Attractiveness of Facial Symmetry in the Context of the Dominant Visual Field

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ARTICLE INFO	ABSTRACT
	One of the key features of an attractive face is symmetry. The presence of symmetry in living organisms reflects their ability to cope with various adverse environmental or genetic factors, thus a symmetrical face signals the hidden qualities of the organism. Despite the evolutionary basis for the attractiveness of facial symmetry, studies that have examined it have yielded diverse results. One reason may lie in the fact that the symmetrical stimulus faces are often composites that are created by using the mirror image of one, which can lead to contradictory outcomes. When evaluating human faces, the dominance of the left visual field (as a reflection of brain lateralisation functions) comes into play, which may modify the attractiveness of the composite depending on whether it was created as a left-sided mirror image (using the left half of the face) or a right-sided mirror image (using the right half of the face). The study aims to evaluate the attractiveness of left-sided and right-sided symmetrical facial composites and how the evaluator's visual field dominance affects the assessed attractiveness. The research was conducted on a sample of 1,921 participants aged from 15 to 77 (M = 23.57; SD = 9.52); 60.7% women using computerised facial composites in quasi-experimental research design. The results show that left-sided facial composites are significantly (p <0.001) more attractive than right-sided, for both female and male faces. Furthermore, it is noted that visual field dominance is not related to the type (left-sided vs. right-sided) of symmetry or the evaluation of its attractiveness – individuals with dominant left visual fields as well as those with dominant right visual fields universally rate the left-sided composite as significantly more attractive than the right-sided composite.

1. Introduction

The human face is a rich and irreplaceable source of information in interpersonal interactions. It allows an individual to be identified, plays a significant role in communication, provides information about an individual's state of mind, emotions, intentions, age, gender, ethnic background, and even personality traits (Oruc et al., 2019). The advantage of the face is its

visibility and easy accessibility during communication, and moreover, the information derived from its characteristics is processed very quickly (Willis & Todorov, 2006), significantly enhancing the efficiency of processing such data. Evolutionarily oriented streams of scientific interest in the human face (such as evolutionary anthropology, evolutionary psychology...) complement the notion that the face can signal important indicators of fitness, fertility, and individual health (Thornhill & Grammer, 1999; Prokosch et al., 2005). In addition, the face provides information that allows us to assess whether the individual with whom we are interacting might be a suitable partner, increasing the chances of our survival or the survival of our genes.

An example of facial features that come to the forefront in relation to the fitness and health of an individual is symmetry. As deviations from symmetry are the result of the unsuccessful attempts by the organism to cope with various adverse environmental (such as climate, pollution, malnutrition, parasitism) or genetic factors (such as inbreeding, mutations) (Møller, 1997), it is assumed that only very high-quality (in terms of resilience, health, etc.) organisms can maintain symmetry throughout their development (Little et al., 2011). In this context, evolutionary pressures have led to a preference for symmetrical organisms (and symmetrical faces) in mate selection situations, and the presence of symmetry is perceived as highly attractive (Rhodes et al., 2001; Baudouin & Tiberghien, 2004; Hatch et al., 2017). However, scientific research has also indicated that additional variables can influence the relationship between attractiveness and symmetry. For example, it has been shown that perceived normality acts as a mediator between symmetry and facial attractiveness (Zheng et al., 2021); facial movement enhances the relationship between symmetry and facial attractiveness (Hughes et al., 2018), or that the effect of symmetry on attractiveness can interact with other features, such as averageness (Jones et al., 2007). A growing body of research has also presented results that confirm there is no straightforward relationship between facial symmetry and attractiveness (see e.g., Swaddle & Cuthill, 1995; Komori et al., 2009; Harun et al., 2023).

When creating symmetrical facial composites to be used as stimuli in research, the manner in which these composites are generated can be crucial. The simplest (and most often used) method to achieve symmetry in a picture of a human face is to create a mirror image of one half. However, the process can be significantly influenced by whether the image was created from the left half or right half of the face. Studies have shown that the information derived from the left side of the face (as viewed by the observer) produces better results, for example, in the detection of emotion (Nicholls et al., 2002; Chen et al., 2007), the recognition of individuals, gender assessment, and estimation of age (Burt & Perrett, 1997; Bourne & Gray, 2011; Dole et al., 2017), and better predictions of the attractiveness ratings of faces (Franklin & Adams, 2010).

