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## Flash Report

## Inferring the preferences of others from spontaneous, low-emotional facial expressions

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## ABSTRACT

The present study investigates whether people can infer the preferences of others from spontaneous facial expressions alone. We utilize a paradigm that unobtrusively records people's natural facial reactions to relatively mundane stimuli while they simultaneously report which ones they find more appealing. Videos were then presented to perceivers who attempted to infer the choices of the target individuals—thereby linking perceiver inferences to objective outcomes. Perceivers demonstrated above-chance ability to infer target preferences across four different stimulus categories: people (attractiveness), cartoons (humor), paintings (decorative appeal), and animals (cuteness). While perceivers' subjective ratings of expressivity varied somewhat between targets, these ratings did not predict the relative “readability” of the targets. The findings suggest that noncommunicative, natural facial behavior by itself suffices for certain types interpersonal prediction, even in low-emotional contexts.

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## Introduction

Research in social psychology, social cognition, and, more recently, social neuroscience has characterized the ability to infer others' mental states as a fundamental social process (Mitchell, 2009). This capability is so basic that its absence is linked to autism, schizophrenia, and sociopathy (Baron-Cohen, Leslie & Frith, 1985; Blair, 2005; Brüne & Brüne-Cohrs, 2005). Given the human face's crucial role in conveying mental states (El Kaliouby & Robinson, 2004), the present study investigates whether people are able to infer the preferences of others from spontaneous, subtle facial expressions *per se*.

We utilize a novel paradigm that unobtrusively video-records participants' faces as they view and indicate their preferences among relatively mundane stimuli. In contrast to still images of faces, which have often been used to examine emotional communication (e.g., Baron-Cohen, Wheelwright & Jolliffe, 1997; Ekman, 1992), dynamic facial images provide richer information for interpersonal inferences (Hall, Bernieri & Carney, 2005). Existing methodologies involving dynamic communicative behavior typically do not isolate the face (e.g., hand and bodily gestures are included; Ickes, 1997) and often do not isolate pure nonverbal behavior (e.g., auditory information is present; Zaki, Bolger & Ochsner, 2008, 2009). When nonverbal facial mechanisms are in fact isolated, they usually occur within highly

ffective contexts (e.g., Hess, Blairy & Kleck, 1997; Rosenthal, Hall, DiMatteo, Rogers & Archer, 1979).

While experiments focusing on more everyday facial responses are lacking, prior research has revealed the face to be a rich source of information. Even extremely brief exposures to emotionally neutral facial images trigger evaluations across multiple trait dimensions (Bar, Neta & Linz, 2006; Todorov, Pakrashi & Oosterhof, 2009; Willis & Todorov, 2006). Other studies demonstrate that people reliably identify basic emotions from faces (Ekman, 1992), recognize dynamic reactions to emotionally provocative stimuli (Buck, 1979), and under certain conditions can detect deception in facial movements (Bond & DePaulo, 2006). However, little empirical evidence exists about accurate inferences based on facial cues for more everyday cognitive mental states in the absence of particularly evocative situations or stimuli and without deceptive intent.

The present experiment involved two phases. The initial *target* phase clandestinely filmed participants as they viewed a series of images and indicated their preferences. Specifically, they indicated their preferences among multiple image pairs from four different categories: (1) people (“Who is more attractive?”), (2) cartoons (“Which one is funnier?”), (3) paintings (“Which one would you rather have on your wall at home?”), and (4) animals (“Which one is cuter?”). In the second *perceiver* phase, new participants watched the videos of the targets and tried to guess the targets' reported preferences, based solely on their facial expressions. Thus, this paradigm explicitly links inferences from nonverbal facial expressions to objective outcomes.

