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The differential power of extraneous influences to modify aesthetic judgments of biological and artifactual stimuli

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Abstract: We addressed the question of the extent to which external information is capable of modifying aesthetic ratings given to two different categories of stimuli—images of faces (which belong to the biological category) and those of abstract paintings with no recognizable objects (which sit in the artifactual category). A total of 51 participants of different national origins rated the beauty of both sets of stimuli, indicating the certainty of their rating; they then re-rated them after being exposed to the opinions of others on their aesthetic status. Of these 51 participants, 42 who met our criteria were selected to complete the experiment. The results showed that individuals were less prone to modifying their ratings of stimuli belonging to the biological category compared to those falling into the artifactual category. We discuss this finding in light of our theoretical Bayesian–Laplacian model and on the evidence given by previous empirical research.

Keywords: artifactual beauty; biological beauty; neuroesthetics

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It is common knowledge that our judgments in general may be affected by several factors; these include our mental state, previous experience, and psychological predisposition when making a judgment. Our opinions and judgments may be especially hostage to external influences, which may include the financial or aesthetic value attributed by others to the object or situation being judged, its supposed authenticity, or the context in which it is judged (Gartus & Leder, 2014; Huang, Bridge, Kemp, & Parker, 2011; Kirk, Skov, Hulme, Christensen, & Zeki, 2009). These general extraneous influences have been variously referred to as contextual effects, conformity effects, and schema changes, inter alia. We prefer in this work to use the term "external information." The effects of external influences in modifying judgments have been studied in a variety of situations, including consumer behavior and political and social decision-making (Cialdini & Goldstein, 2004; Wagner, Menninghaus, Hanich, & Jacobsen, 2014; Zaki, Schirmer, & Mitchell, 2011). Here, we address the question of the extent to which external influences, consisting of the opinions of others, modify our aesthetic judgments.

While accepting that aesthetic judgments may be hostage to external opinions (Izuma & Adolphs, 2013), we set out to learn something about the distribution and potency of such external influences. In particular, we hypothesized that aesthetic judgments of images that belong to the biological categories, such as human faces, would be much more resistant to external opinion than aesthetic judgments of objects that may be considered to fall better under the category of artifactual, man-made objects; we consider abstract, nonrepresentational paintings to fall into the latter category. This can be traced back to our general Bayesian–Laplacian classification of experiences into biological (β) and non-biological or artifactual (α) priors (Zeki & Chén, 2020). At the root of this classification is our belief (Zeki, 2011), supported by recent empirical evidence (Vessel, Maurer,

Denker, & Starr, 2018), that there is broader agreement between humans in general in judgments regarding biological categories than in those regarding artifactual categories. This is not to say that all biological categories are totally immune from external influences, as previous studies on facial attractiveness suggest, but only that they are significantly more so than artifactual categories (Klucharev, Hytönen, Rijpkema, Smidts, & Fernández, 2009; Zaki et al., 2011). But to what extent is the judgment of how beautiful a face is (an aesthetic judgment) subject to external influence? Faces judged to be beautiful by individuals belonging to one ethnic or cultural grouping are, broadly, also regarded to be beautiful by those belonging to a different culture. Moreover, infants orient more toward beautiful faces, regardless of ethnicity, implying that there is some significant cross-cultural agreement about facial aesthetics (Cunningham, Roberts, Barbee, Druen, & Wu, 1995; Fink & Neave, 2005; Langlois et al., 2000; Langlois, Ritter, Roggman, & Vaughn, 1991). Given this, it was interesting to enquire further into the extent to which judgments of facial beauty are resistant to external influence.

There is, of course, a wide variety of ways of addressing this problem. In this initial approach, we chose to begin by comparing two sets of stimuli in terms of how external information, defined as the aesthetic judgment given by others, affects the aesthetic rating given by participants to faces and to abstract paintings with no biologically recognizable elements (thus falling into the artifactual category). We did so by asking participants to rate the two sets of stimuli aesthetically before and after exposing them to external influences. Our hypotheses were threefold: first, that there will be greater unanimity among individuals in aesthetic ratings of images of faces than those of abstract artworks; next, that aesthetic ratings given to faces will be more resistant to external influences than those given to abstract artworks; and finally, that extreme aesthetic ratings will be less susceptible to external influences. Our results supported the first and second of these hypotheses but not the third.