The explanation for the differential perception of the left and right halves of the face is rooted in the principles of visual perception, specifically in the dominance of the left visual field (see, for example, Thomas et al., 2008; Yovel et al., 2008). The superiority of the left visual field is related to the lateralisation of brain functions, with face perception being closely associated with the right hemisphere (Burt & Perrett, 1997; Yovel et al., 2008), which, due to optical chiasm, primarily processes information from the left visual field. For the majority of the population, the left side of a face is therefore more important—they focus more attention on it, receive more information from it, and it also appears that this half of the face is perceived to be more attractive. In this regard, the team led by D.W. Zaidel conducted several studies in the past—in one study, they found no significant differences in the preference for the left or right half of the face when evaluating the attractiveness of left-left and right-right mirror composite faces (Zaidel & Cohen, 2005), while in another work, they reported that paradoxically subjects rated right-sided composite female faces as more attractive than left-sided, whereas the

attractiveness ratings for mirror composite faces of men did not significantly differ between right-sided and left-sided composites (Zaidel et al., 1995).

This ambiguity in the results may arise from the limited volume of research focused on the investigation of the attractiveness of symmetrical facial composites and related factors. It may also be directly linked to the underlying assumption in the evaluation of attractiveness of left-sided versus right-sided symmetrical composites. The dominance of the left visual field is based on the premise that face perception is closely associated with the right hemisphere of the brain. However, this may not universally be the case, as brain lateralisation and the preference to use one of a pair of organs (hands, feet, eyes, ears, etc. - Henderson & Pehoski, 2005) can vary among individuals. Therefore, in the context of a study of the attractiveness of symmetrical faces, it is important to examine both how the symmetrical face was created (whether it is a left-sided or right-sided composite) and which visual field is dominant for the individual who evaluates the composites.

2. Problem

The symmetry of the human face is a feature that significantly enhances its attractiveness. The assessment of facial symmetry's attractiveness is the outcome of a complex perceptual-cognitive process. Since multiple factors can influence this process, scientific studies in this field have yielded diverse results. It appears that when mirror-image composite human faces are used in research to assess the attractiveness of symmetry, a significant variable that may modify the perceived attractiveness of the face is whether the mirror composite is formed from the left or right half of the face. It is presumed that the majority of individuals prefer left-sided facial composites, with the most common explanation for this tendency being the fact that, due to the lateralization of brain functions during development, most individuals exhibit dominance in the left visual field.

3. Objective

When the results of previous studies are considered it indicates there is a need to explore a range of variables that affect the perception of the attractiveness of facial symmetry. The following objectives have been established:

- to verify the attractiveness of a symmetrical face created as a mirror image of the left half or right half of the perceived face;
- to investigate the relationship between the attractiveness of left-sided and right-sided symmetrical faces and the evaluator's dominant visual field.

4. Research Questions

In relation to the need to examine the evaluation of the attractiveness of symmetrical facial composites based on their method of creation (left-sided vs. right-sided) and to explore the evaluation of the attractiveness of left-sided and right-sided symmetrical facial composites in relation to the evaluator's dominant visual field, the following research questions have been formulated:

RQ1: Is the left or right symmetrical facial composite more attractive?

RQ2: Does the dominant visual field have an impact on the evaluation of the attractiveness of left-sided and right-sided facial composites?

5. Method

The data was collected using the convenience sampling method. Participants were approached by researchers, in person, in various settings, including high schools, universities, companies, and public spaces. They were included in the study based on their availability and willingness to participate. At the beginning, the participants were informed of the nature of the research, and, prior to starting the questionnaire battery, informed consent for their participation in the study was obtained. The participants had the option to decline to participate or withdraw from the study at any time without any consequences. The data collection was anonymous and did not include any information that might identify an individual.

A total of 2,053 participants took part in the study, 6.43% of them (N = 132) were excluded from the analysis as they provided incomplete data. The final sample was made up of 1,921 participants aged from 15 to 77 (M = 23.57; SD = 9.52), and 60.7% of them were women.

