Navon-induced processing biases fail to affect the recognition of whole faces and isolated facial features

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Abstract

According to the processing bias account, global Navon-induced processing primes the adoption of a holistic strategy whereas local Navon-induced processing triggers featural processing. As faces are recognized at a holistic level, global Navon-induced processing would increase recognition accuracy of whole faces. On the contrary, local Navon-induced processing would enhance the subsequent recognition of individual facial features. In two experiments we further explored this processing bias account using the part/whole task, a classical test of holistic and featural face processing. Observers were asked to recognize facial features presented in isolation or embedded into whole faces, after global or local Navon-induced processing. In both experiments, results showed a whole-over-part advantage whereby facial features were recognized more accurately in the context of the whole face than in isolation. However, Navon-induced processing failed to modulate this effect as well as the magnitude of holistic-featural face processing. These results cast doubts on the reliability of Navon processing to prime the adoption of a particular processing style for face identification.

Keywords: Global processing, local processing, face recognition, holistic processing, featural processing, Navon stimuli

Introduction

Navon's compound letter paradigm (Navon, 1977) involves the presentation of large letters (global level) formed by small letters (local level). This paradigm has been extensively used to investigate two interrelated aspects of the visual system: global and local processing. One line of research has focused on the *global precedence effect* (for review, see (Kimchi, 1992; Navon, 2003)). In general, this research line has shown that the global form of a visual stimulus is available before the local aspects, although this depends on several variables, such as exposure duration, masking and spacing between the elements (Navon, 2003). A more contemporary research line has investigated Navon-induced processing bias effects, that is, how inducing participants to report Navon's stimuli either at a global or a local level affects subsequent tasks (Hubner, 2000; Large & McMullen, 2006; Macrae & Lewis, 2002; Robertson, 1996). To extend the latter line of research, the present study aims to explore the effects of Navon-induced processing on the recognition of whole faces and individual facial features.

Processing bias effects demonstrate that simple experimental procedures, such as processing Navon's compound letters at a specific level (i.e., global vs. local), can prime observers to adopt that specific processing style on subsequent stimuli. For example, the detection of a Navon letter at a global level enhances the detection of Navon letters at global level in subsequent trials, and vice versa for the local level (Filoteo et al., 2001; Hubner, 2000). Thus, processing Navon letters at a specific level seems to encourage the adoption of that processing strategy. If there is a match between the level reported and the processing level in the subsequent task (i.e., global-global), performance will improve compared to when there is a mismatch (i.e., global-local).

One question that arises is whether inducing observers to adopt a specific processing strategy would affect the performance on a different subsequent task that requires a similar processing mode. This question is theoretically relevant as it would imply that a particular cognitive operation can be engaged by different cognitive tasks, the so-called domain-general view of vision (Gauthier, 2018). According to a long-standing scientific tradition, faces are recognized at a global or holistic level. That is, the face is not processed as independent facial features, but as an undecomposed whole (Estudillo, 2012; Lee et al., 2022; Maurer et al., 2002; Rossion, 2009, 2013; Wong et al., 2021; Young et al., 1987). Thus, according to the processing bias account, inducing participants to process Navon stimuli at a global level should enhance subsequent face recognition. Interestingly, several pieces of research seem to point in this direction (Hill & Lewis, 2007; Macrae & Lewis, 2002; Perfect, 2003, but see (Brand, 2004; Lawson, 2007). For example, in a seminal study, Macrae and Lewis (2002) showed that the ability to identify a previously presented face among several foil faces was improved when observers were required to process Navon stimuli at a global level between the encoding and the retrieval stages. In contrast, asking observers to report the local aspect of Navon stimuli led to poorer face identification. This study has since been replicated with eyewitness (Perfect, 2003) and face recognition (Hills & Lewis, 2007; Weston et al., 2008) paradigms, suggesting that prior global Navon-induced processing increases the use of holistic processing of faces. While this assertion is based on the assumption that faces are identified at a holistic level (Maurer et al., 2002; Rossion, 2013; Tanaka & Simonyi, 2016), a face identification task is a measure of the accuracy to identify faces which says nothing about how faces are processed.

The composite face task is a standard test of holistic face processing (for review, see Rossion, 2013). In this paradigm, the top half face of an identity is combined with the bottom face half of a different identity. Observers' performance to identify the cued face half is poorer when both face halves are aligned compared to when the halves are misaligned (Young et al., 1987). This drop in performance in the aligned condition is a consequence of the holistic interference caused by the to-be-ignored face half (Lee et al., 2022; Rossion, 2013; Young et al., 1987). As in the misaligned condition where both face halves are spatially offset, the gestalt created by both faces halves is broken. Previous research has employed the composite face task to study how Navon-induced processing affects the holistic and featural properties of face identification, but with inconclusive results. For example, Weston and Perfect (2005) found no effect of global Navon-induced processing in the composite face task. In contrast, local Navon-induced processing boosted observers' ability to segment the whole face into parts by speeding up the recognition of the cued face half in the aligned condition. However, in a different study using this task, global Navon processing increased the tendency to process the faces more holistically, whereas local Navon processing did not promote featural processing (Gao et al., 2011; Ventura et al., 2019).

