学位論文の要旨

Abstract of Thesis

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学位論文題目 Title of Thesis（学位論文題目が英語の場合は和訳を付記）

Study on the role of spatial frequency components in cuteness perception of infant faces
(幼児顔の可愛さ知覚における空間周波数成分の役割に関する研究)

学位論文の要旨 Abstract of Thesis

In social interaction, faces often convey us a lot of information about aesthetics. In particular, infant faces — one of the most salient stimuli, can always attract more attention from adults. People prefer to use the word 'cute' to express their love for babies. The cuteness refers to a set of neonate features including large eyes, a small nose and mouth, large head and high forehead (baby schema proposed by Lorenz), which can elicit protective caregiving behavior of adults. The cute characteristics can be found not only in human infant faces but also in animal faces (e.g., cat and dog). In recent years, these features have also been gradually applied in the design of artworks (e.g., Mickey Mouse and Hello Kitty). Even, the culture about cuteness has spread all over the world and generate a wide impact in biology, society and commerce. Therefore, our research interest lies in the cuteness processing mechanism of infant faces. Previous studies mainly focus on how facial elemental features affect cuteness perception, while a wide range of evidence indicated that spatial frequency (SF) is the basic mechanism for visual analysis. It is one of the most important parameters in studies on faces. However, how SFs affect cuteness processing is still unclear. To address these questions, three experiments were conducted to investigate how SFs contribute to the neural representations of cuteness perception. The main work of this thesis is as follows:

Firstly, the cuteness discrimination experiment was conducted to examine the effect of SFs on participants' behavioral performance by using the paired-comparison paradigm. Sixteen infant faces with four cuteness levels (from negative cuteness to positive cuteness: Level_1, Level_2, Level_3 and Level_4) were selected as the version of broad unfiltered faces (BSF) and then four versions of filtered faces were generated from them. Then two faces with same SFs but different cuteness levels (match 1: cuteness Level_1 vs. Level_3; match 2: cuteness Level_2 vs. Level_4) were presented to participants, who were asked to choose the one they think cuter. Finally, the consistent rate was defined to represent participants' discrimination ability. The results indicated that the average consistent rate of two matches showed a decreasing trend with the SFs increased. Interestingly, we found different performance in two kinds of face matches. Specifically, the consistent rate of the first match is not affected by filtered SFs while the second match showed a declining trend with the increase of SFs. These findings seem to indicate the interaction between SFs and cuteness levels.

To investigate this hypothesis more directly, in the second experiment, we examined the effect of SFs on cuteness perception by requiring participants rate the cuteness levels of infant faces on 7-point Likert scales. More importantly, we are interested in whether the behavioral impact of SFs is associated with cuteness levels of infant faces. The results showed that each type of SFs information is all critical to an accurate assessment of cuteness because there is a certain degree of

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reduction in cuteness rating when filtered faces were presented. In general, faces with low SFs (LSF) always make adults feel not cute. Although medium SFs (MSF) and high SFs (HSF) also reduce the cuteness feeling but still cuter than LSF. Not only that, but the reduction size was also related to cuteness levels of broad faces. Specifically, as the cuteness increases, the cuteness ratings of both MSF and HSF decreased but ratings of MSF faces were closer to that with BSF compared with HSF. As for faces with LSF, the ratings in neutral cuteness had a greater reduction than that in positive cuteness.

Although the interaction between SFs and cuteness levels has been behaviorally confirmed, how these effects are reflected with the temporal course of cuteness processing is still not well understood. Similar to the second experiment, participants need to rate one version of broad unfiltered faces and three versions of filtered faces on 7-point Likert scales. At the same time, Electroencephalography (EEG) were recorded, which can be used to reflect the dynamic process of cuteness perception. The event-related potentials (ERPs) and event-related oscillations (EROs) analysis demonstrated that SFs dominance varied as a function of temporal windows. Specifically, during P1-N170 generated by alpha activity, the cuteness processing follows a coarse-to-fine (LSF-to-MSF/HSF) manner. Then, MSF made a rough division between positive and negative cuteness, a process that occurred in P2 modulated by alpha band. Subsequently, in P3 also with a strong focus on alpha activity, the HSF was selected to turn into elaborate evaluation stage. Finally, BSF regulated the delta response to different cuteness levels in late positive component.

In conclusion, the main purpose of this study is to investigate the influence of SFs on cuteness perception. In addition, we also explore how different SFs are selectively made use of in infant facial cuteness perception from both temporal and oscillatory perspectives. Our data establish these important findings: Firstly, the effect of SFs on cuteness perception was associated with the cuteness levels of broad faces. Second, SFs dominance is changing as the cuteness processing progresses. In particular, MSF has a particular advantage over LSF and HSF for rough cuteness discrimination. And the elaborate evaluation is based on the integration of multiple SFs ranges. Thirdly, the alpha and delta bands were highly relevant for cuteness processing. The present findings provide a good basis for understanding the dynamic processing of cuteness perception and the relationship between cuteness perception and SFs.