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A Cross-Cultural Comparison of Aesthetic Preferences for Neatly Organized Compositions:

Native Chinese- vs. Native Dutch-Speaking Samples

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Abstract

Do aesthetic preferences for images of neatly organized compositions (e.g., images collected on blogs like Things Organized Neatly[®]) generalize across cultures? In an earlier study (Van Geert & Wagemans, 2019), focusing on stimulus and person properties related to order and complexity, Dutch-speaking participants ($N = 421$) indicated their preference for one of two simultaneously presented images (100 pairs) and completed questionnaires such as the Big Five Inventory and the Personal Need for Structure scale. Preferences related to differences in order, soothingness, and fascination ratings between the images in a pair. In the current study, we compared the data of the native Dutch-speaking participants from this earlier sample ($N = 356$) to newly collected data from a native Chinese-speaking sample ($N = 220$). Overall, aesthetic preferences were quite similar across cultures, and preferences related to differences in soothingness and order between the images in a pair for both Chinese-speaking and Dutch-speaking participants. However, some interesting differences were found as well. Chinese-speaking participants showed an additional preference for simplicity, and Dutch-speaking participants for fascination. As fascination ratings of the images related positively with measures of order and complexity, whereas soothingness ratings related positively with order and negatively with complexity (Van Geert & Wagemans, 2019), these results hint at a cross-culturally consistent relationship between order and aesthetic appreciation, but a cross-culturally diverse link between complexity and appreciation.

Keywords: aesthetics, order, complexity, cross-cultural differences

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Images of neatly organized compositions are images of a set of objects, or parts of objects, organized in a neatly or tidy way (Van Geert & Wagemans, 2019). These images are very popular online (e.g., on the blog Things Organized Neatly® curated by Austin Radcliffe). To investigate aesthetic appreciation and preferences for this type of images, Van Geert and Wagemans (2019) conducted a large-scale online study focusing on stimulus and person characteristics related to (the balance between) order and complexity. Order is defined as all aspects related to the structure and organization in a stimulus, whereas complexity relates to the quantity and variety of information in a stimulus (Van Geert & Wagemans, 2020). Images of neatly organized compositions are special in the sense that they take an intermediate position between two types of stimuli that are often used in aesthetics research: very simple artificial stimuli on the one hand, and ecologically valid but very semantically complex art stimuli on the other hand.

Preferences for Neatly Organized Compositions

In the online study by Van Geert and Wagemans (2019), 421 participants completed a two-alternative forced choice task with 100 fixed pairs, in which aesthetic preferences were assessed: participants indicated which of two simultaneously presented images they preferred. 84 of those participants completed a second optional part of the study and rated all individual images on how ordered, complex, soothing, and fascinating they perceived them to be. The results from this research (see Figure 1) suggested that different types of aesthetic appreciation correlate positively with each other (preferences, soothingness ratings, fascination ratings) for these images of neatly organized compositions, but that they show differential relationships with subjective order and complexity: Soothingness related positively with order and negatively with complexity, whereas fascination related positively

with both order and complexity. These differential relationships of soothingness and fascination with subjective order and complexity could be taken to result from different routes towards aesthetic appreciation, one mediated by pleasure, and the other by interest (Graf & Landwehr, 2015, 2017).

This study also suggested that the balance between order and complexity depends on a combination of predictors rather than an interaction between them. Consistent with the earlier literature, the relation between order and complexity seemed to be both complementary and antagonistic (Van Geert & Wagemans, 2020). On the one hand, order and complexity complemented each other in predicting how fascinating an image is perceived to be. On the other hand, order and complexity were partial opposites in their relation to soothingness.

Figure 1. Schematic representation of Van Geert and Wagemans' (2019) main findings.

Note. Numbers indicate Pearson product-moment correlations; * $p < .01$, ** $p < .001$, *** $p < .0001$. For the correlations with the objective complexity measures, the range of correlations is indicated, going from the correlation with the objective measure for which the correlation was smallest in absolute number to the correlation with the objective measure for which the correlation was largest in absolute number. Figure licensed under CC BY 4.0 by the authors. Retrieved from <https://doi.org/10.6084/m9.figshare.8038775>.