We did not filter targets' videos based on their expressivity or other criteria. We thereby avoided inflating estimates of accuracy due

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to selection of stimuli (Hall et al., 2008). In contrast, some paradigms (including those of Baron-Cohen et al., 1997 and Ekman, 1992) select stimuli on the basis of perceiver agreement. Similarly, in the “slide-viewing paradigm” (Buck, 1976, 1979), unobtrusive footage of targets viewing evocative images is pre-selected based on two criteria: (1) whether an initial sample of perceivers guesses the image category better than chance and (2) whether the target is rated as making significant facial movements. Such stimuli selection is appropriate when the goal is to find correlates of accurate inference, but can be misleading when attempting to estimate the degree of accuracy in interpersonal inferences.

Because nonverbal cues by themselves are considered relatively uninformative in certain types of mental state inference (e.g., empathic accuracy; Gesn & Ickes, 1999; Hall & Schmid Mast, 2007), we were uncertain whether perceivers would be better than chance at inferring the targets' preferences in the current natural, noncommunicative context. We therefore included cartoons as one of the stimulus categories, thinking that targets would be most expressive when evaluating humor.

**Method**

*Target phase*

Eight participants (mean age = 19.25, SD = 1.04, 5 females) participated in a study ascertaining “social attitudes from images” in exchange for course credit. Participants were instructed to provide a series of preferences among multiple image pairs presented on a computer screen, comprising the abovementioned categories: people, cartoons, paintings, and animals. The two images of a given pair were presented sequentially, each for a fixed amount of time—3 seconds each for people, paintings, and animals; 7 seconds for the more cognitively challenging cartoons (see Fig. 1). Participants were instructed to look at each image in the pair for an equal amount of time, even if they instantly made up their mind upon first sight of the second image. This, combined with sequential presentation of each image pair, ensured that perceivers in the second stage could not use

cues such as eye gaze and looking time to guess target preferences. After viewing each pair, participants had 5 seconds to indicate their preference on a paper questionnaire. Each participant made judgments on 12 image pairs within each category, for a total of 48 pairs. The order of each image pair was randomized, and the order of presentation of the images within each pair was counterbalanced across participants.

Unbeknownst to participants, throughout the task, a built-in computer camera filmed their faces. After the experiment, participants were debriefed and asked to sign a film release, with the option of refusing to sign and requesting the film deleted. All participants signed the release and granted permission for use of their footage in subsequent experiments. Thus, no participant was dropped from the target phase of the experiment.

*Stimuli*

Target videos were spliced into individual clips that filtered out irrelevant nonverbal behavior (i.e., behavior during the allotted 5-second preference indication period and during the 1-second fixation cross between images). A library of 768 individual clips (384 pairs) from the eight targets was thus available for the next phase. Each clip in the library depicted nonverbal facial reactions to an image, and each one broadcasted the entirety of the target reaction (i.e., each 7-second reaction to each cartoon and each 3-second reaction to the other image types).

*Perceiver phase*

The second phase presented videos on a computer screen using MediaLab v2008 (Jarvis, 2008). Fifty-six participants (mean age = 19.45, SD = 1.14; 34 females) participated in exchange for course credit. Participants learned the basic procedure of the first phase, and subsequently tried to guess the targets' preferred image in each pair, based on the videos.

Each participant was randomly assigned to view target reactions to only one of the four image categories (e.g., people only). Participants