Method

Participants

One hundred eleven participants were recruited through Prolific Academic, social media, and by word of mouth. Of these, only 51 completed the entire experiment (28 females and 23 males; age range: 18 to 65 years, mean age: 28.8 years [*SD* = 11.27 years]). Eight participants reported having had more than 6 years of general training in either fine art or art history, while the remaining 43 reported only an average of 1.56 years (*SD* = 1.59). Participants were nationals of 19 different countries (see Supplementary 1). Of these, 48 were native English speakers or spoke English fluently, while for the remaining three English was a second language; however, they declared themselves to have not had any trouble in understanding and executing the instructions. Forty-five percent of the participants described themselves as being not completely heterosexual, which was in line with previous reports on sexual orientation in the younger British population, as reported by an adapted Kinsey Scale (Zeki & Romaya, 2010) and by the recent YouGov poll among 18–24-year-olds in the United Kingdom (https://yougov.co.uk/topics/lifestyle/articles-reports/2015/08/16/half-young-not-heterosexual). All participants were informed that the study was designed to study beauty judgments. All aspects of our study conformed to the guidelines of the 2013 World Medical Association Declaration of Helsinki and was approved by the University College London Ethics Committee.

Stimuli

We used two types of stimuli. The first consisted of photographs of faces derived from different databases (the Face Research Lab London Set; DeBruine & Jones, 2017; and the Chicago Face Database; Ma, Correll, & Wittenbrink, 2015) and from a variety of other online sources (Pexels, Adobe Stock, Pinterest, Google Images). Based on the attractiveness ratings, scored from 1 to 7, given in those databases, in addition to our preliminary study in which we assessed the average attractiveness of the images available from the other online sources, we selected the following: 20 images with the lowest attractiveness ratings (10 male, 10 female), 20 images with the highest attractive ratings (10 male, 10 female), and 20 below and 20 above the median attractiveness ratings (20 male, 20 female; see Supplementary 2 for details).

We next collected photographs of abstract paintings obtained from an online source containing averaged beauty ratings scored from 1 to 9 (Sidhu, McDougall, Jalava, & Bodner, 2018). From these, we selected: 20 images with the lowest beauty ratings, 20 with the highest beauty ratings, and 20 below and 20 above the median ratings. Three abstract artworks that resembled bodily-like shapes were

removed and replaced with artworks with similar beauty ratings prior to the experiment. The size of all images was converted into 600 × 600 pixels in Photoshop, with the background set to white.

Procedure

The experimental procedure was designed in PsychoPy 3.0 (Peirce et al., 2019) and executed using the online platform Pavlovia (https://pavlovia.org/). After giving informed consent, participants were asked to give their sex and sexual orientation (to ascertain whether there was a sexual-orientation-biased aesthetic rating for faces), and their years of training in either fine arts or art history. Sexual orientation was obtained by using an adapted Kinsey Scale (Kinsey, Pomeroy & Martin, 2003; Zeki & Romaya, 2010), which scales the sexuality of the participants from 1 (*completely heterosexual*) to 7 (*completely homosexual*). Years of training in the arts were similarly collected using a 1 to 7 scale (from *0 years* to *6+ years* of training).

Participants were then instructed on the behavioral task and, to familiarize them with it, one practice session was administered before beginning the experiment.

The experiment consisted of two blocks (faces/abstract artworks) of 80 trials each. Each trial had four components (questions): participants were first asked to give (a) their beauty rating and (b) how certain they were of their rating. They were then exposed to (c) external information (of which the details are given below). They were, finally, asked once more (d) to give their final beauty rating in light of the external input (see Figure 1). During the external information phase, participants were shown fictitious average ratings which, they had been told, represented the average opinion of other participants (see Supplementary 3 for the instruction given to the participants). Fictitious rather than real ratings were used because we expected the ratings of biological stimuli to be more consistent across individuals than those of artifactual ones; hence using real ratings to sway opinion would have been less effective for biological than artifactual stimuli. Similarly to Zaki et al. (2011), ratings were manipulated as follows: when participants rated any image less than three, the fictitious average rating was presented as being either equal to the initial participant rating or to two or three points higher than the original rating, the two being given with equal probability. Similarly, when participants rated any image more than five, the fictitious average rating was presented as being either equal to the initial participant rating or to two or three points lower than that rating, the two being given with equal probability. Finally, for ratings between three and five, the average rating was presented with a 50% chance of being equal, 25% of being two or three points higher, and 25% of being two or three points lower.