Cross-Cultural Consistency of Relations Between Order, Complexity, and Aesthetic Preference

Here the question is asked whether the obtained findings also apply to non-Western populations. Specifically, this study explored the cross-cultural generalizability of findings concerning aesthetic preferences for neatly organized compositions and the stimulus properties, person properties, and interactions between stimulus and person that are associated with them.

Early cross-cultural research in aesthetics focused on the concept of aesthetic sensitivity and found evidence for a considerable level of universality of aesthetic preferences in general between Japanese, Chinese, and Western participants (e.g., Chan, Eysenck, & Götz, 1980; Eysenck & Iwawaki, 1971, 1975; Iwawaki et al., 1979; for a review, see Che, Sun, Gallardo, & Nadal, 2018). In light of Berlyne's (1971) ideas on aesthetics, some studies investigated the cross-cultural consistency of preferences for intermediate complexity levels and for symmetry. As Berlyne's (1970, 1971) theory predicted all organisms to prefer an intermediate arousal level, and as a consequence intermediate levels of collative variables (e.g., complexity), his theory would have predicted common preferences across cultures. Whereas the results regarding complexity differed between studies and cultures, symmetry was consistently preferred above non-symmetry across cultures (Che et al., 2018). Child and Iwao (1968) reported a small positive cross-culturally consistent link (Japan vs. United States) between tolerance of complexity and aesthetic sensitivity, which suggests a common relation between some personality traits and aesthetic preferences across cultures (Che et al., 2018).

To investigate whether the findings of Van Geert and Wagemans (2019) generalize to non-Western populations, a slightly shortened version of the study by Van Geert and Wagemans (2019) was conducted with native Chinese-speaking participants, and their

preferences were compared to those of the native Dutch-speaking participants in the sample of Van Geert and Wagemans (2019). Due to practical constraints, only two out of the three original personality questionnaires and no rating data (i.e., order, complexity, soothingness, and fascination ratings) were collected in the Chinese sample.

Method

Participants

The criteria for participation and data collection procedures for the earlier collected Dutch-speaking sample are described by Van Geert and Wagemans (2019). For the current analysis, we selected all native Dutch-speaking participants ($N = 356$) from this earlier collected sample ($N = 421$). Here only the criteria for participation and data collection procedures for the newly collected data from the native Chinese-speaking sample will be described.

Anyone between 16 and 100 years old and able to understand Chinese instructions could participate. There were no restrictions regarding nationality and mother tongue. For the analysis, only participants with Chinese as mother tongue were included. Participants were recruited via personal contacts of the researchers. Participation was completely voluntarily: No monetary reward was offered for participation.

The Chinese version was completed by 220 native Chinese-speaking participants¹ between 17 and 77 years (137 women, 80 men, 3 other, $M_{\text{age}} = 29.7$ years, $SD_{\text{age}} = 13.4$ years)². The Dutch version was completed by 356 native Dutch-speaking participants between 16 and 77 years (232 women, 124 men, $M_{\text{age}} = 41.0$ years, $SD_{\text{age}} = 16.1$ years)³. As can be noticed from the means, the Chinese-speaking sample was slightly younger in general. Also

¹ This included 217 participants indicating Chinese (中文) and 3 participants indicating Chinese, simplified script (简体中文) as their mother tongue.

² In total, the Chinese version was started 323 times. One hundred and three participations were not completed.

³ In total, the Dutch version was started 413 times. Fifty-seven participations were not completed.

when it comes to education level, the Chinese-speaking sample was less representative than the Dutch-speaking one: a large majority of the Chinese-speaking participants was highly educated (75.91% with a university degree and 8.18% with a college degree compared to 29.21% and 34.27% in the Dutch-speaking sample).

The order, complexity, soothingness, and fascination ratings used in the analysis are based on data from 84 participants between 20 and 75 years (56 women, 28 men, $M_{\text{age}} = 43.4$ years, $SD_{\text{age}} = 16.7$ years). Only 8 participants in the second part completed the English version, whereas 76 completed the Dutch version. The study received ethical approval from the Social and Societal Ethics Committee of the authors' institution (G-2016 04 547).

Materials

Images. The images and image pairs used in this study are the same as in the study by Van Geert and Wagemans (2019). A detailed explanation on the selection procedure used can be found there. Hundred image pairs involving 184 different images were selected (16 images were included twice). An overview of the images and image pairs that we are allowed to show can be found on osf.io/fxekp/.