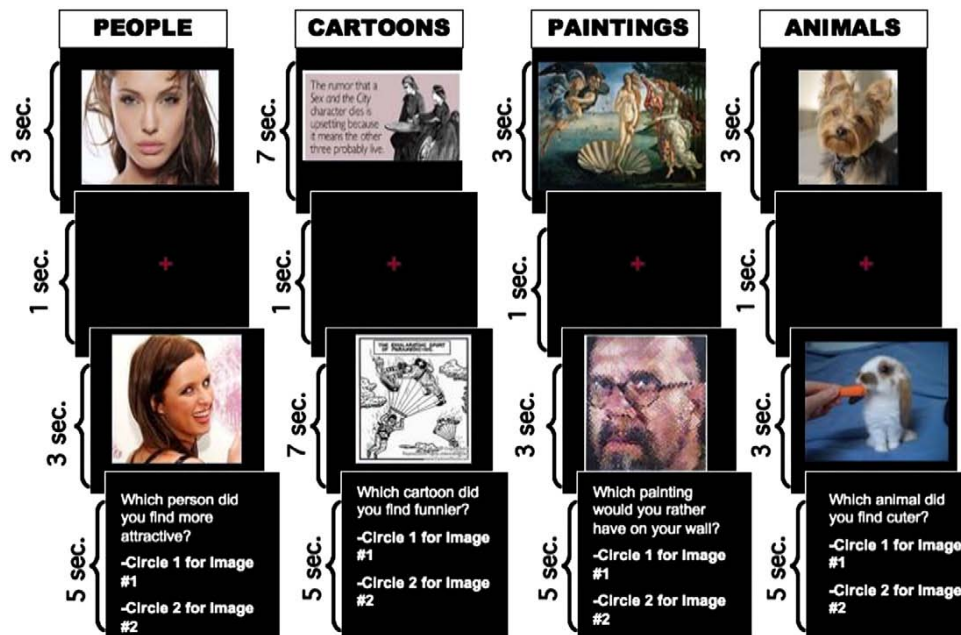


Fig. 1. Schematic representation of a trial within each image category for targets in the first phase, with sample stimuli. Images were presented sequentially for a fixed amount of time. The order of image pairs within each category was randomized and counterbalanced.

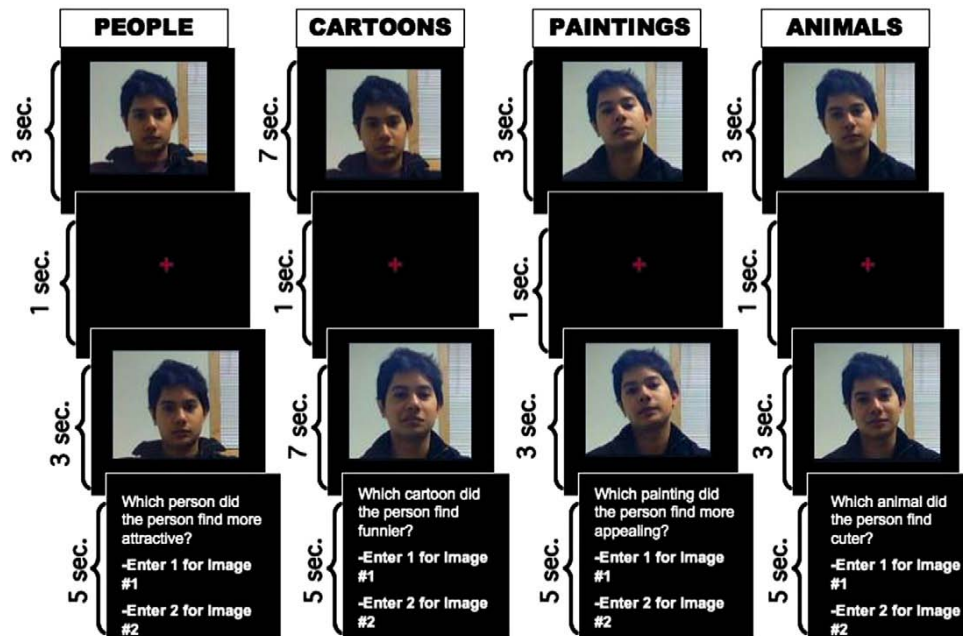


Fig. 2. Schematic representation of a trial within each image condition for perceivers in the second phase, with still shots from sample video clips. Target videos were presented sequentially for a fixed amount of time. The order of the video clip pairs was randomized both between and within targets, and the order of clips within each pair was randomized.