These conflicting results can potentially be explained by methodological differences in the tasks: while Weston and Perfect (2005) used the classical version of the composite face task (Rossion, 2013), Gao and colleagues (Gao et al., 2011) employed the complete version (Richler et al., 2008). Indeed, recent research found no association between these two versions of the composite face task (Richler & Gauthier, 2014), suggesting that both tasks tap into different cognitive processes. Given the current debate about which composite face design provides a more valid measure of holistic processing (see Richler & Gauthier, 2014, Rossion, 2013), the effect of Navon-induced processing on holistic and featural face processing remains an open question which requires further investigation using alternative measures of holistic processing.

With two different experiments, the present study attempts to shed light on this issue, by using the part/whole task (Rezlescu et al., 2017; Tanaka & Farah, 1993; Tanaka & Simonyi, 2016). In this paradigm, observers are asked to identify facial features presented either in isolation or in the context of the whole face. The part/whole task is considered one of the gold-standard measures of holistic processing (Tanaka & Simonyi, 2016), which is operationalized as the difficulty to ignore facial features when they are presented in the context of a whole face (Leder & Carbon, 2004, 2005). The part/whole task provides not only an index of holistic processing, but also independent measures for the ability to recognise isolated facial features (part condition) and facial features in the context of the whole face (whole condition). In addition, compared to the classical version of the composite face task, the part/whole task present a stronger association with face identification measures, suggesting that this task could be a better index of the holistic processing required for face identification (Rezlescu et al., 2017).

Experiment 1

Experiment 1 used the classical memory-based part/whole task (Tanaka & Farah, 1993; Tanaka & Simonyi, 2016; Wong et al., 2021). In this task, observers were asked to study a set of face-name pairings (e.g., Joe). Following this encoding stage, observers were required to report either the global or local level of Navon stimuli. In a subsequent two-alternative forced-choice task, observers' memory for face parts was tested either in isolation (e.g., Joe's nose vs. distractor's nose) or in the context of the whole face (e.g., Joe's nose in the context of Joe's face vs. distractor's nose in the context of Joe's face). Following the processing bias account, it is hypothesised that global Navon-induced processing would lead to a stronger holistic face processing index and an improvement in the whole condition. In contrast, local Navon-induced processing would lead to a decrement in the magnitude of holistic face processing index but an enhancement in the recognition of isolated facial features (part condition).

Methods

Participants and Design

103 Chinese ethnic University students (71 females; mean age = 20.44, SD =2.55) were recruited. They reported normal or corrected-to-normal vision. Three participants (1 female)

were excluded due to chance-level performance on the part/whole task, leaving 50 participants in the local and 50 participants in the global conditions. Participants signed an informed consent form and received course credits for their participation. A power analysis using MorePower 6.0 (Campbell & Thompson, 2012) indicated that a total number of 96 participants (48 per group) were required to detect an interaction between group (global- versus local-priming) and face condition (whole versus part), with a medium effect size η^2_p = .08, α = .05, power (1-β) = .80. Our sample size was also considerably larger than that recommended by other authors who did find an effect of Navon on face identification using an identical set of Navon stimuli (Lewis et al., 2009).

Apparatus and Materials

Navon stimuli consisted of black letters presented on a white background (*Figure 1A*). The local letters were 0.2° wide × 0.3° high each and were spatially arranged on a 17 × 12 grid to form a global letter that was 4.2° wide × 6.5° high. This set produced reliable priming effects on face recognition in previous research (Hills & Lewis, 2007, 2009; Lewis et al., 2009).