Questionnaires. As in Van Geert and Wagemans (2019), we used the Big Five Inventory (BFI; 44 items with response options ranging from 1 (*strongly disagree*) to 5 (*strongly agree*); John et al., 1991) and the Personal Need for Structure scale (PNS; 12 items with response options ranging from 1 (*strongly disagree*) to 6 (*strongly agree*); Thompson et al., 2001). The Symmetry, Ordering, and Arranging Questionnaire (Radomsky & Rachman, 2004) was left out as no validated Chinese translation was available.

Validity information on the Chinese version of the BFI (John & Srivastava, 1999) is available in Carciofo, Yang, Song, Du, and Zhang (2016). A principal components analysis with varimax rotation of the 44 BFI items was conducted on the data of participants to the Chinese version of the current study ($N = 220$). The five factor solution explained 45% of the

variance, but not all items loaded on the expected dimension. Absolute primary loadings ranged from .14 to .74, with an average primary loading of .51. In addition, some absolute cross-loadings went up to .61. The results of this principal component analysis and an additional confirmatory factor analysis are included in the analysis file on osf.io/avhxq/.

The Chinese version of the PNS (Chen, Huang, Wang, & Shi, 2008) is based on the two-factor interpretation of Neuberg and Newsom (1993) and therefore only contains 11 items. Two principal components analyses with varimax rotation of the 11 PNS items were conducted on the data of participants to the Chinese version of the current study ($N = 220$), one exploring a one-factor solution and one exploring a two-factor solution. The one-factor solution explained 31% of the variance, with loadings ranging from .19 to .79. The two-factor solution, which explained 46% of the variance, did not resemble the two factors of Neuberg and Newsom (1993): five out of the seven items that were supposed to be in the second factor loaded most highly on the first factor. Therefore, in the analyses using the PNS, the one-factor solution including 11 items was used. The results of these principal component and additional confirmatory factor analyses for the Chinese questionnaire data collected in this study are included in the analysis file on osf.io/avhxq/.

Image questionnaire. Participants rated the general pleasantness of looking at these images (i.e., “How pleasant did you find the images to look at in general?”) on a scale ranging from 1 (*not at all pleasant*) to 7 (*very pleasant*). Moreover, they were asked to indicate their previous experience with this type of images (i.e., “Did you see similar images before?”) on a scale ranging from 0 (*never*) to 4 (*very often*). If the participants indicated to have seen similar images before, they also indicated whether they had already consciously sought for similar images (i.e., “If so, did you already consciously search for similar images?”) on the same scale ranging from 0 (*never*) to 4 (*very often*). If they did already search for similar images, they were asked to describe why they had done so (i.e., “If so, why?”).

Procedure

Data from the Chinese sample were collected online from May 2017 until August 2017. When participants visited the webpage of the questionnaire, they were provided with a short description of the study and were asked for their informed consent. If participants agreed to participate, they were asked to log in with an e-mail address, to complete some basic demographic information (i.e., gender, age, mother tongue, and highest education level), and the Big Five Inventory (BFI, 44 items).

Then, a 2AFC image task was conducted, in which participants had to indicate which of two simultaneously shown images they preferred. Participants were presented with 100 image pairs and were asked each time to click on the image they preferred. The image pairs were presented in a semi-random order, preventing that pairs including images used in more than one pair were shown immediately after each other. Additionally, the position (i.e., left or right) of the images hypothesized to be the more complex was counterbalanced between participants: For approximately half of the participants, the image hypothesized to be more complex (“id1” from now on) was always the right image presented on the screen, whereas for the other half this image was the left one⁴. When participants had indicated their preference for one of the images, the presentation sequence automatically continued to the next pair.

Afterwards, participants completed the Personal Need for Structure scale (PNS, 11 items), as well as the short questionnaire about their aesthetic appreciation of the type of images that were shown and their previous experience with them. After completing the questionnaires, participants were given a short debriefing text and they could indicate if they wanted to be informed about the results of the study. The mean completion time of the study

⁴ Averaged over all image pairs, which image within each pair was positioned left or right had no influence on the proportion of preference for that image, based on a two-sample test for equality of proportions, $\chi^2(1) = 1.75$, $p = .19$ for the Chinese version and $\chi^2(1) = 2.23$, $p = .14$ for the Dutch version.

was 20 minutes and 55 seconds for the Chinese version and 23 minutes 14 seconds in the Dutch version.

