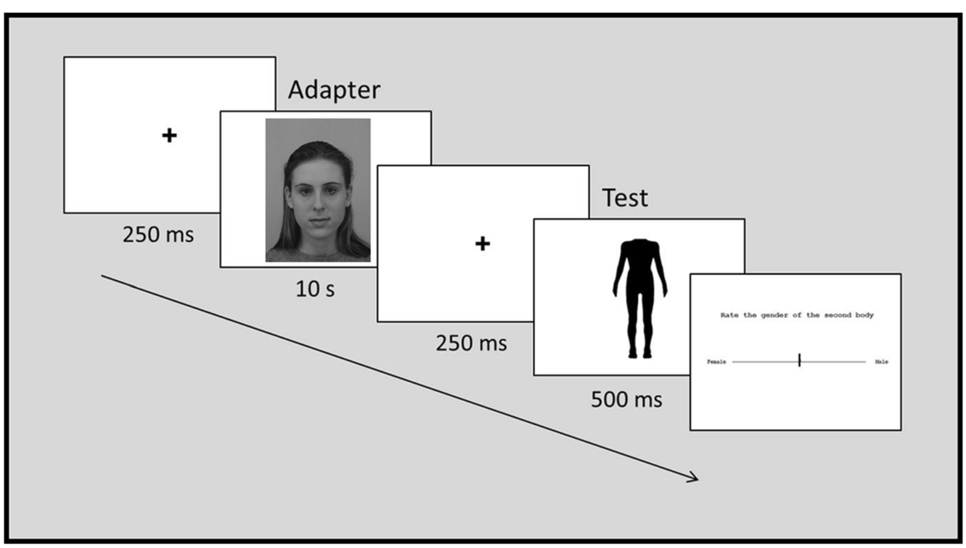

Fig. 4 A representation of the visual events constituting the structure of a single trial in Experiment 2

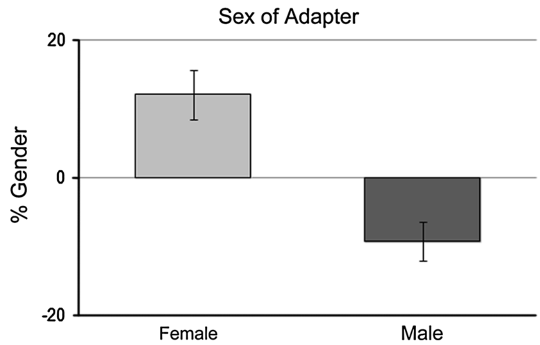

Fig. 5 Plot of the aftereffect as a function of Sex of the adapter (positive percentages represent perceived masculinity, negative percentages represent perceived femininity). *Error bars* represent standard errors of the mean

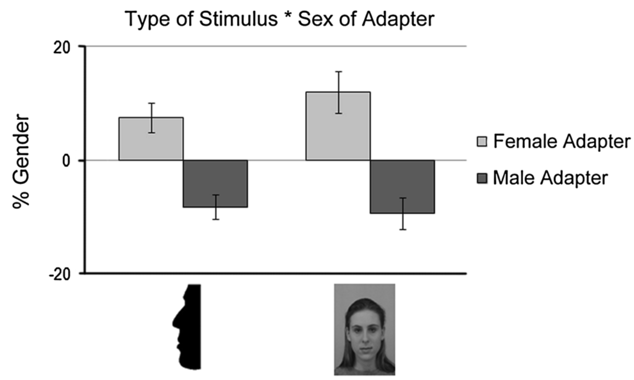

Fig. 6 Plot of the aftereffect as a function of Sex of the adapter and type of stimulus (positive percentages represent perceived masculinity, negative percentages represent perceived femininity). *Error bars* represent standard errors of the mean

The main effect of Type of Adapter ($F_{(1,\ 46)} = 0.402$; $p = 0.529$; $\eta^2 = 0.09$) and the interaction between Type of Adapter and Sex of Adapter ($F_{(1,\ 46)} = 0.930$; $p = 0.340$; $\eta^2 = 0.15$; Fig. 6) did not show any significant difference.