The order of presentation of each trial in each block was randomized and the experiment was counterbalanced to avoid order-effect.

Analysis

We started with a mixed (within–between) analysis of covariance to test whether beauty ratings given to faces were affected by the sex of the participants (i.e., whether female participants rated images of males more beautiful than those of females on average and vice versa). Next, we computed the mean minus one (MM1; Vessel et al., 2018) to inspect the average agreement between beauty ratings for images of faces and abstract artworks. The MM1 is calculated by computing the correlation between all the ratings given by one participant with the average ratings of every other participant per image, a procedure repeated for every participant. This resulted in individual preference scores (r values), which reflect the extent to which individual ratings are in agreement with the mean rating (Germine et al., 2015; Sutherland et al., 2020). We then applied a Fisher transformation on the r values (z values – Fisher r to z transformation); such a transformation has been shown to result in less biased estimates when assessing agreement between participants (Vessel et al., 2018). After this, we took the mean of the z value and, following convention, transformed it back to r (Fisher z-to-r transformation; see Vessel et al., 2018, for details).

To test our main hypothesis, that external information influences differentially aesthetic judgments of faces (biological) and abstract artwork (artifactual), we undertook three within-subject comparisons: First, we tested whether external information influences the experience of beauty in the sense of leading to a re-rating that departs from the original rating for both categories. Next, we tested whether such influences were higher when the initial beauty rating of the participant was medium (i.e., when a rating between 3 and 5 was given) than when it was extreme (i.e., when a rating between 1 and 2 or between 6 and 7 was given). Finally, we tested whether this external information effect acts differently on the judgment of beauty of faces versus that of abstract artworks. We then explored, using the