Image Calculations and Ratings. Further information on the calculated statistical image properties and collected image ratings can be found in Van Geert and Wagemans (2019).

Data Analysis

The data analysis focused on comparing estimates of the association of aesthetic preferences and stimulus and person properties related to order and complexity between a native Chinese-speaking and a native Dutch-speaking sample. We examined the cross-cultural generalizability of the aesthetic preferences in general, as well as that of the specific preferences for order, complexity, soothingness, and fascination. To explore the association between aesthetic preferences and several stimulus aspects, we calculated Pearson product-moment correlations (and their corresponding 99% confidence interval) between the different image pair measures and proportions of preference for a specific image in the pairs. To explore individual differences in preference for order, complexity, soothingness, or fascination, Pearson correlation coefficients between the different preferences and the measured person properties were calculated. To test differences in the correlations of aesthetic preference with image pair and person properties between both language groups, we calculated Zou's (2007) confidence interval for comparing two correlations based on dependent groups with overlapping variables, using the cocor R package (Diedenhofen & Musch, 2015).

All data processing and analyses were conducted using the statistical program R (Version 3.6.1; R Core Team, 2019) and the following R packages: tidyverse (Wickham et al., 2019), lavaan (Rosseel, 2012), psych (Revelle, 2018), cowplot (Wilke, 2019), knitr (Xie, 2020), corrplot (Wei & Simko, 2017), cocor (Diedenhofen & Musch, 2015), Hmisc (Harrel Jr,

2019), SemiPar (Wand, 2018), and qgraph (Epskamp, Cramer, Waldorp, Schmittmann, & Borsboom, 2012). The data, analysis code, and other open materials for this study are available on osf.io/xtva8/.

Results

Overall Pleasantness and Experience

Overall, most participants perceived the images as pleasant to look at (i.e., 60.5% of Chinese and 78.4% of Dutch participants indicated somewhat pleasant, pleasant, or very pleasant) and did not regularly see similar images before (i.e., 87.7% of Chinese and 89.1% of Dutch participants). Of the participants who had seen similar images before, almost no participants indicated to search for this type of images regularly (i.e., 2.3% of 60.5% and 1.8% of 78.4%, which is in both cases approximately 1.4% of all participants; see Supplementary Figures S1 and S2).

Aesthetic Preferences for Neatly Organized Compositions

Amount of variability between image pairs and participants. As expected, image pairs differed in the amount of individual variation in preference that was present: Proportions of preference for the supposedly most complex image id1 varied between 0.13 and 0.84 ($M = .4553$, $SD = .1487$) in the Chinese-speaking sample and between 0.22 and 0.80 ($M = .4990$, $SD = .1315$) in the Dutch-speaking sample. Preferences for image id1 also varied between participants, with preference proportions ranging from 0.11 to 0.79 ($M = .4552$, $SD = .1247$) in the Chinese-speaking sample and from 0 to .89 ($M = .4990$, $SD = .1336$) in the Dutch-speaking sample.

Cross-cultural consistency in general aesthetic preferences. In general, aesthetic preferences were rather similar across cultures. Preferences in the Chinese and the Dutch sample were highly positively correlated, $r(98) = 0.58$, 99% CI [0.38, 0.73] (see Figure 1).

Figure 1. Cross-cultural consistency of aesthetic preferences in general.

Cross-cultural consistency in aesthetic preferences for order and soothingness. The relation of aesthetic preferences with differences in order and soothingness within a pair was very similar across cultures (see Figures 2 and 3). In both the Chinese-speaking and the Dutch-speaking sample, the larger the difference in order ratings for the images within a pair, the more often the more ordered image was preferred, $r_{\text{Chinese}}(98) = .33$, 99% CI [.09, .54] and $r_{\text{Dutch}}(98) = .36$, 99% CI [.11, .56]. Furthermore, a larger difference in soothingness ratings

between the images in a pair related to a higher preference for the more soothing image in the pair, $r_{\text{Chinese}}(98) = .53$, 99% CI [.31, .69] and $r_{\text{Dutch}}(98) = .57$, 99% CI [.37, .72]. All correlations of the different image pair measures with the proportion of preference for the image preferred on average in each language group are reported in Figure 2.