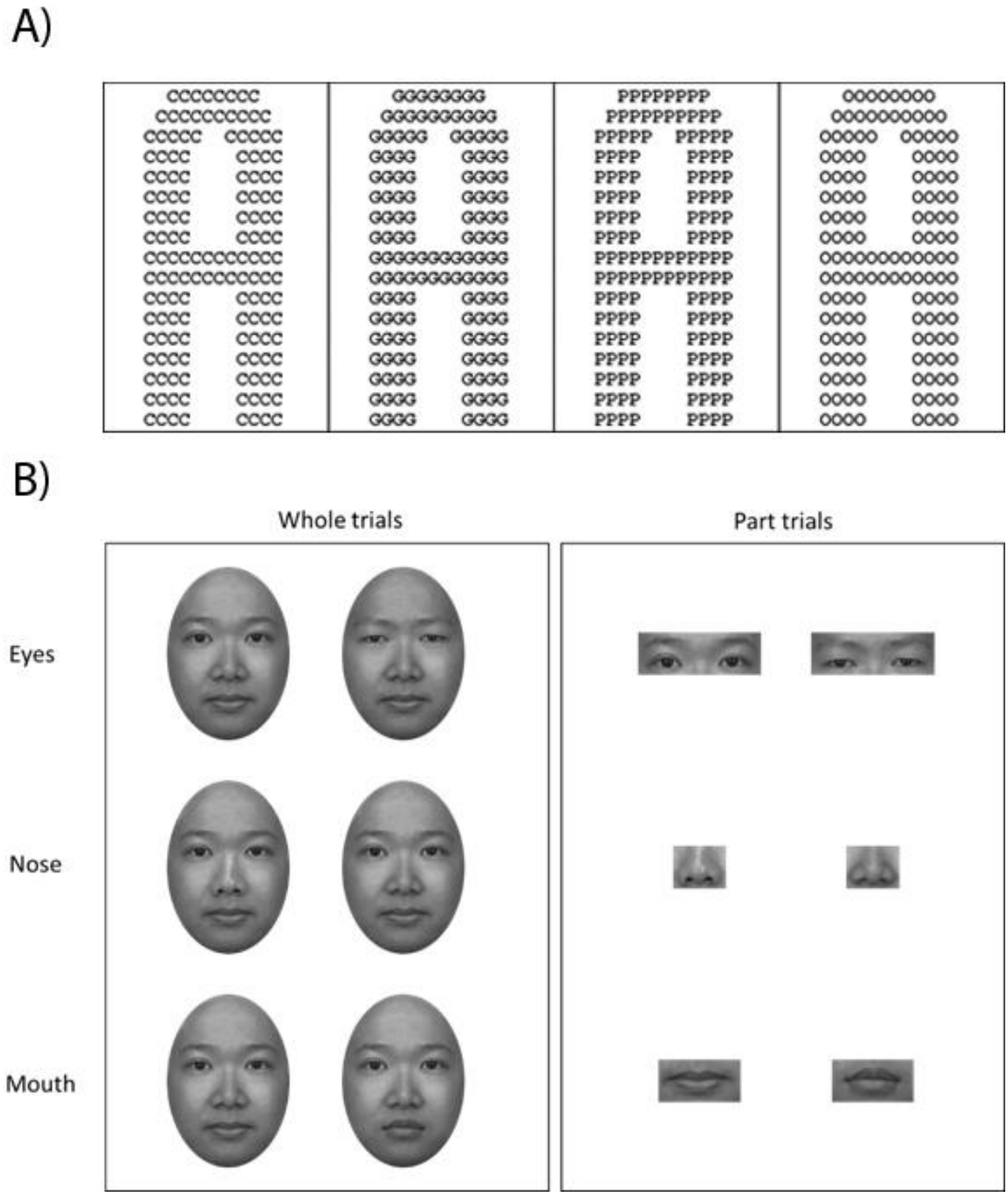

Figure 1. (A) Examples of Navon letter used in Experiment 1 and (B) Examples of face images used in the part/whole task.

Face stimuli were created from 12 face images of Chinese-ethnic university students (6 females). Importantly, these faces were unfamiliar to our participants. Faces showed neutral expression and were first cut to form an ellipse that excluded external features. To minimise the low-level image cues (e.g., skin colour information), all face images were transformed into 8-bit grayscale images in Adobe Photoshop CS6. There was a total of four target faces (two females) and eight distractor faces (4 females). A standard face outline template was used, and each target face was created by aligning eyes, nose, and mouth features into the template using PsychoMorph software. Distractor faces for the whole trials were created by replacing one feature (i.e., eyes, nose, or mouth) in the target face with the respective feature of another face of the same sex. Part stimuli were created by extracting the eye, nose, or mouth region from each of the target faces and the distractor faces. Target and distractor stimuli for the part trials displayed only the critical feature (see *Figure 1b*). The whole faces were of 7.5° horizontal by 10.5° vertical and for isolated features the sizes were: eyes 6.5° × 2.2°; nose 2.6° × 2.2°; mouth 3.8° × 1.9°. Stimuli were presented on an 18.5-inch LED Backlit LCD Monitor, with a screen resolution of 1366 × 768.