Discussion

Several studies have demonstrated that face gender adaptation causes aftereffects in the direction opposite to the gender of the adapter face, when viewing an androgynous test face (Webster et al., 2004; see Webster & MacLeod, 2011 for a review), but less is known about gender adaptation across different stimulus categories. Ghuman et al. (2010) reported a cross-category adaptation aftereffect demonstrating that prolonged viewing of a human body without a face shifts the perception of face gender and identity. In a first experiment, they showed that adaptation to a body altered the identity face space even though the adapter stimulus did not contain a face. In a second experiment, they showed that adaptation to a headless female or male body altered the perceived gender of a subsequently viewed face. Moreover, in another experiment they showed that prolonged exposure to gender-specific objects (i.e., football helmet, purse, etc.) failed to produce a face gender aftereffect (but see Javadi & Wee, 2012, for different results). Thus, beyond the controversial effectiveness of culturally determined properties of gendered objects, gender aftereffects do seem to depend on the intrinsic biological relationship between bodies and faces. Taken together, these results reveal that high-level perceptual adaptation can occur when the property or features being adapted are automatically inferred rather than perceived in the adapting stimulus. These body-to-face adaptation effects demonstrate that bodies alone can alter the tuning properties of neurons that code for the gender and identity of faces. Moreover, body-to-face adaptation demonstrates that high-level perceptual aftereffects can occur when the to-be-adapted features are not present in the adapting stimulus.

Considering the above results, here we decided to use a face-to-body adaptation paradigm wherein adapters were front-view photos of faces and silhouetted face profiles, as already used by Davidenko (2007). These authors showed that silhouetted face profiles can be used as a simple and powerful methodology for studying face perception since they carry a rich amount of information including gender, age, and attractiveness, even though they do not contain internal features. Moreover, using an implicit adaptation paradigm, they showed that gender aftereffects occur with face silhouettes (Davidenko et al., 2008).

Although it is already known that gender adaptation can occur across categories (Ghuman et al., 2010; Javadi & Wee, 2012; Kessler et al., 2013), as far we know the present study is the first study trying to investigate whether gender perception of human bodies is sensitive to cross-category adaptation. Taking together the fact that bodily gender is subject to aftereffects (Palumbo et al., 2013), and that bodily gender can induce cross-category aftereffects on faces (Ghuman et al., 2010; Kessler et al., 2013), it was reasonable to formulate the prediction that cross-category gender aftereffects could manifest themselves in the opposite direction, from faces to bodies. In the present experiments, indeed, we found a cross-category adaptation aftereffect in which prolonged exposure to silhouetted face profiles or front-view photos of faces, shifted the perceived gender of androgynous bodies in a contrastive manner. Specifically, in Experiment 1.1 we observed that when participants were adapted to silhouetted male and female face profiles, aftereffects were manifest in the evaluation of androgynous bodies. The latter were evaluated as appearing more female after viewing male faces than after viewing female faces and vice versa. In addition, in

Experiment 2 the same pattern of results was obtained when participants were adapted to front-view photographs of faces.

Taken together, our results clearly indicate that adaptation to faces produce cross-categorical aftereffects along the gender dimension, when exploiting face adapters presented both in frontal view and as profiles, and androgynous body silhouettes have to be evaluated for perceived gender, suggesting that frontal and profile faces can adapt neuronal populations that represent gender-specific visual features. Moreover, face-to-body adaptation confirms that high-level perceptual aftereffects can occur between cross-categorical stimuli that share common properties. The lack of differences between the results of female and male participants diverges from previous research on gender perception aftereffects, in which observer sex was found to modulate results (Palumbo et al., 2013; Skuk & Schweinberger, 2013). This might probably be due to the small sample size of males and females in the present experiments, but also because the format of stimuli employed in the present paradigm as adapters and tests (face and head silhouettes as adapters; body silhouettes as tests) differs from those employed before (body silhouettes being both adapters and tests in Palumbo et al., 2013; voices or faces + voices as adapters, voices as tests in Skuk and Schweinberger, 2013), suggesting that the interaction of observer sex and gender aftereffects might depend on a complex pattern. It must be finally remarked that the stimuli used here as adapters and tests all belonged to the domain of visual person phenotype (bodies, faces and heads) and it could be wondered whether the aftereffects observed actually reflect perceptual recalibration of physical features shared by the stimuli (roundness vs squareness, ratio of upper vs lower parts of stimuli, etc.) rather than conceptual anchoring mediated by the semantic feature represented by gender, an aspect that will have to be resolved by further research.

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