Figure 2. Correlations between average preferences per language group with other image pair properties ($N = 100$ pairs). Correlation plot generated with the R package corrplot (Wei & Simko, 2017). Prop_ZH_ID1 = proportion of preference for ID1 in the Chinese-speaking sample; Prop_NL_ID1 = proportion of preference for ID1 in the Dutch-speaking sample. Correlations with $p < .01$ are shown on a colored background.

Figure 3. Correlation between difference in standardized order rating (top) and standardized soothingness ratings (bottom) and aesthetic preference in the Chinese (left) and Dutch (right) version respectively.

Cross-cultural diversity in aesthetic preferences for complexity and fascination.

However, the relations between aesthetic preference and complexity and fascination were very different between Chinese-speaking and Dutch-speaking samples (see Figure 4). First, in

the Chinese sample, a preference for simplicity was present: the larger the difference in complexity rating between the images in a pair, the more often the less complex image was preferred, $r(98) = -.43$, 99% CI $[-.62, -.20]$. This negative relation was absent in the Dutch-speaking sample, $r(98) = .04$, 99% CI $[-.21, .30]$. The estimated difference in correlation was significantly different from zero, estimate = $-.48$, 99% CI $[-.69, -.25]$. Second, in the Dutch-speaking sample, there was a strong positive relation of aesthetic preference with fascination: the larger the difference in fascination ratings between the images in a pair, the more often the more fascinating image was preferred, $r(98) = .58$, 99% CI $[.38, .73]$. This positive relation was absent in the Chinese-speaking sample, $r(98) = .08$, 99% CI $[-.18, .33]$. Also this estimated difference in correlation was significantly different from zero, estimate = $-.50$, 99% CI $[-.72, -.29]$.

Figure 4. Correlation between difference in standardized complexity rating (top) and standardized fascination ratings (bottom) and aesthetic preference in the Chinese (left) and Dutch (right) version respectively.

It is important to note that the size of differences in order ratings and the size of differences in complexity ratings in the image pairs were unrelated, $r(98) = -.10$. Also the order and complexity ratings for the images themselves were unrelated, $r(182) = -.07$. The results regarding order and complexity, therefore, do not follow from each other (i.e., they are

independent). The results for soothingness and fascination, however, seem to follow from the results for order and complexity, as differences in soothingness were strongly positively correlated with the differences in order and negatively with differences in complexity, and differences in fascination were strongly positively correlated with differences in both order and complexity (see Figure 2).

Individual differences in aesthetic preferences and relation to person properties. Except for the correlations with PNS, the pattern of correlations between individual preferences (for order, complexity, soothingness, and fascination) and other person properties (see Figure 5) was rather similar in direction and strength. For example, in both language groups, scoring high on Openness to Experience was related slightly positively with more often preferring the more complex image in the pairs, $r_{\text{Chinese}}(218) = .27$, 99% CI [.10, .42], $r_{\text{Dutch}}(354) = .22$, 99% CI [.09, .35]. In addition, age seemed to be negatively correlated to preferences for fascination and complexity in both language groups, $r_{\text{Chinese}}(218) = -.45$, 99% CI [-.58, -.30], $r_{\text{Dutch}}(354) = -.21$, 99% CI [-.33, -.07] for complexity and $r_{\text{Chinese}}(218) = -.43$, 99% CI [-.57, -.28], $r_{\text{Dutch}}(354) = -.27$, 99% CI [-.39, -.14] for fascination.

The correlations of the personality measures and age with preference for order, soothingness, and complexity in the Chinese-speaking sample should be interpreted with the necessary caution. In the case of the PNS, there were some differences between the two samples but the effects are small, and there is no clarity on the validity of the Chinese PNS questionnaire in the current sample (cf. Questionnaires in the Method section). In the case of age, the correlations are driven by the rather few older participants in the Chinese sample. When it comes to the correlations with the Big Five traits, the validity of the Chinese BFI questionnaire was not optimal, but for the Openness factor, for instance, most items loaded most highly on that factor.