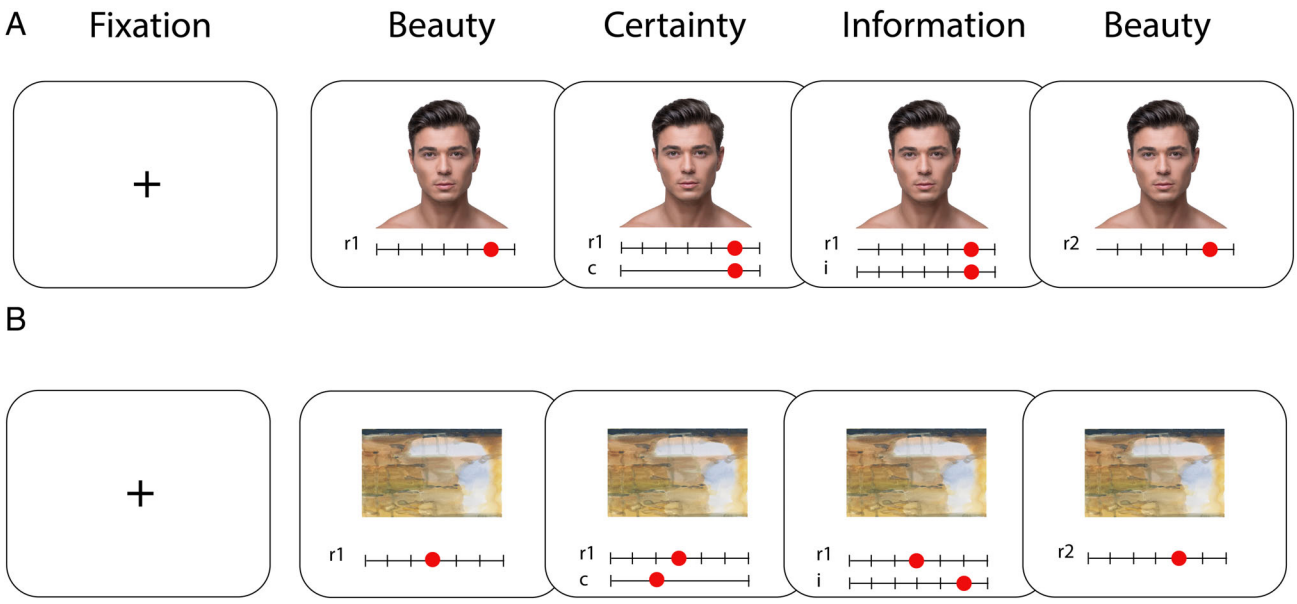

Figure 1. Online experimental paradigm. Participants were asked to complete 80 trials per category (total of 160 images). After a brief presentation of a fixation cross (500 ms), each trial consisted of four steps. A first beauty rating: Participants were asked to give their beauty rating (r1. "how beautiful?," from 1 to 7). Their first rating (r1) was displayed for the entire duration of the trial. Certainty: subjects were then asked to indicate how certain they were of their rating, on a continuous 1–7 scale, from *not at all* to *totally*. Immediately following this, participants were told to compare their rating with the fictitious average rating (i). A final beauty rating: After being exposed to the fictitious average rating, participants were asked to give their final beauty rating (r2). (A) Example of the timeline for one trial of beauty rating for faces. (B) Example of the timeline for one trial of beauty rating for artworks.

average certainty expressed by the participants, individual differences in resistance to external information. All analyses were conducted in R Studio Version 1.2.5033 using R version 3.6.2 (R Core Team, 2013).

Results

Mean beauty ratings for faces and abstract artworks

Mean beauty ratings for faces and abstract images were 3.45 and 3.72, with standard deviations of 1.41 and 0.61, respectively. Consistent with previous studies, average beauty ratings for faces from female participants were highly correlated with average beauty ratings from male participants, $r(78) = .97$, $p < .001$ (Germine et al., 2015). Also, a two-way mixed analysis of covariance indicated that the sex of the participants did not significantly interact with beauty ratings for faces of the opposite sex, $F(1, 49) = 2.24$, $p = .141$; that is, both males and females rated the faces of the opposite sex in a similar way. Regardless of the sexual orientation of the participants, $F(1, 48) = 0.32$, $p = 0.575$, images of female faces were rated significantly more beautiful than those of males, with mean (*SD*) female beauty ratings of 3.67 (0.68), and mean (*SD*) male beauty ratings of 3.24 (0.81), $F(1, 49) = 20.93$, $p < .001$ (see Supplementary 4, for effect sizes).

Average ratings of beauty for faces correlated highly with their average attractiveness rating, as reported in previous studies ($r_s = .89$, $p < .001$; DeBruine & Jones, 2017; Ma et al., 2015; see Supplementary 5 for scatter plot). This suggests that images of faces that are rated as attractive are, on average, also rated as beautiful. For the ratings of abstract artworks, however, there was only a weak correlation between our participants' ratings and ratings given in the previous study of Sidhu et al. (2018; $r_s = .27$, $p = .015$). Moreover, an analysis of the agreement in beauty ratings between our participants showed that the average of all the correlations (Fisher *Z*-transformed) between the set of ratings given by one participant, with the averages of the ratings of the same images given by every other participant per category, was high for faces, while it was low for abstract images (with MM1 = .79, 95% confidence interval [CI] = [.69, .87] and MM1 = .35, 95% CI = [.13, .54], respectively). In sum, the agreement in the ratings of beauty for faces was significantly higher than that for abstract artworks, as shown by a paired *t* test between the *z* values of the individual preference scores, $t(50) = 13.96$, $p < .001$ (see Figure 2; and see Supplementary 4 for effect sizes).