The questionnaire battery was administered using pen and paper, and basic demographic information was collected at the beginning. The effect of the dominant visual field in the evaluation of facial composites was assessed using two faces. These composites were made up with one half of the face representing male features with a smooth transition into the other half of the face with characteristic female features. The transition between the two halves of the face was perfectly blended to avoid any disruptive effects. The second face was identical to the first, except that in this case, one half was feminine and the second half was masculine (see Figure 1). The facial composites were used and reprinted with the permission from the author.
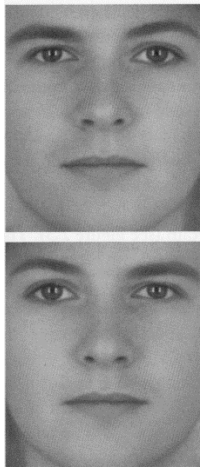

Figure 1. Facial composites with feminine features on the right (top image) and left (bottom image) halves of the face
Source: Perrett, 2010

The dominant visual field was determined based on the response to the question: "Which face is more feminine?" Depending on whether an individual chose the face based on the left or right half, they were assigned to the group with a dominant left or right visual field. The distribution of the dominant visual field in the sample is reported in Table 1.

Table 1.
Distribution of dominant visual field in the research sample

Gender	Visual field dominance		Total
	Left	Right	
Male	445	310	755
Female	736	430	1,166
Total	1,181	740	1,921

The attractiveness of the type of symmetry was examined using two male and two female facial composites (example in Figure 2), which were created as mirror images of the right and left halves of the face. Participants were asked to indicate which one they considered to be more attractive. Based on their selection, it was determined whether the participant found the left or right facial composite to be more attractive.
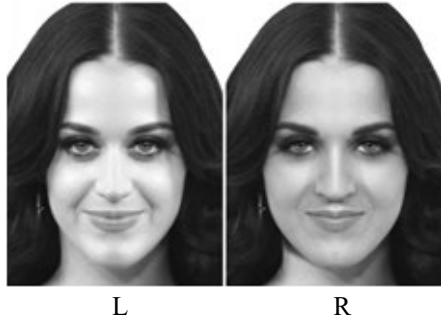

L   R

Figure 2. Example of a female facial composite created as a mirror image of the left (L) and right (R) halves of the face
Source: Jebreil, 2015. [Online]. Retrieved [2017-09-16] from URL: <http://sarahjebreildds. com/symmetry/>
2015.

The procedure used can be considered a quasi-experimental research design – the dependent variable is the attractiveness of the composite, the independent variable is the side of the face (left or right) from which the face is made. Since the stimulus is the same face (photo), it can be claimed that all possible intervening variables are controlled. If the participant marks one of the two faces as more attractive, it can be concluded that the cause is only the side of the face (left or right), from which the composite was mirrored. Since participants were not randomly assigned to either the experimental or the control group, the procedure can be described as quasi-experimental.

The data was analysed using the IBM SPSS software, version 28 (Statistical Package for the Social Sciences). The significance level for the evaluation of statistical significance was set at 0.05.

6. Results

RQ1: Is the left or right symmetrical facial composite more attractive?

For both pairs of facial composites (male and female), the participants reported a significant preference for the composite created as a mirror image of the left half of the face (identified as more attractive) (see Tables 2 and 3). The chi-square test revealed that the attractiveness of the left-sided facial composite was significantly higher than that of the right-sided composite, for both female faces ($\chi = 886.530$; $p < 0.001$) and male faces ($\chi = 415.122$; $p < 0.001$).

Table 2.
Choice of attractive female facial composite

Composite attractiveness	Observed N	Expected N	Residual	Chi-Square	Asymp. Sig.
Left-sided	1,613	960.5	652.5	886.530	< 0.001
Right-sided	308	960.5	-652.5		

Table 3.
Choice of attractive male facial composite

Composite attractiveness	Observed N	Expected N	Residual	Chi-Square	Asymp. Sig.
Left-sided	1,407	960.5	466.5	415.122	< 0.001
Right-sided	514	960.5	-466.5		

RQ2: Does the dominant visual field have an impact on the evaluation of the attractiveness of left-sided and right-sided facial composites?

Based on the correlations (Table 4 and 5), it is evident that there is no statistically significant correlation between the attractiveness of left/right symmetry and the dominant visual field.

