Upright faces seem to have longer duration of presentation than inverted ones

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Abstract. Nontemporal variables were shown to influence subjective duration. Some of these variables are known to alter recognition performance. We suggested that the ease of pattern recognition underlies the effect exerted by some nontemporal stimuli characteristics on brief duration estimation. In order to test this assumption, recognition was manipulated by presenting facial stimuli in upright and inverted position. Upright faces are known to be recognized easier than inverted ones. The results showed that the upright faces were judged to last longer than the inverted ones when presented for the same time intervals within the range of 10 to 70 ms. It was concluded that recognition performance might play an essential role in the effect of some nontemporal variables on brief duration perception.

INTRODUCTION

In duration perception theory and research a major role is attributed to the influence of nontemporal stimulus information on both long (11) and short time interval estimation (1). Such nontemporal variables as intensity (7, 10), contrast (12), complexity (11), meaningfulness (8), familiarity (2), spatial frequency (9, 12), size (13), form, area and perimeter (4) have been shown to influence duration perception. On the other hand, some of these variables, e.g. intensity, contrast, familiarity affect re-
cognition performance. We suggest that the ease of recognition performance underlies the effect of some nontemporal variables on brief duration perception. In order to test this assumption, we manipulated recognition, keeping all physical characteristics of the stimuli unchanged. This was achieved by using upright and inverted faces as stimuli. It is known that face recognition is particularly prone to disruption when faces are inverted (18, Valentine and Bruce, in press, cited after 3).

There is evidence that allows for some speculations about the expected influence of recognition on duration estimates. High intensity, high contrast or greater familiarity enhances recognition on one hand, and leads to longer subjective duration on the other hand (7, 10, 12). An example for the effect of familiarity on the perception of time intervals presented with auditory stimuli is the impression that native speakers in a foreign country seem to talk much faster than people back at home. This subjective impression was supported experimentally as well (5, 14, 15). The observations mentioned above induced us to predict a positive correlation between duration judgments and recognition accuracy: duration estimates were expected to be greater in the case of easier recognition, i.e. for facial stimuli in upright position.

METHODS

Ten black-and-white photographs of faces were included in the stimulus set. Five faces were pleasant (advertising photographs) and five were unpleasant (photographs of people with injuries or cauterisations taken from facial surgery documentation). Both types of faces (pleasant and unpleasant) were presented in an upright and inverted position. The slides were rear projected on a white translucent screen by means of a Kodak Carousel slide projector. A two-channel projection tachistoscope was used for the presentation of stimuli. A brief appearance of the facial stimuli interrupted the constant presentation of a visual noise masking pattern. The visual angle subtended by the image ranged from 9 × 9 to 10 × 10 degrees of visual angle, depending on where the subject sat. Neutral density filters were used to equalize the mean luminance of the stimuli and mask. Both stimuli and mask produced an illumination of 40 lx at the subject's eyes level. The duration of presentation was controlled by two electromagnetic shutters, having rise and fall times of about 1 ms. The facial stimuli were exposed for 10, 20, 35, 50 or 70 ms. The subject sat in a semi-dark room at a distance of about 3 m from the screen. Earphones prevented him from hearing the faint clicks of the shutters. The stimuli were presented to the subjects before the experiment both in the upright and inverted positions, with two
seconds’ duration. Subjects were told that these physiognomic stimuli would be presented for different time intervals. Their task was first to judge the duration of presentation of each face and then to specify under forced-choice whether the presented face was pleasant or unpleasant. The “pleasantness” and the “unpleasantness” of the two types of faces was verified by the ratings made by the subjects before the experiment. The percentage of correct answers was used as a measure of recognition performance of the upright and inverted faces. This type of measurement allowed us to eliminate biasing, which could appear because of the subject’s preference for one of the two possible answers (pleasant face or unpleasant face), especially for the shorter durations in the range where guessing predominates. The recognition performance can be regarded as bias-free, when the percentage of correct responses for upright and inverted faces is obtained by pooling together the two types of answers.

The method of magnitude estimation was used for duration judgement. The standard duration was 35-ms uniform illumination of the test field (with luminance equal to the mean luminance of the facial stimuli and the mask) preceded and followed by the mask. Its subjective duration was designated by the number 10. It was presented 5 times in the beginning of each experimental session. The subjects were required to attach to each subsequent stimulus presentation a number as many times larger or smaller than 10 as the duration of presentation seemed longer or shorter than the standard duration. The subjects recorded their estimates on a sheet of paper.

Each combination: Type of face × Position × Duration was presented 15 times in an experimental session in a quasi random design, so that in 10 consecutive presentations no face appeared twice. Three sessions were performed with each subject. The total number of presentations per subject was 900. Six subjects (4 females and 2 males) run in groups of three were paid to participate in the experiment. They were aged 35-40 years and had normal or corrected to normal vision.