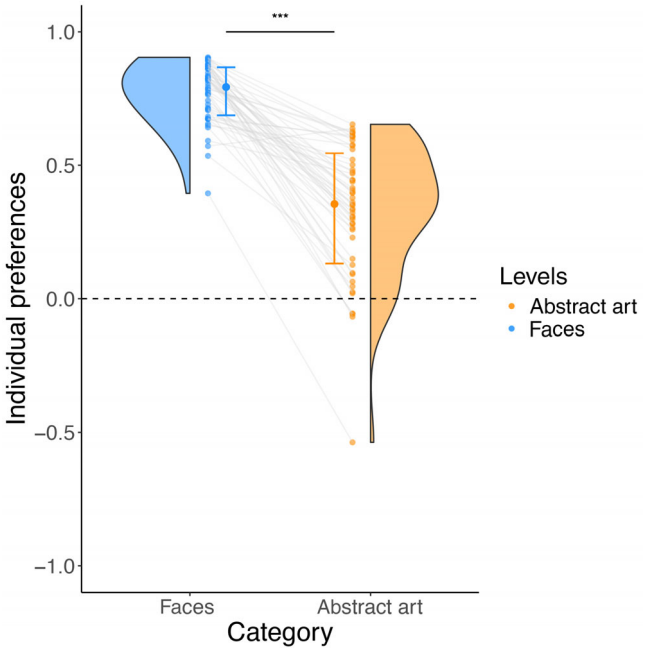

Figure 2. Mean minus one (MM1) beauty rating agreement across participants. Half violin plots of the distribution of agreement for beauty ratings for faces and abstract art. Dots represent individual preferences (i.e. the correlation between one's own beauty ratings and the average ratings given to each image by others). Higher scores indicate less idiosyncratic judgments. Gray lines connect individual preferences for the two categories (faces and abstract art) and central dots represent the MM1. Error bars represent 95% confidence interval (CI); the dashed horizontal line represents a total absence of agreement between participants' ratings. For further details, see text. Image computed adapting van Langen's (2020) tutorial. ***$p < .001$.

Main analysis: Effect of external influences on beauty

Eight participants who reported having had more than 6 years of art or art history training were excluded from our analysis because previous reports suggest that art expertise confers a resistance to reassessment of ratings when valuing artworks (Kirk, Harvey, & Montague, 2011). Another participant was excluded because she was extremely uncertain of her ratings, giving an average certainty of 2.17, compared to the average certainty ratings of the others, which was 6.18. (SD = 0.77; total sample = 42). Excluding the outlier did not influence the results.

For each trial, the strength of the external influence was quantified as the difference between the second and the first beauty rating (rating change [RC]). To test the magnitude of the external influences on beauty ratings, we inverted the distribution of RC when the mismatching information was negative. That is:

$$RC(n) = \begin{cases} -(r2 - r1) \ if \ i < r1 \\ r2 - r1 \ if \ i > r1, \end{cases}$$

where n corresponds to the number of the trial, $r1$ to the beauty rating before exposure to external information, and $r2$ to the beauty rating after; i refers to the value of the external information given to the participant.

The first paired-sample sign-test showed that there was a significant difference in RC between conditions in which there was mismatch between the first rating and the external opinion, and the conditions in which there was no such mismatch ($p < .001$, one-tailed, Holm–Bonferroni adjusted; see Figure 3A legend a for descriptive). That is, the averaged RC was higher for 33 participants, compared to the condition where there was no mismatch. This indicates that external information can influence the rating of beauty.

A second paired-sample sign-test showed that there was no significant difference in the effect of external information on ratings that were extreme or medium; that is, the effect was more or less similar when the first rating was higher than 5 or lower than 3 versus when the rating was between 3 and 5 (p = .37, one-tailed, Holm–Bonferroni adjusted; see the Figure 3* legend for descriptive). This indicates that external information impacts extreme and average beauty ratings similarly.

Turning next to learn whether there was a difference in the effect of external information on beauty ratings for faces (biological) compared to ratings for abstract artwork (artifactual), we used a third paired sign-test. This showed that the effect of external information on beauty ratings for images of faces was significantly lower than that for abstract artworks (p = .017, one-tailed, Holm–Bonferroni adjusted; see Figure 3C legend for descriptive). Thus, participants were on average more likely to change their beauty ratings in light of external information when evaluating images of abstract artwork than when evaluating faces; more specifically, of those participants who changed their ratings (35 out of 42), 25 did so more for abstract artworks than for faces, while only 10 did the reverse.