Table 4.
Relationship between the dominant visual field and the attractiveness of symmetry in the female facial composite

		Composite attractiveness		Total	Chi-Square	Asymp. Sig. (2-sided)
		Left-sided	Right-sided			
Dominant Visual Field	Left field	997	184	1,181	0.468	0.494
	Right field	616	124	740		
	Total	1,613	308	1,921		

Table 5.
Relationship between the dominant visual field and the attractiveness of symmetry in the male facial composite

		Composite attractiveness		Total	Chi-Square	Asymp. Sig. (2-sided)
		Left-sided	Right-sided			
Dominant Visual Field	Left field	857	324	1,181	0.718	0.397
	Right field	550	190	740		
	Total	1,407	514	1,921		

Further analyses confirmed that individuals with a dominant right visual field also judged the left facial composite to be more attractive, and this finding was statistically significant ($p < 0.001$) for both female and male faces (see Tables 6 and 7).

Table 6.
Choice of more attractive female facial composite by individuals with a dominant right visual field

Composite attractiveness	Observed N	Expected N	Residual	Chi-Square	Asymp. Sig.
Left-sided	616	370,0	246,0	327,114	< 0.001
Right-sided	124	370,0	-246,0		

Table 7.
Choice of more attractive male facial composite by individuals with a dominant right visual field

Composite attractiveness	Observed N	Expected N	Residual	Chi-Square	Asymp. Sig.
Left-sided	550	370,0	180,0	175.135	< 0.001
Right-sided	190	370,0	-180,0		

7. Discussion

The analyses that focused on the attractiveness of left vs. right facial symmetry in facial composites revealed a strong preference for the face that was created as a mirror image of the left (from the observer's perspective) half of a face. The left-sided composite was judged to be significantly more attractive than the right-sided composite for both female and male faces. This result was statistically significant and held true for individuals with a dominant left visual field as well as those with a dominant right visual field. These findings suggest that the localisation of the brain functions involved in processing information from a human face is

more strongly linked to the right hemisphere and has a far greater effect than the dominance of the corresponding visual field. These results indirectly support the findings of studies that have investigated the consequences of brain damage in the fusiform face area (FFA). Cases of FFA damage in the left hemisphere result in letter agnosia, while damage to the same area in the right hemisphere leads to prosopagnosia (Glezerman, 2013).

The localisation of functions responsible for the evaluation of human faces and its relationship to the dominant visual field has been explored by several authors (e.g., Brysbaert, 1994; Megreya & Havard, 2011; Harrison & Strother, 2020). Some studies suggest that the difference between the left and right hemispheres is not so pronounced. However, at various levels, it has been consistently demonstrated that the dominance of the left visual field contributes to the quality and processing speed of information from faces. For example, Yovel et al. (2006) state that "the two hemispheres exchange information symmetrically at early stages of face processing and together generate a shared facial representation, which is better when facial information is directly presented to the right hemisphere [dominant left visual field] than to the left hemisphere [dominant right visual field]" (p. 462).

Harrison and Strother, in their recent study, focused on the verification of an untested assumption regarding bias in the face-selective cortex of the right hemisphere towards the left visual field that might provide an advantage in face recognition performance. Through a series of experiments, they not only clarified the relationship between the dominant visual field and the localisation of brain functions associated with face recognition and evaluation in different situations, but also conducted a series of regression analyses to specify the direction of this relationship. The results of their work indicate that FFA laterality makes separate contributions to the prediction of left visual field bias (Harrison & Strother, 2021). This would mean that the right hemisphere does indeed dominate in the recognition and evaluation of human faces, and due to this lateralisation (which may not be present in all individuals), the left visual field is dominant when processing facial information. Based on these findings, it is possible to accept the results of studies that have confirmed the dominance of the right hemisphere in face processing and evaluation processes, which would also explain the results of our research. Although our study confirmed the attractiveness of left-sided symmetry for individuals with a dominant left visual field, it also highlighted the attractiveness of left-sided composites in individuals with dominant right visual fields. The expectation that visual field dominance would be related to the attractiveness of left vs. right symmetrical facial composites did not prove to be valid. Instead, the results indirectly suggest that the attractiveness of the type of composite is more closely tied to the specific lateralisation of brain functions rather than to visual field dominance. Therefore, it seems that the attractiveness of left-sided facial symmetry, as well as the dominance of the left visual field, are shared consequences of brain lateralisation. A need to verify this hypothesis may inspire further research in this area.