Procedure

Participants were seated approximately 60 cm from the monitor. First, participants performed the learning stage of the part/whole task (Tanaka & Simonyi, 2016). They were instructed to memorise four faces (two females) and their associated names (e.g., John, Anne). Each face-name pair was shown for five seconds with an inter-stimulus interval of one second. To ensure that observers were familiarised with each face, they entered the next phase only when they could identify all face-name pairs without committing any error. In the second phase, participants performed the standard Navon procedure to induce processing bias (Hills & Lewis, 2007, 2009; Lewis et al., 2009; Weston et al., 2008). Participants were presented with a set of 125 Navon letters. Each Navon letter was presented in the centre of the screen for five seconds and participants were instructed to provide a verbal answer for each trial by identifying the image either on the large letters, ignoring the small letters (global level), or on the small letters, ignoring the large letters (local level).

Subsequently, observers entered to the test stage of the part/whole task (Tanaka & Farah, 1993; Tanaka & Simonyi, 2016; Wong et al., 2021). First, they were asked to choose a particular face feature of a target face (e.g. "Which is John's nose?). This question was followed by a choice of two alternative images presented on the left and right sides of the screen. The image pair remained on the screen until a response was made. For each test pair, participants were required to indicate if the target stimulus was on the left or the right by pressing one of two allocated keys. The face part was tested either in isolation or in the context of the whole face. For the part condition, the display consisted of two isolated features (i.e., two eyes, two noses, or two mouths), one from the target face, and the other from the distractor face. For the whole condition, the display contained two whole faces, with the target and a distractor face differing only with respect to one face part. There were a total of 48 trials, 24 for each condition. Whole and part trials were randomly intermixed. As the classical dependent variable of the part/whole task is the identification accuracy, observers were instructed to be as accurate as possible (Leder & Carbon, 2004, 2005; Rezlescu et al., 2017). To reinstate the Navon effect, each test pair was followed by five Navon trials in which participants were asked to identify the Navon letter either at the global or local level, depending on the condition they were first allocated (Hills & Lewis, 2007, 2009). The entire experiment lasted approximately 45 minutes.

Results[1]

In addition to conventional frequentist analysis, we also conducted the equivalent Bayesian analysis to test the relative support for the alternative and null hypotheses (Wagenmakers, Love, et al., 2018; Wagenmakers, Marsman, et al., 2018).

First, we explored whether inducing observers to process Navon stimuli at a global and local level primes the recognition of facial features in the context of the whole face and in isolation, respectively. These results are presented in Table 1. A 2 (face condition: whole

[1] The data that support the findings of this study are openly available in osf.io at http://doi.org/10.17605/OSF.IO/7QWGU

vs. part) × 2 (Navon-induced processing group: global vs. local) mixed ANOVA revealed a main effect of face condition [F (1, 98) = 102.76, p < .001, η^2_p = .51], showing better recognition of facial features in the whole than in the part condition. Bayesian analysis revealed that the differences between whole and part conditions were 1.063e +14 more favoured than the lack of differences between these conditions (BF_{10} = 1.063e +14). The main effect of Navon-induced processing group did not reach statistical significance [F (1, 98) = 0.09, p = .76, η^2_p = .001]. Bayesian analysis showed that the lack of differences between groups was 4.88 times more favoured compared to the differences between groups (BF_{01} = 4.88). Finally, the interaction between face condition and Navon-induced processing group was not statistically significant [F(1, 98) = 0.32, p = .57, η^2_p = .003]. In fact, Bayesian analysis showed that the lack of interaction was 4.00 times more favoured than the interaction (BF_{01} = 4.00).

Table 1.

Mean and Standard Deviation of Percentage Accuracy for Each Face Condition and Navon-induced processing group

Face Condition	**Navon-induced processing group**	**Mean**	**SD**
Whole	Global	82.33	12.15
	Local	83.58	12.29
Part	Global	71.83	11.34
	Local	71.83	10.43

In a second part of our analysis, we explored whether the processing of Navon letters modulates the holistic and featural processing of faces. We calculated the part/whole effect (PWE) —an index of holistic face processing— by using the following formula (Wang et al., 2012; Zhu et al., 2009): PWE = (% correct whole - % correct part) / (% correct whole + %

correct part). PWE scores are presented in *Figure 3*. An independent samples t-test showed that the PWE scores were not significantly different between the Global and the Local Navon-induced processing groups [$t(98) = .42$, $p = .6$, $d = .08$]. The equivalent Bayesian analysis revealed that the lack of differences between groups was 4.38 times more favoured than the differences between the groups ($BF_{01} = 4.38$)