Analysis of individual differences in resistance to external influences

While on average, the effect of external information impacted beauty ratings significantly, the degree to which different individuals showed resistance to external influences varied. The slopes in Figure 3B represent participants' tendencies to change their beauty ratings when presented with external information; the steeper the slope, the higher the tendency of changing one's beauty ratings

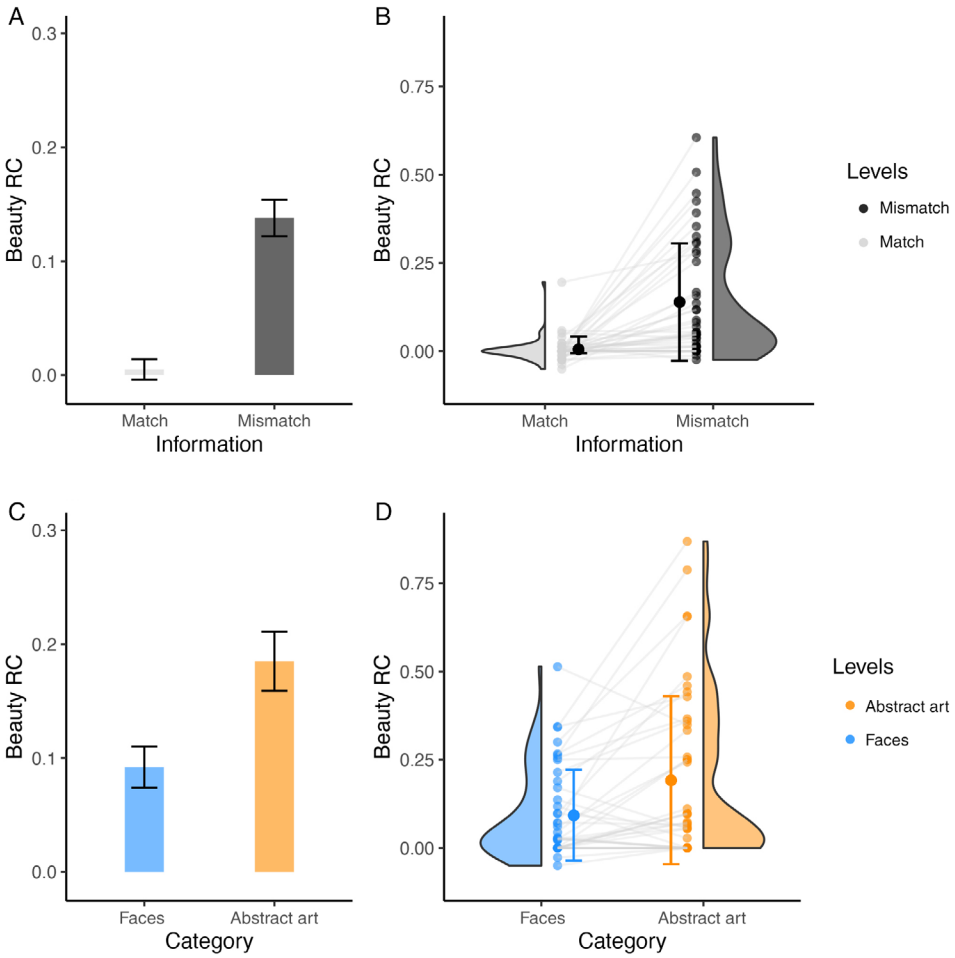

Figure 3. Effect of external information on beauty ratings. The *y*-axis represents the average beauty rating change (RC) between the first and the second ratings, while the *x*-axis represents the different conditions (external information and category). (A) Effect of external information (fictitious ratings) when the external information matched the first rating given (i.e., where the two ratings were equal) and when the two did not match, mean average RC = 0.01 (*SD* = 0.04), median = 0, mean average RC = 0.14 (*SD* = 0.17), median = 0.05, respectively. (B) Same as panel (A), but with individual differences shown. (C) Average effect of external information (fictitious ratings) on beauty ratings for images of faces versus images of abstract artworks; mean average RC = 0.09 (*SD* = 0.13), median = 0.03, mean average RC = 0.19 (*SD* = 0.24), median = 0.07, respectively. (D) Same as panel (C), but with individual differences shown. The error bars in (A) and (C) represent the 95% confidence interval (CI). (B) and (D) error bars represent the *SD* and the gray lines connect rating changes between the conditions (match, mismatch) or categories (faces, abstract art). Images computed adapting van Langen's (2020) tutorial. *The effect of external information on ratings that were extreme and medium; mean average RC = 0.13 (*SD* = 0.19), median = 0.06, mean average RC = 0.14 (*SD* = 0.20), median = 0.05, respectively.

toward the average rating in light of the external information obtained.