Acknowledgment

References

Baudouin, J. Y., & Tiberghien, G. (2004). Symmetry, averageness, and feature size in the facial attractiveness of women. *Acta psychologica, 117*(3), 313–332. https://doi.org/10.1016/j.actpsy.2004.07.002

Bourne, V. J., & Gray, D. L. (2011). One face or two? Contrasting different versions of the chimeric faces test. *Laterality, 16*(5), 559–564. https://doi.org/10.1080/1357650X.2010.498119

Brysbaert M. (1994). Lateral preferences and visual field asymmetries: appearances may have been overstated. *Cortex; a Journal Devoted to the Study of the Nervous System and Behavior, 30*(3), 413–429. https://doi.org/10.1016/s0010-9452(13)80338-3

Burt, D. M., & Perrett, D. I. (1997). Perceptual asymmetries in judgements of facial attractiveness, age, gender, speech and expression. *Neuropsychologia, 35*(5), 685–693. https://doi.org/10.1016/S0028-3932(96)00111-X

Dole, M., Méary, D., & Pascalis, O. (2017). Modifications of visual field asymmetries for face categorization in early deaf adults: a study with chimeric faces. *Frontiers in Psychology, 8*, 30. https://doi.org/10.3389/fpsyg.2017.00030

Franklin, R. G., Jr, & Adams, R. B., Jr (2010). The two sides of beauty: laterality and the duality of facial attractiveness. *Brain and Cognition, 72*(2), 300–305. https://doi.org/10.1016/j.bandc.2009.10.002

Glezerman, T. B. (2013). How autistic persons perceive faces (Cerebral organization of face recognition and autism). In: Glezerman, T. B. (Ed.), *Autism and the Brain.* (69–83), Springer. https://doi.org/10.1007/978-1-4614-4112-0_4

Harrison, M. T., & Strother, L. (2020). Does right hemisphere superiority sufficiently explain the left visual field advantage in face recognition?. *Attention, Perception & Psychophysics, 82*(3), 1205–1220. https://doi.org/10.3758/s13414-019-01896-0

Harrison, M. T., & Strother, L. (2021). Does face-selective cortex show a left visual field bias for centrally-viewed faces?. *Neuropsychologia, 159*, 107956. https://doi.org/10.1016/j.neuropsychologia.2021.107956

Harun, N. A., Adam, K. B. C., Abdullah, N. A., & Rusli, N. (2023). Is a symmetrical face really attractive?. *International Journal of Oral and Maxillofacial Surgery, 52*(6), 703–709. https://doi.org/10.1016/j.ijom.2022.09.031

Hatch, C. D., Wehby, G. L., Nidey, N. L., & Moreno Uribe, L. M. (2017). Effects of objective 3-dimensional measures of facial shape and symmetry on perceptions of facial attractiveness. *Journal of Oral and Maxillofacial Surgery : Official Journal of The American Association of Oral and Maxillofacial Surgeons, 75*(9), 1958–1970. https://doi.org/10.1016/j.joms.2017.04.042

Henderson, A., & Pehoski, Ch. (2005). *Hand Function in the Child: Foundations for Remediation*. 2nd Edition. Elsevier.

Hughes, S. M., & Aung, T. (2018). Symmetry in motion: Perception of attractiveness changes with facial movement. *Journal of Nonverbal Behavior, 42*(3), 267–283. https://doi.org/10.1007/s10919-018-0277-4

Chen, W., Liu, C.H., Fu, X. (2007). Asymmetry of Left Versus Right Lateral Face in Face Recognition. In: Paiva, A.C.R., Prada, R., Picard, R.W. (eds) *Affective Computing and*

Intelligent Interaction. ACII 2007. Lecture Notes in Computer Science, vol. 4738. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-74889-2_63

Jebreil, S.: *Symmetry.* [Online]. Retrieved [2017-09-16] fromURL: <http://sarahjebreildds. com/symmetry/> 2015.