made judgments on the 96 video clip pairs from the selected category. The only exception was the cartoons condition, which showed only four targets and 48 video pairs per perceiver (due to the greater length of each clip). Thus, each target was viewed by half of the participants in the cartoons condition. All of each target's videos were presented before moving onto another target's videos. Like image presentation in the target phase, each video pair was presented sequentially, and the order of the two video clips within each pair was randomized. Moreover, the order of the video pairs was randomized at both the between-target and within-target levels. After each pair participants decided whether the target preferred the image that he/she viewed in the first or second clip (see Fig. 2).<sup>1</sup> After viewing and judging each target's 12 video pairs, perceivers rated the target's facial expressiveness on a scale ranging from 1 (*not at all expressive*) to 5 (*extremely expressive*).

## Results

### Targets' image preferences

We speculated that pairs in which targets tended to heavily favor one image over the other might yield greater accuracy than more evenly matched pairs, since such pairs would yield bigger differences in facial expressions. Thus, to explore whether target base rate preferences might affect accuracy, we established a base rate for each

image within each pair. Specifically, each target-viewed image pair was classified as either a *lopsided* choice (if the number of targets preferring one image over the other was six or greater) or an *even* choice (four versus four or five versus three). Using this criterion, of the total 48 image pairs, 26 were lopsided, while 22 were even.

Targets demonstrated no significant primacy or recency effects in their preferences within each pair. Of the 384 total image preferences (8 targets  $\times$  48 pairs), 190 were the first image in the pair, versus 194 for the second.

### Perceivers' inferences

Accuracy was measured by the percentage of perceivers' preference judgments that matched targets' expressed preferences. One-sample *t*-tests revealed that accuracy scores for judgments were significantly above chance (50%) within all four categories (see Fig. 3). Scores were highest for cartoons ( $M = 67.62\%$ ,  $SD = 7.77$ ;  $t(23) = 11.11$ ,  $p < .001$ ), then relatively equal among people ( $M = 54.69$ ,  $SD = 3.70$ ;  $t(11) = 4.39$ ,  $p = .001$ ), paintings ( $M = 56.15$ ,  $SD = 6.58$ ;  $t(9) = 2.96$ ,  $p < .02$ ), and animals ( $M = 54.79$ ,  $SD = 4.64$ ;  $t(9) = 3.27$ ,  $p < .01$ ).

To test whether the base rate of target preferences influenced accuracy, paired-sample *t*-tests compared perceivers' accuracy in reading target reactions to even pairs versus reading reactions to lopsided pairs. Across categories, target reactions to lopsided choices garnered significantly greater accuracy ( $M = 63.88\%$ ,  $SD = 13.55$ ) than did target reactions to even choices ( $M = 59.68$ ,  $SD = 9.43$ ,  $t(55) = 2.24$ ,  $p < .03$ ). However, both even and lopsided choices yielded above-chance accuracy across and within all categories, all  $p$  values  $< .05$ .

To see whether the accuracy of inferences could have been due to a few particularly expressive targets, we computed target readability scores within each condition by averaging the total accuracy score of each target across perceivers. Although readability scores differed between targets, these differences were not consistent across image categories. For example, whereas participants were below chance in inferring target no. 1's people

<sup>1</sup> Additionally, within each category, each participant was assigned to one of two conditions. In the rich condition, before each video pair, the two corresponding images evaluated by the target were shown to the perceiver. While this provided participants with an extra piece of information, the image order did not necessarily correspond with the order of the video clips—a point that was heavily emphasized. In the lean condition, perceivers viewed only the video clips, without any indication of the images. However, no differences emerged between rich and lean conditions within any of the four category judgments, so all reported analyses collapsed across lean and rich conditions. One potential explanation for the lack of difference is that perceivers' own preference projections outweigh the potential benefit of extra information; the additional process of attempting to match target reactions with specific images might reduce the accuracy of prediction. This is an empirical question to be addressed in future studies.