RESULTS

ANOVA (mixed model, 17) was performed on the duration estimates, with the factors of interest being Position (upright or inverted) and Duration. These factors were considered fixed. The Subject factor was considered random. (The duration estimates of the pleasant and unpleasant faces were not included in the analysis, as they could not be compared with the corresponding percentage of correct responses because these responses were biased). The analysis of variance is summarized in Table I. The factors Position and Duration yielded signifi-
### Table I

Summary of the analysis of variance

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjects (S)</td>
<td>5</td>
<td>20800.0</td>
<td></td>
</tr>
<tr>
<td>Position (A)</td>
<td>1</td>
<td>1481.0</td>
<td>11.4*</td>
</tr>
<tr>
<td>AS</td>
<td>5</td>
<td>130.0</td>
<td></td>
</tr>
<tr>
<td>Duration (D)</td>
<td>4</td>
<td>29482.7</td>
<td>99.8***</td>
</tr>
<tr>
<td>DS</td>
<td>20</td>
<td>295.5</td>
<td></td>
</tr>
<tr>
<td>AD</td>
<td>4</td>
<td>237.6</td>
<td>9.8***</td>
</tr>
<tr>
<td>ADS</td>
<td>20</td>
<td>24.3</td>
<td></td>
</tr>
</tbody>
</table>

Simple main effect

| A for level d₁ (10 ms) | 1   | 87.9  | 3.6  |
| A for level d₂ (20 ms) | 1   | 48.1  | .20  |
| A for level d₃ (35 ms) | 1   | 77.8  | 3.2  |
| A for level d₄ (50 ms) | 1   | 289.3 | 11.9***|
| A for level d₅ (70 ms) | 1   | 1928.0| 79.3***|

* P < 0.05,  ** P < 0.01,  *** P < 0.001.

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Fig. 1. The differences between the mean duration estimates of upright (†) and inverted faces (‡) averaged for all subjects are plotted against exposure time on the left-hand side ordinate. They are represented by the curve in the upper part of the Figure. Closed circles indicate a significant difference between the duration estimates of upright and inverted faces; open circles indicate a nonsignificant difference. On the right-hand side ordinate is plotted the percentage of correct responses represented by the bars both for upright (†) and inverted faces (‡). The black parts of the bars represent recognition above the chance level. The hatching indicates a significant difference between the two bars, i.e. between the percentage of correct responses for upright and inverted faces.
cant main effects and a significant interaction as well. The meaning of the interaction was revealed by a more detailed analysis (17). It showed that the simple main effect of the factor Position at the levels of the factor Duration was significant only for 50 and 70 ms (Table I).

The differences between the mean duration estimates of the upright and inverted faces are represented in Fig. 1. The differences in the duration estimates are paralleled to the differences between the percentage of correct recognitions of upright and inverted faces. Both differences in duration estimates and in the percentage of correct recognitions increased with increasing exposure time and reached significant values for 50 and 70 ms ($P < 0.001$) (6).

Fig. 2. The differences between the mean duration estimates of all correctly and all incorrectly recognized facial stimuli averaged for all subjects are plotted against exposure time on the left-hand side ordinate. They are represented by the curve in the upper part of the Figure. On the right-hand side ordinate is plotted the percentage of correct responses represented by the bars. The black parts of the bars indicate recognition above the chance level. Other denotations as in Fig. 1.

If duration estimates increase with the ease of recognition, then longer subjective duration should correspond to the faces recognized correctly as compared to those unrecognized. Figure 2 presents the differences between the mean duration estimates of all correctly and
all incorrectly recognized faces. These differences increase with exposure time and become significantly greater than 0 when the percentage of correct responses exceeds the chance level \(P < 0.001\) (6).

**DISCUSSION**

The present results showed that longer duration was attributed to more easily recognizable patterns, i.e. to upright faces in comparison to inverted ones. This effect was demonstrated for all durations of presentation used in the experiment. It should be noted that both differences in the duration estimates and in recognition accuracy increased with the increase of exposure time and reached significant values for durations of presentation equal to 50 and 70 ms. The finding that easier recognition is accompanied by longer subjective duration can be illustrated in another way: the recognized facial stimuli are judged to last longer than the unrecognized ones.

If upright faces are considered to be more familiar from everyday experience than inverted ones, then our results can be compared with the results concerning the influence of familiarity on brief duration estimation. Witherspoon and Allan (16), using verbal stimuli, have demonstrated that familiarity defined as a prior presentation of an item provides for longer subjective duration. The same was observed by Devane (5), Warm et al. (15) and Warm and McCray (14) who defined familiarity along a frequency of usage dimension. Our results confirm all these findings, but contradict those of Avant and Lyman (2), who argued that the greatest apparent duration accompanied the least recognizable stimulus. Words and nonwords and upright and inverted words presented within the range of 10 to 30 ms served as stimuli in their experiments. It is possible that different experimental procedures, different types of stimuli and different definitions of the term familiarity yield different results. The effect of intensity, contrast or familiarity on brief duration perception might be regarded as different manifestations of the influence of recognition on subjective duration.

Therefore, the effects of intensity, contrast of familiarity on brief duration perception can be regarded as different manifestations of the influence of recognition on subjective duration.

We assumed that, as both upright and inverted faces were presented for the same time intervals, the subjects might have concluded that upright faces which were more easily recognized must have been presented for a longer duration.

In terms of information processing it could be suggested that upright
faces being more familiar from everyday experience, are processed faster than inverted ones. This assumption is confirmed by the greater accuracy of recognition performance of upright in comparison to inverted faces. Perceived duration might be influenced by the speed of extraction and processing of nontemporal stimulus information by the visual system. When the nontemporal stimulus information is processed faster, then more time would be available for the processing of the temporal information of the stimulus and maybe a relatively greater part of the time interval would be taken into account when estimating its duration. This line of reasoning implies that attention is shared between temporal and nontemporal stimulus feature processing.

It is known that facial perception is distinctive from the perception of other visual objects. However, the consistence of our results with those obtained with other types of stimuli (verbal stimuli, patterns of different contrast and intensity etc.) suggests that the conclusions made about the relationship between duration perception and recognition hold true not only for duration perception of facial stimuli, but also for any brief duration perception in general. If so, in certain cases inferences concerning the recognizability of patterns could be made from differences in duration estimates.

REFERENCES


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