Jones, B. C., DeBruine, L. M., & Little, A. C. (2007). The role of symmetry in attraction to average faces. *Perception and Psychophysics, 69*(8), 1273–1277. https://doi.org/10.3758/ bf03192944

Komori, M., Kawamura, S., & Ishihara, S. (2009). Averageness or symmetry: which is more important for facial attractiveness?. *Acta Psychologica, 131*(2), 136–142. https://doi.org/ 10.1016/j.actpsy.2009.03.008

Little, A. C., DeBruine, L. M., and Jones, B. C. (2011). Exposure to visual cues of pathogen contagion changes preferences for masculinity and symmetry in opposite-sex faces. *Proceedings of the Royal Society of London B: Biological Sciences, 278*(1714), 2032–2039. https://doi.org/10.1098/rspb.2010.1925

Megreya, A. M., & Havard, C. (2011). Left face matching bias: right hemisphere dominance or scanning habits?. *Laterality, 16*(1), 75–92. https://doi.org/10.1080/13576500903213755

Møller, A. P. (1997). Developmental Stability and Fitness: A Review. The American *Naturalist, 149*(5), 916–932. https://doi.org/10.1086/286030

Nicholls, M. E., Wolfgang, B. J., Clode, D., & Lindell, A. K. (2002). The effect of left and right poses on the expression of facial emotion. *Neuropsychologia, 40*(10), 1662–1665. https://doi.org/10.1016/s0028-3932(02)00024-6

Oruc, I., Balas, B., & Landy, M. S. (2019). Face perception: A brief journey through recent discoveries and current directions. *Vision Research, 157*, 1–9. https://doi.org/ 10.1016/j.visres.2019.06.005

Perrett, D. I. (2010). *In Your Face. The New Science of Human Attraction*. Palgrave Macmillan. https://doi.org/10.1007/978-0-230-36484-4

Prokosch, M. D., Yeo, R. A., & Miller, G. F. (2005). Intelligence tests with higher g -loadings show higher correlations with body symmetry: Evidence for a general fitness factor mediated by developmental stability. *Intelligence, 33*(2), 203–213. https://doi. org/10.1016/j.intell.2004.07.007

Rhodes, G., Yoshikawa, S., Clark, A., Lee, K., McKay, R., & Akamatsu, S. (2001). Attractiveness of facial averageness and symmetry in non-western cultures: in search of biologically based standards of beauty. *Perception, 30*(5), 611–625. https://doi. org/10.1068/p3123

Swaddle, J. P., & Cuthill, I. C. (1995). Asymmetry and human facial attractiveness: symmetry may not always be beautiful. *Proceedings. Biological Sciences, 261*(1360), 111–116. https://doi.org/10.1098/rspb.1995.0124

Thomas, C., Avidan, G., Humphreys, K., Jung, K. J., Gao, F., & Behrmann, M. (2009). Reduced structural connectivity in ventral visual cortex in congenital prosopagnosia. *Nature Neuroscience, 12*(1), 29–31. https://doi.org/10.1038/nn.2224

Thornhill, R., & Grammer, K. (1999). The body and face of woman: One ornament that signals quality? *Evolution and Human Behavior, 20*(2), 105–120. https://doi.org/10.1016/S1090-5138(98)00044-0

Willis, J., & Todorov, A. (2006). First impressions: making up your mind after a 100-ms exposure to a face. *Psychological Science, 17*(7), 592–598. https://doi.org/10.1111/j.1467-9280.2006.01750.x

Yovel, G., Tambini, A., & Brandman, T. (2008). The asymmetry of the fusiform face area is a stable individual characteristic that underlies the left-visual-field superiority for faces. *Neuropsychologia, 46*(13), 3061–3068. https://doi.org/10.1016/j.neuropsychologia.2008.06.017

Zaidel, D. W., & Cohen, J. A. (2005). The face, beauty, and symmetry: perceiving asymmetry in beautiful faces. *The International Journal of Neuroscience, 115*(8), 1165–1173. https://doi.org/10.1080/00207450590914464

Zaidel, D. W., Chen, A. C., & German, C. (1995). She is not a beauty even when she smiles: possible evolutionary basis for a relationship between facial attractiveness and hemispheric specialization. *Neuropsychologia, 33*(5), 649–655. https://doi.org/10.1016/0028-3932(94)00135-c

Zheng, R., Ren, D., Xie, C., Pan, J., & Zhou, G. (2021). Normality mediates the effect of symmetry on facial attractiveness. *Acta Psychologica, 217*, 103311. https://doi.org/10.1016/j.actpsy.2021.103311