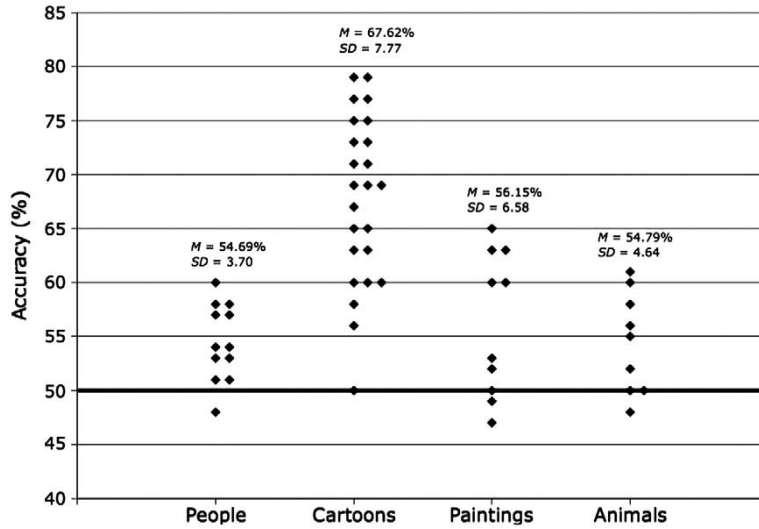


Fig. 3. Scatter plot of individual perceiver accuracy scores as a function of target-viewed image category.

preferences, they were above chance for this same target in the other three conditions. Notably, only one target (no. 8) yielded above chance results in all four categories, and even these scores were not outliers. Moreover, we performed a series of tests iteratively removing each of the eight targets. Out of 32 tests (4 categories  $\times$  8 tests), 30 tests revealed above-chance performance ( $p$  values  $< .05$ ), and the results were marginally significant for the remaining two,  $p = .06$  and  $.09$ , respectively. Thus, it did not appear that one particularly expressive target was consistently driving accuracy across or within any of the four conditions (see Fig. 4).

In addition, although participants reliably perceived differences between targets in their individual expressivity (Cronbach's  $\alpha$  ranged from .88 for paintings to .95 for cartoons), these ratings were fairly low ( $M = 2.03$  out of 5 across all conditions). Moreover, there was not much variance between image categories in perceived target

expressivity; expressiveness was relatively equal for inferences about people ( $M = 2.00$ ,  $SD = 0.89$ ), cartoons ( $M = 2.22$ ,  $SD = 0.92$ ), paintings ( $M = 1.79$ ,  $SD = 0.81$ ), and animals ( $M = 2.06$ ,  $SD = 0.86$ ), suggesting that perceivers saw low informational value in the targets' faces, regardless of category.

We further explored whether expressiveness ratings predicted accuracy of inference within each category. For each perceiver, we computed the correlation between (a) his/her assessed expressiveness of each of the eight targets and (b) his/her objective accuracy score toward each target and submitted the Fisher  $z$ -transformation of these correlations to additional analyses. Specifically, we tested whether the correlations were significantly higher than zero. This was only the case for the cartoons category:  $r = .59$ ,  $SD = .60$ ,  $t(23) = 4.82$ ,  $p < .001$ . The correlations for the other categories were not significantly higher than zero:  $r = .08$ ,

