Does the attractiveness-bias exist in the smile expression perception?

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Abstract: Facial attractiveness and positive expression perception are key issues in nonverbal social communication. In this paper, we investigate the possible effect of facial attractiveness bias in smile expression perception, and propose a statistical likelihood that attractive female persons tend to present smile expression with lower physical intensity than unattractive female persons. To test this claim, two dimension of expression (naturalness or expression intensity (EI)) were rated in two experiments. In experiment 1, subjects rated 55 image target persons with smile expression of uncontrolled physical intensity, no obvious attractiveness bias was observed. In experiment 2, in order to compensate for influence of varying degree of physical expression intensity for different image target persons, we constructed a set of controlled expression intensity stimuli with same target face set using graphics morphing technology. The result indicated a pronounced statistical significance of attractiveness bias. Finally, the possible potential relationship of attractiveness bias and smile expression perception is discussed.

顔のスマイル表現知覚において魅力度の影響が存在するか？

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概略：顔の魅力や肯定的な表現知覚は，非言語的な社会的コミュニケーションの重要な問題である。本論文で我々はスマイル表現知覚における顔の魅力によるバイアスの起こりうる効果を調査し，魅力的な女の人が魅力のない女の人よりより低い物理的な強度でスマイル表現を呈示する傾向があるという統計的な可能性を提案する。この主張を検証するために、表現の２つの次元（自然度、表現強度（EI））について，２つの実験を行って評価した。実験1において，被験者が，55人の画像刺激上の人物について，統制されていない物理的な強度を持つスマイル表現の強度を評価した。しかし，その結果からは，明確な魅力によるバイアスは観察されなかった。そこで実験2では，異なる画像刺激人物の間で物理的な表現強度の度合いが異なっている影響を補償するために，我々は画像モーフィング技術を使用して，実験1と同じ顔刺激セットにおいてスマイル表現強度が同じになるように統制した顔刺激を作成した。これを用いた結果は，魅力によるバイアスのはっきりした統計的有意差を示した。最後に、魅力によるバイアスとスマイル表現知覚との間で起こりうる潜在的関係について，議論した。

1. Introduction:

Facial attractiveness is one of most salient features in interpersonal attraction and social communications, and attractive individual also appears to benefit considerably from this physical trait in many aspects, involving social evaluation (Miller, 1970), mate se-lection (Thornhill, 1998), employment decision (Watkins & Johnston, 2000), and even voter preferences for political candidates (Efran & Patterson, 1974).

Although it is extremely difficult to determine all minute components of facial attractiveness, physical

attractiveness can primarily be viewed as being composed of static components (face shape, hair style, skin condition) and dynamic changeable components involving makeup, facial expression (Kim,1984). Both static and changeable aspects of attractiveness has been intensively investigated by esthetician. Also, psychologists are studying face perception (Jones, 2006) and expression perception (Calder, 2000).

But the interaction mechanism between static and changeable components of attractiveness, especially expression, still appears obscure. Although some elaborate researches have been done, Argyle (1972) (also see Bercshied & Walster, 1974) holds that positive facial expression enhances the perceived attractiveness via reinforcement effect, smile can have a positive and beneficial effect than angry or inexpressive facial display.

One of the primary characteristic of perception is that human tend to perceive our impression about others into coherent and meaningful wholes (See Asch & Zukier, 1984). Face is the site to present expressions. It should be difficult for person to perceive the expression while ignoring static facial attractiveness. Dion *et.al.* (1972) argued that human seems to believe "what is beautiful is also good", Forgas (1988) holds that smile of attractive person appear more self-confident, and also more responsible for transgressions, but the same expression had exactly the opposite effect when displayed by unattractive individual.

All this findings indicated that static face configuration possibly affects expression perception. Thus, in this research, we intend to investigate the issue of influence of attractiveness on smile expression perception. Additionally, based on the experimental result, we have proposed a statistical likelihood that attractive female persons tend to present smile expression with lower physical intensity than unattractive female persons.

Two experiments have been conducted to explore the issue and testify the hypothesis; in the first experiment, we investigated whether expression perception bias exist via attractiveness bias. Three dimensions (expression intensity, naturalness, attrac-

tiveness) of smile and natural expression on fifty-five image target persons will be rated, and then we check its statistical interaction relationship. In the second experiment, in order to reduce influence of varying degree of physical expression intensity, we will construct a set of controlled expression intensity stimuli with same target face set in the experiment 1, the results of two experiments will be compared and discussed in terms of physical expression intensity and attractiveness bias.

2. Study1
2.1 Subjects.

Subjects were 11 Japanese undergraduate students (paid) and 9 Chinese doctoral students (unpaid). All participants have normal or corrected-to-normal vision.

2.2 Stimuli

Fifty-five image target persons were selected from CAS_PEAL Face Database randomly and each image person has natural, smile expressions. Thus, 110 black and white facial photos were used in the experiment. The hair of face was included, but all clothing and glasses were masked.

2.3 Apparatus

The photos were presented on 19 inch LCD screen (DELL, Precision 470) controlled by the pc (DELL Xeon™ 2.8G HZ and NVIDIA Quadro FX 1400). The face photo subtended a visual angle of approximately 12 degree (horizontally) by 15 degree (vertically).