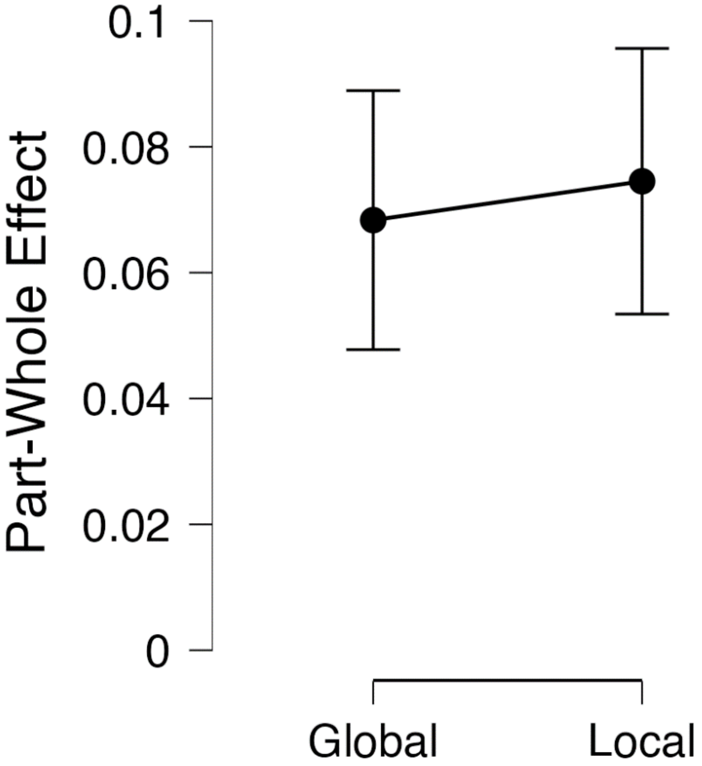

Figure 2. Index of holistic processing for each Navon-induced processing group as measured by the part/whole effect. Error bars represent 95% Confidence Intervals.

Discussion

Experiment 1 investigated the effect of Navon-induced processing bias on the part/whole task. Altogether, our results showed that observers' accuracy was better in the whole than in the part condition, replicating other studies using this paradigm (Leder & Carbon, 2004; Tanaka & Farah, 1993). However, Navon-induced processing failed to enhance the recognition of whole faces and isolated facial features, and to modulate the magnitude of holistic-featural processing for faces.

These results are remarkable as our design, Navon stimuli and procedure were identical to those of other studies that found Navon-induced processing bias effects (Hills & Lewis, 2007, 2009; Lewis et al., 2009). However, such a procedure might not be optimal for inducing such processing bias effects. For example, following previous research, our Navon stimulus remained on the screen for a total of five seconds even after participants verbally responded (Hills & Lewis, 2007, 2009; Lewis et al., 2009). Nevertheless, some research has shown that such a long exposure duration could induce switches in the processing of Navon stimuli (Luna, 1993; Paquet & Merikle, 1984). In addition, although most previous research exploring Navon-induced processing biases used a between-subject design, it is possible that, with this type of design, any effect of Navon processing is obscured by individual differences across groups. These limitations are addressed in Experiment 2.

Experiment 2

Similar to Experiment 1, Experiment 2 aimed to investigate the effect of Navon-induced processing on holistic and featural face processing using the part/whole task. However, we introduced several modifications. First, in an attempt to reduce the potential effects of long exposure to Navon stimuli (Luna, 1993; Paquet & Merikle, 1984), in Experiment 2, observers were encouraged to make their response as fast as possible using a computer keyboard and Navon stimuli disappeared after response. Second, to avoid potential individual differences across groups, observers performed both the global and local Navon-processing conditions, in different blocks. Additionally, to have a direct comparison of the potential priming effects of Navon-induced processing on the recognition of whole faces and isolated facial features, we included a neutral (baseline) condition. In this neutral condition, participants only had to complete the part/whole task. Finally, in Experiment 2, we used the perceptual part/whole task (DeGutis et al., 2013; Rezlescu et al., 2017; Tanaka & Simonyi, 2016). It is possible that the strong memory demands of the classical part/whole task hindered the potential Navon processing bias effects. The perceptual part/whole task minimizes these memory demands and produces identical part/whole effects (DeGutis et al., 2013; Rezlescu et al., 2017; Tanaka & Simonyi, 2016).

In summary, with the aforementioned changes, Experiment 2 maximizes the probability of obtaining Navon-induced processing biases. According to the Navon processing bias account, global Navon-induced processing would produce a stronger holistic face processing index and an improvement in the whole condition. In contrast, local Navon-induced processing would lead to a decrement in the magnitude of holistic face processing index, but an enhancement in the recognition of isolated facial features.

Methods

Participants and Design

140 Caucasian ethnic University students (121 females; mean age = 21.19, SD = 5.51) participated in this experiment. Observers reported normal or corrected-to-normal vision, signed an informed consent form, and received course credits for their participation. A power analysis using MorePower 6.0 (Campbell & Thompson, 2012) indicated that a total number of 58 participants were required to detect a medium-size interaction ($\eta^2_p = .08$) between Navon-induced processing condition (neutral, global and local) and face condition (whole and part), $\alpha = .05$, power ($1-\beta$) = .80. However, to maximize the probabilities of getting a significant effect of Navon processing on face identification, we used an oversampling strategy.