We found that the more certain participants were of their ratings on average, the less they were prone to changing their initial ratings, and hence the more resistant they were to external information. This is reflected by the moderate correlation between the steepness of the slopes and the amount of certainty expressed by the individual, $r_s = -.54$, $p < .001$.

Moreover, subjects who showed the greatest tendency to modify their ratings in response to external opinion were those who modified their ratings more for abstract artworks (artifactual stimuli) than for faces (biological stimuli). This was reflected by the strong correlation between the individual slopes in Figure 3B and those in Figure 3D, $r_s = .80$, $p < .001$ (see also Supplementary 6 for details).

Discussion

In this work, we set out to explore the extent to which received opinion, which we refer to as external information, modifies an individual's aesthetic ratings for images of faces and abstract artworks. Past studies have shown that

external information can influence judgments in general, including aesthetic ones, a result with which our present findings are consistent (Berns et al., 2005; Cialdini & Goldstein, 2004; Kirk et al., 2009; Zaki et al., 2011). What remains unknown is whether this effect works uniformly for all kinds of aesthetic experiences. We have shown in this study that the capacity of such extraneous influences to modify the aesthetic judgments of images that fall under the category of biological stimuli is much less pronounced than that for those falling under the artifactual category. This was consistent with our theoretical formulation of the distinction between biological and artifactual experiences and the resistance of the former to be updated in light of experience compared to the latter (Zeki & Chén, 2020).

Studying the neural determinants of the experience of beauty brings with it difficulties quite unique and unlike anything that is encountered in studies of other sensory experiences. Individuals normally judge faces as beautiful even in spite of the fact that the faces they so rate differ significantly in many aspects—for example, more or differently colored hair, different shaped lips, varying extents of forehead and so on; it is in fact the totality of the face that is being judged as being beautiful and so rated. Equally with artifactual beauty, the judgment is immediate even in spite of the fact that objects being judged may vary significantly; for example both a building and a painting may be judged as beautiful or not, even in spite of the fact that the two belong to different categories. We tried to minimize the latter by restricting our category of artifactual objects to modern abstract paintings, and ask subjects to give their rating on the basis of the whole painting. It stands to reason to expect that, had we asked subjects to rate paintings according to, say, the colors in them, we may have had different ratings. Equally, if we had asked subjects to rate faces according to specific features, such as the eyes, we might well expect to have different ratings. Instead, for both categories, we asked merely for the beauty of the entire stimulus, which we believe to be a perfectly justifiable way of proceeding. Future studies may well want to break these holistic stimuli into their components, which would be an interesting thing to do. One may ask subjects, for example, to rate the eyes only according to beauty or to rate only the colors in a painting; such future studies may yield interesting results.

Underlying our approach are some beliefs that are worth a brief mention. Along with Immanuel Kant, we believe that all experiences must be interfaced through concepts. However, we depart from Kant by partitioning aesthetic experiences in a spectrum ranging between two extremes, biological and artifactual (Zeki & Chén, 2020). Kant (1790/1987) supposed that aesthetic experiences, as opposed to "utilitarian" experiences, are interfaced through "indeterminate" concepts and, as a consequence, the experiencing individual could assume that his or her aesthetic judgment has universal assent. We, on the other hand, suppose that there should be some considerable agreement between individuals belonging to different ethnic and cultural groups in the aesthetic judgment of faces because they are interfaced through inherited brain concepts that are shared among all humans (Zeki, 2011; Zeki & Chén, 2020), which appears to be the case (see also Langlois et al.,1991;2000). In line with our supposition, other studies indicate that assent on the perceived attractiveness of faces between individuals is substantially higher than assent for stimuli that fall under the artifactual category (Vessel et al., 2018; Zeki & Chén, 2020); in other words, an individual's aesthetic judgment of faces corresponds better to his or her imagined aesthetic judgment that other individuals might make of the same face compared to the judgments that other indviduals' might make of abstract artworks (Leder, Goller, Rigotti, & Forster, 2016).