Figure 5. Correlations between different participant measures for the Chinese-speaking (left) and the Dutch-speaking sample (right; $N_{\text{Chinese}} = 220$, $N_{\text{Dutch}} = 356$). Correlation plot generated with the R package *corrplot* (Wei & Simko, 2017). OrderedPref = preference for ordered images; ComplexPref = preference for complex images; SoothingPref = preference for soothing images; FascinatingPref = preference for fascinating images; PNS = Personal Need for Structure. Correlations with $p < .01$ are shown on a colored background.

Discussion and Conclusion

In summary, three main findings were obtained. First, average aesthetic preferences were very similar across cultures. Second, in both language groups, participants preferred more ordered and more soothing images above less ordered and less soothing ones. Third, cross-cultural differences were present as well: A preference for simplicity was only present in the Chinese language group and preference for fascination only in the Dutch language group.

The cross-cultural consistency in average aesthetic preferences accords well with earlier cross-cultural research on aesthetics suggesting a considerable level of universality (e.g., Chan, Eysenck, & Götz, 1980; for a review, see Che et al., 2018).

Whereas the soothingness of an image can be predicted by high order and low complexity, how fascinating an image is perceived to be is associated with high order and high complexity (Van Geert & Wagemans, 2019). Individuals within a culture but also between cultures differ in the extent to which their aesthetic preferences are associated with perceived order and complexity, and (consequently) also in the extent to which their aesthetic preferences are associated with soothingness and fascination. This study brings evidence for cross-cultural differences in the role complexity plays in aesthetic appreciation. On average, complexity was more disliked in the Chinese-speaking sample, whereas fascination (positively linked to complexity) played a positive role in aesthetic appreciation in the Dutch-speaking sample. This result is in line with the findings of Fingerhut et al. (2020), who asked Japanese and German participants to rate figurative artworks differing in level and type of complexity, and found the relation between complexity and aesthetic ratings to be more positive and more consistent for Western European than for East Asian observers.

From these results, we propose that the relationship between order and aesthetic appreciation is cross-culturally consistent, but that the relation between complexity and aesthetic appreciation is cross-culturally diverse. This is in line with previous evidence on the existing variance within as well as between cultures. Che et al. (2018) reviewed earlier cross-cultural work on complexity and symmetry, and concluded that the relation between aesthetic appreciation and complexity differed between studies and cultures, while the relation between appreciation and symmetry (i.e., a form of order) was much more consistent across cultures. Van Geert and Wagemans (2019) found more variation between individuals (within a Western sample) in their correlation of soothingness and fascination with complexity than in their correlation of soothingness and fascination with order (see Figure S17 and Figure S18 in the Supplemental Material of Van Geert & Wagemans, 2019). Order thus seems to be a more consistent factor in aesthetic appreciation, both within and across cultures.

Individual differences in preferences for complexity and fascination related positively with Openness to Experience and negatively with age in both the Chinese- and Dutch-speaking samples. These results indicate a cross-culturally consistent relationship, and converge with some earlier work suggesting a common relation between some personality traits and aesthetic preferences across cultures (Child & Iwao, 1968; Che et al., 2018). The results regarding the Personal Need for Structure scale do not follow this cross-culturally consistent pattern, but could be due to invalidity of the Chinese data for the PNS in this study.

Post-Hoc Interpretation of Preference for Simplicity in the Chinese-Speaking Sample

As this study was meant to be exploratory, we did not have any hypotheses on the existence or direction of differences in preferences for order or complexity between the native Chinese-speaking and native Dutch-speaking samples. However, based on our analysis of additional literature, we can suggest the following interpretation.

Whereas Western aesthetics is concerned with beauty, symmetry, order, disinterest, and pleasure, traditional Chinese aesthetics is more concerned with balance, tranquility, and purity, amongst others (Mattice, 2013). In the ancient Chinese ways of thinking, everything in the world is related, and cannot be easily separated from each other (Wang, Masuda, Ito, & Rashid, 2012). Nisbett and colleagues have described several studies in which East Asian individuals tend to be more attentive to both salient and contextual information, whereas North American individuals focus on the salient information only (for a list of references, see Wang et al., 2012). Wang et al. (2012) suggest that East Asian individuals will have a more holistic orientation, leading to a larger difficulty to separate target from peripheral information and the main message from the details. In contrast, North American individuals tend to focus on salient, core information while ignoring less core information like context or details.