Apparatus and Materials

Navon stimuli consisted of black Helvetica bold font letters presented on a grey background (*Figure 3a*). There were a total of four global Navon and four local Navon stimuli. Stimuli in the global condition consisted of H and F letters made up of small D and E letters. Stimuli in the local condition consisted of D and E letters made up of small H and F letters. The local letters were 0.7° wide × 0.9° high each and the global letter was 4.7° wide × 4.9° high. Stimuli were presented on a 23-inch LED Backlit LCD Monitor, with a screen resolution of 1920 × 1080. Although the Navon stimuli used in this experiment were used in previous Navon-induced processing studies (see Gao et al., 2011), there are important methodological differences between both studies (for details, see the procedure section and Gao et al., 2011).

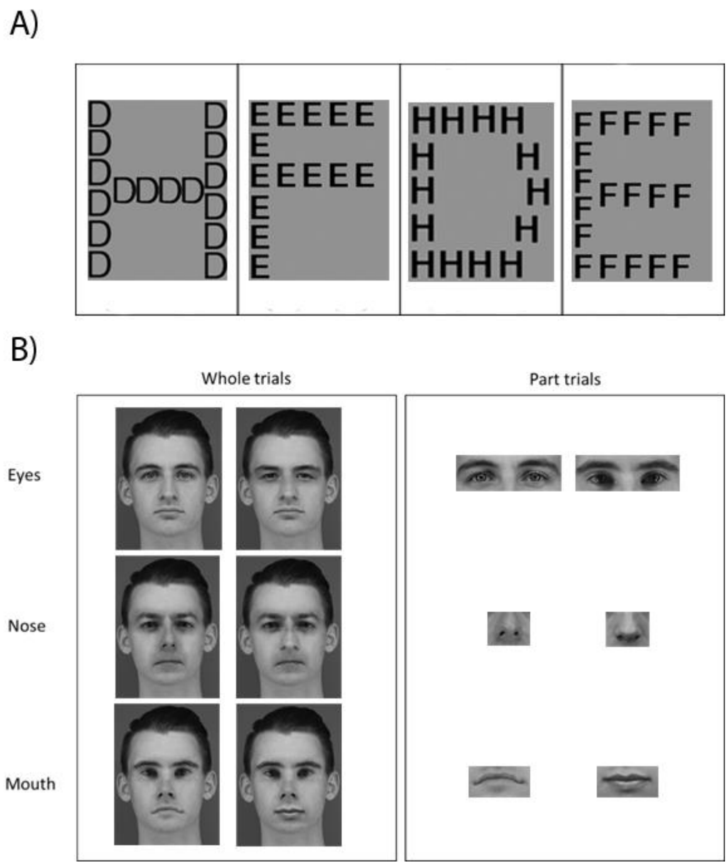

Figure 3. (A) Examples of Navon letter used in Experiment 2 and (*B)* Examples of face images used in the part/whole task.

Face identities consisted of 12 (six females) Caucasian faces. These faces were modified using Photoshop to create new faces with unique combinations of internal features. For each sex, six target faces were created by adding noses, mouths, and eyes, from five different identities. Target faces preserved the hair and the face outline from the original identity, but the internal features were from different identities. Whole and part trials were created using the same procedure specified in Experiment 1, with the difference that the faces were embedded in a grey background. See Figure 3b for stimuli example.

Procedure

Participants were seated approximately 60 cm from the computer screen. This experiment had a total of three different stages. In the neutral stage, observers simply performed the part/whole task. The neutral stage was always the first stage to avoid potential carry-over Navon bias effects. In the second and third stages, observers performed a Navon processing task followed by a part/whole task. The allocation of the Navon-induced processing condition (global and local) to each of these two stages was counterbalanced across participants.

In the Navon Tasks, observers were firstly presented with a fixation cross for 500 ms. Next, a Navon letter appeared in the centre of the screen and observers were asked to report whether the global (or local) level displayed an F or an H, by pressing the corresponding key on a computer keyboard. Observers were asked to perform this task as fast and as accurately as possible. There was a total of 100 Navon processing trials for each stage.

In the part/whole task, observers were firstly presented with a target face for 1000 ms followed by a mask for 500 ms. Following this mask, participants were presented with two side-by-side test images until they made a response. The test images were either two whole faces (whole trials) or two isolated facial features (part trials). Participants had to indicate which of the test stimuli matched the target, by pressing one of two allocated keys. Each of the stages had a total of 144 trials, with the same number of whole and part trials across stages. To reinstate the Navon effect, each part/whole trial started with four Navon processing trials in which participants were asked to identify the Navon letter either at the global or local level, depending on the condition they were performing. This experiment lasted approximately 30 minutes.