In this study, we use our hypothesis and results from previously published work to enquire into whether external influences have equal sway with aesthetic rating of faces (as representing biological stimuli) compared to abstract paintings (representing artifactual stimuli). In our study, too, agreement on the aesthetic ratings of faces was also higher than that for abstract artworks, and the aesthetic ratings of faces given by our participants were highly similar to that reported in previous studies. In contrast, the average aesthetic ratings of abstract artworks were only weakly related with the average aesthetic ratings of such works reported previously (Sidhu et al., 2018).

An interesting corollary to the supposition that there are inherited brain concepts through which aesthetic judgments are interfaced is the extent to which individuals can update such concepts, or beliefs, in light of new experience, as is generally assumed in Bayesian inferential models. Some of our previous results showed that experiences such as color, interfaced through biologically inherited concepts, are more resistant to updating than those interfaced through acquired concepts (Zeki, 2011; Zeki & Chén, 2020). We emphasize that, even in the

updating of beliefs based on biological concepts in light of experience, there are gradations; color categorizations represent perhaps an extreme in not allowing any significant updating, as do stimuli that have certain "significant configurations" that mark them as constituting a human face (Zeki, 2013; Zeki, Javier, & Mylonas, 2020). Humans are unlikely to modify their experience of what a normal face looks like even if exposed repetitively to disfigured faces (see also Chen & Zeki, 2011; and Zeki & Ishizu, 2013, for a brain-based perspective of this issue). Equally, humans are unlikely to categorize a leaf as red even when it reflects more long-wave (red) light, as it does at dawn and dusk, because of brain operations resulting from inherited brain concepts that, through a comparison process, result in constant color categorization, as discussed at length elsewhere (Land, 1974, 1983; Zeki & Chén, 2020; Zeki et al., 2020). In summary, the Bayesian system of updating beliefs is more potent the more stimuli depart from the biological toward the artifactual category because the acquired concepts through which they are interfaced are less rigid and therefore more modifiable.

The general view expressed above is reflected in the results of the present study, which show that the capacity of extraneous influences to modify aesthetic judgment of faces, although present, is much less pronounced than that for abstract artworks and more pronounced than that for other biological categories, such as color. This implies that there is a gradation in the degree to which external influences can modify judgments within the biological category. Indeed, while aesthetic ratings of faces are substantially shared across individuals, there may in addition be individual differences (Germine et al., 2015; Hönekopp, 2006; Vessel et al., 2018) and that such differences may mostly be accounted for by environmental rather than genetic factors (Germine et al., 2015; Sutherland et al., 2020). Hence, we believe that what is shared is not shared because of environmental influence but because of a common inheritance that leads to common brain concepts. Our belief is strengthened not only by the results of this study, but also by studies that have shown that infants tend to look more at faces that are reliably classified as attractive by adult individuals (Slater et al., 1998). We note that although our participants were drawn from 19 countries, most were nevertheless from Western countries. Hence there was less ethnic than cultural diversity. Future studies will no doubt correct this imbalance.

We also found that there was no significant difference in the external influence on stimuli that had been highly rated and those that were not. This came as a surprise to us, since we had previously hypothesized that the more beautiful an image is perceived to be, the less likely the experiencing individual is to change their opinion of how beautiful it is. One possible interpretation of this null result is that the effect was too small to be detected by our sample size. Future work may shed more light on this counter-intuitive result.

Finally, we found that the capacity of external influences to modify ratings was related to the certainty with which individuals made their first aesthetic rating: the more certain they were of that, the less effective was an external influence in modifying their initial rating. This was true for both the biological and the artifactual categories used in this study.

We conclude by noting simply that the results presented here are consistent with our hypothesis of the presence of an inherited brain concept that can influence the experience of beauty of biological stimuli, such as faces.

Disclosure of conflict of interest

The authors declare there are no conflicts of interest.

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Supporting information

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Appendix S1. Supporting information.