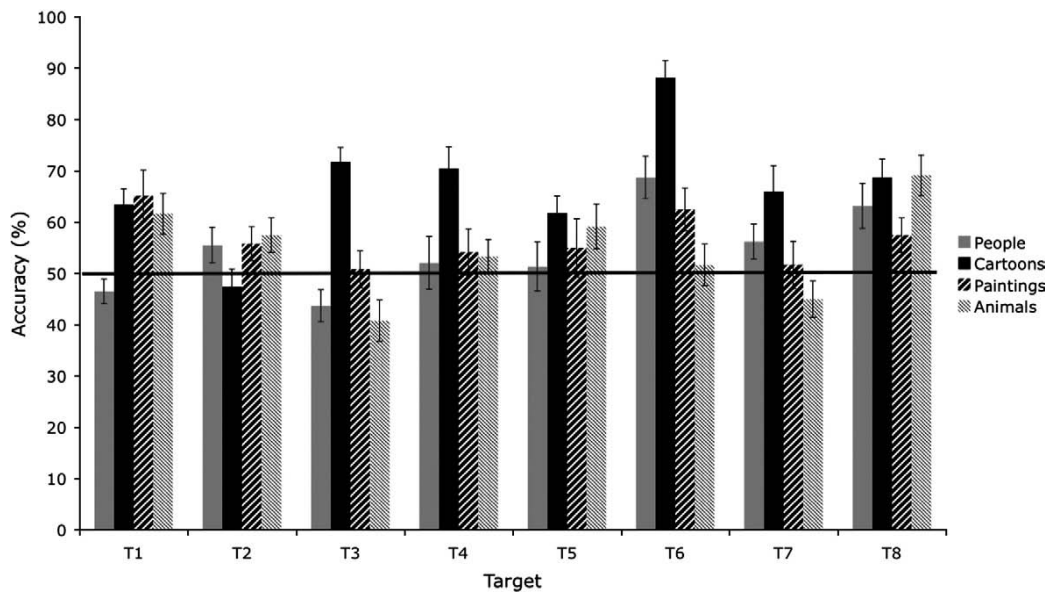


Fig. 4. Perceiver accuracy scores as a function of target and target-viewed image category.

$SD = .43$ ,  $t < 1$  for people;  $r = .07$ ,  $SD = .30$ ;  $t < 1$  for paintings;  $r = .22$ ,  $SD = .37$ ;  $t(9) = 1.77$ ,  $p = .11$  for animals.

## Discussion

Despite drawing solely from minimal, low-emotional nonverbal facial cues, perceivers performed above chance in guessing targets' preferences across all four image categories (cartoons, paintings, people, and animals). Not surprisingly, accuracy was highest when inferring cartoon funniness. Cartoons are more evocative than the other images used, and indeed targets were judged to be slightly more expressive in this condition, which was also the only one in which target-rated expressiveness predicted objective accuracy. Perceivers had low confidence overall about the information value of targets' expressions, even in the high-accuracy cartoon condition. That participants nevertheless performed above chance suggests that inference of attitudes from nonverbal expressions may recruit psychological mechanisms outside of explicit awareness. Moreover, perceiver accuracy was greater when determining targets' reactions to lopsided image pairs compared to more evenly matched ones. This suggests that targets' relative image preferences account for some of the variance in target readability.

The present study contributes to two lines of research on the accuracy of social judgments. The first concerns interpersonal empathic accuracy (e.g., Ickes, Stinson, Bissonnette & Garcia, 1990; Zaki et al., 2008; 2009). Such studies typically film targets speaking (alone or with another person), then ask them to retrospectively indicate their mental states while watching the prerecorded video, and finally have perceivers guess targets' indicated mental states. The current methodology extends this research by investigating mental state identification without after-the-fact, third-person labeling of emotional states, as well as isolating minimal facial expressions as the sole communicative mechanism.

Our results also extend findings about interpersonal thin slicing (Ambady, LaPlante & Johnson, 2001), which have shown people to be surprisingly accurate at interpersonal evaluations from brief excerpts of behavior. Such paradigms utilize both consensus-based accuracy measures (i.e., judgment correspondence with third-person expert opinion; Ambady & Rosenthal, 1992) and more objective criteria (e.g., guessing the actual relationship between people in a brief interaction; Costanzo & Archer, 1989). The present study builds upon the latter type by basing accuracy on actual target-indicated evaluative preferences and reveals the potency of thin-slices of noncommunicative facial behavior alone.

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