Results

Performance with Navon stimuli was over 95% accurate in both Global and Local conditions. The typical global precedence effect was found as participants were faster at the global level than at the local level (544 msecs vs. 562 msecs, t(139) = 2.40, p = .01, d = .20). We explored whether Navon-induced processing biases the recognition of facial features in the context of the whole face and in isolation. These results are presented in Table 2. A 2 (face condition: whole vs. part) × 3 (Navon-induced processing: neutral vs. global vs. local) repeated measures ANOVA revealed a main effect of face condition [F (1, 139) = 245.19, p < .001, η^2_p = .63], with better recognition of facial features in the whole than in the part condition. Bayesian analysis showed that the differences between whole and part conditions were 5.130e +33 more favoured than the lack of differences between these conditions (BF_{10} = 5.130e +33). The main effect of Navon-induced processing also reached statistical significance [F (2, 278) = 12.19, p < .001, η^2_p = .08]. Bayesian analysis showed that the differences between Navon conditions were 333.28 times more favoured compared to the lack of differences (BF_{10} = 333.28). Post-hoc analysis (Holm-Bonferroni corrected) revealed better recognition after the global condition compared to the neutral condition [t(139) = 4.47, p < .001, d = .37, BF_{10} = 2047.92], and after the local condition compared to the neutral conditions [t(139) = 3.76, p < .001, d = .31, BF_{10} = 70.19]. However, performance in the part/ whole task was similar after the global and local conditions [t(139) = .90, p = .38, BF_{01} = 10.03]. Finally, the interaction between face condition and Navon-induced processing did not reach statistical significance [F(2, 278) = 2.29, p = .10]. In fact, Bayesian analysis showed that the lack of interaction was 1.14 times more favoured than the interaction (BF_{01} = 1.14)[2].

Table 2.

[2] To confirm the lack of difference between global and local Navon-induced processing, we performed a follow-up test involving only the global and local Navon-induced processing conditions. The ANOVA revealed a main effect of face condition [F (1, 139) = 164.60, p < .001, η^2p = .54], with a better recognition of facial features in the whole than in the part condition. However, neither the main effect of Navon-induced processing nor the interaction between both factors reached statistical significance [both Fs < 1].

Mean and Standard Deviation of Percentage Accuracy for Each Face Condition and Navon-induced processing condition

Face Condition	**Processing condition**	**Mean**	**SD**
	Neutral	73.70	10.39
Whole	Global	79.01	11.81
	Local	78.00	11.80
	Neutral	66.90	9.30
Part	Global	69.01	9.99
	Local	68.71	8.61

As in Experiment 1, we also calculated the PWE to explore whether Navon-induced processing modulates the holistic and featural processing of faces. Results are presented in Figure 4. A one-way repeated measures ANOVA (neutral vs. global vs. local) revealed no differences across Navon-induced processing conditions in the PWE [F (2, 278) = 1.52, p = .22]. Bayesian analysis showed that the lack of differences in the PWE across conditions was 7.47 times more favoured than the interaction ($BF_{01} =$ 7.47).

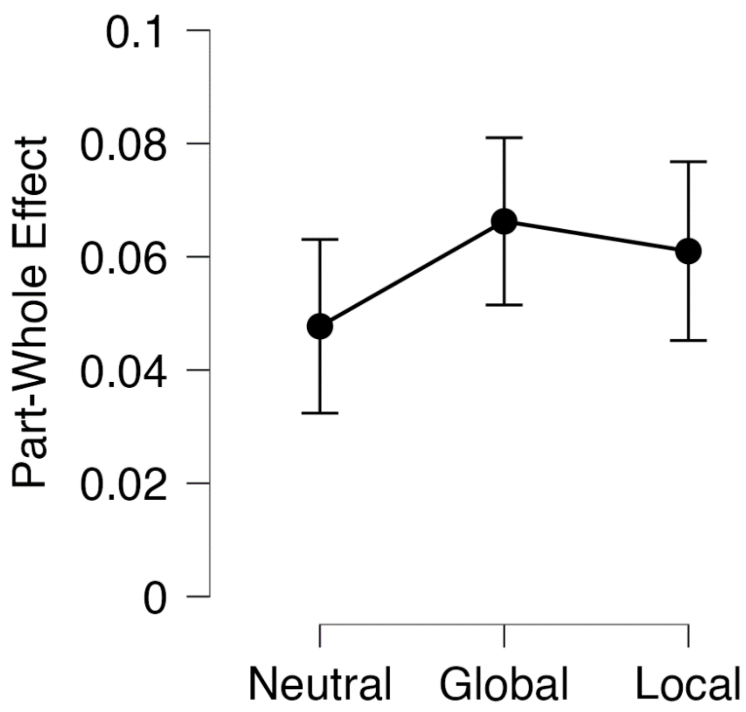

Figure 4. Index of holistic processing for each Navon-induced processing condition as measured by the part/whole effect. Error bars represent 95% Confidence Intervals.