Fingerhut et al. (2020) found the relation between aesthetic ratings and complexity defined as the number of objects in the stimulus to be positive in a Western European sample

but rather negative in an East Asian participant sample. Western European observers showed a strong positive correlation between aesthetic ratings and complexity defined as the diminishing amount of empty space, a correlation for which no evidence was found in the East Asian sample. Complexity defined as the amount of texture present in an image was positively correlated with aesthetic ratings in both the Western European and the East Asian sample. When inspecting the image pairs in the current study for which a large difference in preference was present (see examples in Supplementary Figure S3), the main factors distinguishing the images in a pair seem to be the number of objects and the overall, holistic organization of the display. Participants in the native Chinese-speaking sample more often seemed to prefer the image containing a smaller number of objects compared to participants in the native Dutch-speaking sample. In addition, Chinese-speaking participants more often seemed to prefer the image in the pair in which the relation between different objects in the display is more clearly defined, more harmonious, and less cluttered than Dutch-speaking participants.

East Asian and Western individuals may not only differ in the level of complexity they prefer on average, they may also differ in how they experience complexity. As Chinese-speaking participants may have more attention for context and details, the images judged as ‘less complex’ by Western participants may be experienced as more complex by East Asian participants, like the native Chinese-speaking individuals in our study, than by Western participants, like the native Dutch-speaking individuals in our study. For example, in East Asian cultures, empty space is seen as a substance that depicts something (Zhang, 2004; Pelowski et al., 2012). The optimal amount of information may thus differ between cultures, partly because different cultures vary in how much complexity they experience in an image. This experienced level of complexity may be influenced by how much attention an individual pays to details and contextual information.

Earlier research found East Asian cultural products to be more information-rich than North American cultural products, which tend to be simpler (Wang et al., 2012). This may be a consequence of East Asian individuals being more sensitive to contextual information, and North American individuals focusing on some major pieces of information while ignoring further context (Choi et al., 2003; Masuda et al., 2008; Masuda et al., 2012). That individuals in East Asian cultures would be more habituated to information-rich stimuli does not necessarily imply that they will also prefer information-rich stimuli in all contexts. The harmony or order between parts in an image may play a crucial role in whether more or less information-rich products are preferred by East Asian participants. For example, in a cross-cultural study of color drawings, Japanese participants used a larger number of hues in their colorings than North American participants but the Japanese colorings were more harmonious: the hues they used were less contrasting and less intense (Ishii et al., 2014).

The interpretation laid out in this paragraph cannot be evaluated based on the current study, as the complexity ratings for the images were based on a fully Western sample of participants. Future research could additionally collect ratings from an East Asian sample and verify whether there is a mean difference in how complex the images are experienced in general.

Potential Limitations

Difference in familiarity with type of stimuli? The current findings could be influenced by the type of stimuli used in the study, i.e., images of neatly organized compositions. As images of neatly organized compositions are a Western cultural phenomenon, one may assume Chinese-speaking participants to be less familiar with this type of images. Chinese-speaking participants were however not less familiar with this type of images than Dutch-speaking participants: in both samples, approximately only twelve percent

of participants had often or very often seen this type of images before (see Supplementary Figure S1).

Less representative Chinese-speaking sample. Just like the Dutch-speaking sample, the Chinese-speaking sample was a convenience sample. The resulting Chinese sample was less diverse in age and education levels than the Dutch sample, and also less representative for the population. Based on feedback from some participants, the reasons could be that desktop use is very uncommon among older Chinese and that many older Chinese with lower education level have no email address (which was required to participate) or very limited digital knowledge and skills. Nevertheless, we are confident that the results are interpretable, even with this less representative sample. The strong negative correlation between aesthetic preference and complexity in combination with a strong negative correlation between age and preference for complexity suggests that the difference between the language groups would even be more outspoken with a more representative Chinese-speaking sample.