Discussion

Experiment 2 largely replicated the results of Experiment 1. Observers' were more accurate in the whole compared to the part condition, replicating previous studies using the perceptual part/whole task (DeGutis et al., 2013; Rezlescu et al., 2017). Although the performance was similar after global and local Navon-induced processing, observers performed better in these two conditions compared to the neutral condition. As the neutral condition was always performed the first, this finding probably reflects simple practice effects. This is supported by the fact that the magnitude of holistic processing was similar across the three different stages.

It could be argued that the aforementioned practice effects could also explain the lack of differences in the part/whole task after global or local Navon-induced processing. However, this explanation is unlikely as performance in this task was well below ceiling (see

Table 2) and we did not find differences in the PWE between the neutral (i.e., always the first condition) and the global or local conditions. Another potential drawback is related to the small number of face identities used as stimuli throughout the three Navon-induced processing conditions. However, despite this methodological limitation, we replicated the standard PWE. Thus, it seems unlikely that the low number of identities used explains the null differences across the global and local Navon-induced processing conditions.

General Discussion

Across two studies we explored the effect of Navon-induced processing on the recognition of whole faces and isolated facial features using the part/whole task. Results showed a better performance recognizing facial features when they are embedded into whole faces compared to the isolated presentation, replicating previous research (Leder & Carbon, 2004; Rezlescu et al., 2017; Tanaka & Farah, 1993; Tanaka & Simonyi, 2016). However, neither recognition performance in the whole and part conditions, nor the magnitude of holistic processing for faces was affected by prior Navon-induced processing.

These results contrast with previous research showing a better performance in face identification after global Navon processing compared to local Navon processing (Hills & Lewis, 2007; Macrae & Lewis, 2002; Perfect, 2003; Weston et al., 2008). Our results are also in contrast to other studies using the composite face task, which showed enhanced holistic processing of faces after global processing Navon processing (Gao et al., 2011; Ventura et al., 2019) and local processing of faces after local Navon processing (Weston et al., 2008). This is remarkable as the Navon stimuli employed in our experiments have produced reliable processing bias effects on face recognition in previous studies (Gao et al., 2011; Hills & Lewis, 2007, 2009; Lewis et al., 2009). In addition, our sample size was also considerably larger than that of previous studies which found an effect of Navon on face processing tasks (Lewis et al., 2009), ruling out the possibility that our study is underpowered.

Two potential reasons could explain the lack of processing bias effects in the present study. First, previous research exploring Navon processing bias effects on holistic and featural face processing has used the composite face task (Gao et al., 2011; Ventura et al., 2019; Weston & Perfect, 2005). However, in this study, we have used the part/whole task, an alternative measure of holistic processing. Although compared to the composite face task, the part/whole task is more strongly associated with face identification, both tasks are poorly associated with each other, suggesting that they tap different cognitive mechanisms (Rezlescu et al., 2017). Thus, differences between the cognitive mechanisms associated with these tasks might explain the conflict results. Future research could explore this account by directly comparing Navon processing bias effects on both the composite face task and the part-whole task.

Secondly, it is also possible that Navon processing is not a reliable method to produce processing bias effects on face stimuli. In fact, the reported null effects of Navon-induced processing on face identification are not unprecedented in the literature. For example, Lawson (2007) failed to find the effects of global processing on upright faces. She also found that the discrimination of inverted faces and objects —which relies more on featural processing (Farah et al., 1998; Rossion, 2008)— was not enhanced by local Navon processing. Similarly, across five different studies, Brand (2004) found processing bias effects only in one of the studies. As null results are less likely to be published compared to significant effects (Greenwald, 1975), Navon-induced processing bias effects on face recognition might have been overestimated in the literature. Interestingly, more recent research (Howard et al., 2019) has reported not only no effects of global Navon processing on the recognition of own and other-race faces (Experiment 1) but also that global Navon processing could indeed reduce face memory performance (Experiment 2, see also Experiment 2 in Weston et al., 2008).

In conclusion, although we observed a robust part/whole effect, our study found no evidence that Navon priming at the global or local level affects the recognition of whole faces or individual facial features. In other words, neither Navon global-level processing augmented the tendency to integrate facial features into wholes, nor local-level processing enhanced featural identification in a part/whole task. Overall, these results cast doubts on the previous claims that Navon priming (local/global) influences subsequent face processing strategies.

Conflict of interest

The authors declare no conflict of interest.

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