Image ratings based on Western participants only. The subjective image ratings of order, complexity, soothingness, and fascination used to determine the more ordered, complex, soothing, and/or fascinating image in the pair were based on a Western sample of participants only ($N = 84$, mostly Dutch-speaking, some English-speaking). The resulting findings are thus based on a Western interpretation of the concepts “order” and “complexity”. It could be the case that these concepts would be interpreted differently in a native Chinese sample, or that the level of complexity experienced in the used images would be different (as suggested earlier in the Discussion). This difference in the experience of complexity could lead to different order and complexity ratings and consequently different findings could be the result when the ratings were based on a native Chinese sample. This would not invalidate the current findings, however; it only specifies in which way the current results should be interpreted (i.e., from a Western point of view on the concepts of order and complexity).

Future research could collect ratings from a native Chinese sample to investigate whether “order” and “complexity” have different meanings or are experienced differently in Chinese culture.

Doubtful validity of the Chinese PNS questionnaire. Although we used a validated Chinese version of the PNS, the validity in the current sample was doubtful (cf. Questionnaires in Method section). We therefore suggest not to interpret the correlations between aesthetic preference and this personality questionnaire and the differences in these correlations compared to the Dutch sample.

Low experimental control. As the study was conducted online and we did not ask participants about the device used, we had no control on the screen size of participants’ device. Based on feedback from some participants, we expect more participations on smartphone in the native Chinese sample compared to the native Dutch sample, which could have influenced the ease of participating in the study (i.e., more horizontal and vertical scrolling involved when participating on smaller device). We do not have any concrete indications, however, that this potential confound would actually have had any influence. The larger proportion of smartphone use in combination with the reduced ease of participation on smartphone may explain the large proportion of dropout in the Chinese-speaking sample (see Footnotes 2 versus 3). In addition, the size in which the images were presented stayed the same across devices, as size was determined absolutely (maximum width of 600 pixels and maximum height of 800 pixels, keeping the original aspect ratio of the image).

Conclusion

In conclusion, aesthetic appreciation for images of neatly organized compositions was relatively consistent across cultures (i.e., Chinese and Dutch-speaking language groups). Whereas preferences for ordered and soothing images were very cross-culturally consistent, some cross-cultural differences emerged as well. Chinese-speaking participants preferred

images that are subjectively experienced as simple, whereas Dutch-speaking participants preferred fascinating images, which are often rather complex. This cross-cultural difference in the appreciation of complexity relates to earlier findings indicating more interindividual variation in the relation between aesthetic appreciation and complexity than between aesthetic appreciation and order. The association between order and aesthetic appreciation is thus more consistently positive than the association between complexity and aesthetic appreciation, both within and between cultures. Further investigations should focus on further investigating and theoretically explaining the cross-cultural consistencies and differences found.

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Supplementary Figures**How pleasant did you find the images to look at in general?**

Figure S1. Distribution of the overall pleasantness score participants gave to the images in the Chinese-speaking (left) and the Dutch-speaking (right) sample.

Did you see similar images before?

ZH

NL

If so, did you already consciously search for similar images?

ZH

NL

Figure S2. Distribution of how often participants saw (A) and searched for (B) similar images before in the Chinese-speaking (left) and the Dutch-speaking (right) sample.

TON_170

Standardized complexity rating: -0.56

Pref_{ZH} = 78.64%; Pref_{NL} = 49.16%

TON_172

Standardized complexity rating: 1.06

Pref_{ZH} = 21.36%; Pref_{NL} = 50.84%

TON_64

Standardized complexity rating: -0.15

Pref_{ZH} = 70.91%; Pref_{NL} = 45.51%

TON_65

Standardized complexity rating: 1.04

Pref_{ZH} = 29.09%; Pref_{NL} = 54.49%

TON_69

Standardized complexity rating: 0.05

Pref_{ZH} = 86.82%; Pref_{NL} = 63.76%

TON_68

Standardized complexity rating: 1.29

Pref_{ZH} = 13.18%; Pref_{NL} = 36.24%

TON_81

Standardized complexity rating: -0.57

Pref_{ZH} = 47.73%; Pref_{NL} = 25.00%

TON_76

Standardized complexity rating: 0.25

Pref_{ZH} = 52.28%; Pref_{NL} = 75.00%

Figure S3. Examples of image pairs with a large difference in preference between the Chinese-speaking (ZH) and Dutch-speaking (NL) sample (pair ids: TEX_32, CL+TX_5, NUM_9, TEX_6). As we have not yet obtained permission to reproduce all of the images in Supplementary Figure 3, they are not visible in the preprint version of this manuscript and have been replaced with image icons.