2.4 Procedures

Subjects were individually tested. There are two sessions in this experiment.

In the first session, Likert method (See figure1) was employed to rate the expression intensity, naturalness, and attractiveness. Subjects were asked to select one of expressions and then rate each photo on these three dimensions by Likert scale from 1-9. Each photo was randomly shown on the screen for 1500 ms and expressions of different target person were rated. Four expressions (smile, angry, sad, and no expression) could be selected, and "sad", "angry" are distracters.

Likert rating method   Thurstone rating method

Figure.1 Two Rating method

The subjects had the following instruction to comprehend expression intensity and naturalness. Attractiveness is not further explained. "Imagine this target person is standing before you and make this expression to you, can you feel his joy/angry/sadness from this expression? If you can feel, please choose the corresponding selection (joy-"smile expression", angry-"angry expression", or sadness-"sad expression"). If you can not feel any of them, please choose "no expression" option. Furthermore, how many corresponding emotions can you feel from his/her expression? If you think that you feel large-amount emotion, rate high score, if you feel small-amount emotion, rate low score. Besides, whether this person presents the expression naturally? Is facial muscle movement consistent with the corresponding emotion who wants to express? If you feel it is consistent, rate high score, otherwise, rate low score."

Before the experiment, subjects saw 8 face photos to get a basic impression of score range, and these data was not further analyzed. In order to make subjects use as much of the scale from 1 to 9 as possible, subjects were prompted to divided score range into three sub- categories (1-3 very low intensity, 4-6 normal intensity, 7-9 high intensity).

In the second session, Thurstone method (See Figure 1) was used to verify accuracy of attractiveness rating result by Likert method. Twelve target persons (12*11/2 = 66 trials) were rated, subjects were shown two facial pictures with natural expression and were asked to select which one is more attractive.

2.5 Results:

The data normalization ($Xi = Xi / Avg(X)$) on the Likert scale value has been done before further analysis. Because a preliminary analysis revealed no significant differences between Japanese group and Chinese group (p = 0.82), their data were merged for subsequent analyses.

It is not appropriate to remove all wrong judge response about one target person, because these data indicated the information of physical expression intensity of the corresponding expression. Therefore, each judge and rate was coded as the following method; 1) Hit (correct judge): corresponding rate value is directly used. 2) Correct rejection (a face with expression was judge as "no expression"): corresponding rate value will be reassign to 0. 3) Miss (mistaken judge): corresponding rate value will be reassign to -1.

An ANOVA of attractiveness and expression intensity do not revealed a significant interaction (F(1,54)=0.064, p=0.801). Also, the significance has not been found between naturalness and attractiveness (F(1,54)=0,106, p=0.746)(See Table 1). From the data distribution (see Figure 2), the data points primarily even distributed regardless of attractiveness, indicating no obvious expression bias effect according to varied attractiveness.

2.6 Discussion

The data is inconsistent with halo effect and indication in previous literatures (See Forgas, 1988), there are two possibilities to reconcile this discrepancy. One simple explanation is that attractiveness bias actually does not affect expression perception. The other way to interpret the inconsistency is due to varied physical expression intensity in terms of attractiveness. We can firstly hypothesize that the attractiveness bias will affect expression perception and

Table 1 Mean Rating and Standard Deviation of Expression intensity (EI) and Naturalness

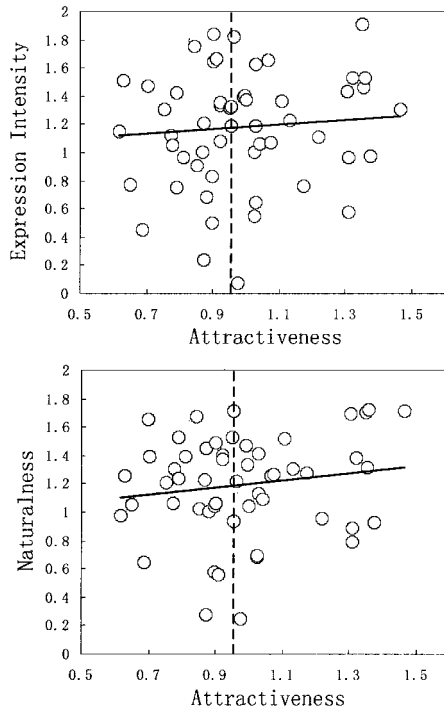| Face Dimensions		Facial expression		F(1,54) Test (Divided by Attractiveness)
		Smile	natural	
Naturalness	M	1.19	N	F=0.106, P=0.746
	SD	0.352		
Expression Intensity	M	1.17	N	F=0.064, P=0.801
	SD	0.427		
Attractiveness	M	0.987	0.982	N
	SD	0.203	0.209	

Figure 2 Expression intensity (top panel) and naturalness (bottom panel) as a function of attractiveness. The vertical dotted line divides data points into two sub-sets according to attractiveness. Also, correlation lines (solid lines) are fitted between attractiveness and expression intensity or naturalness, respectively.

thus produce the additional positive perception bias. Additionally, it is also assumed that perceived intensity varied linearly with the physical intensity of the expression for the same target person (See Hess, 1997). Based on these two assumptions, a simplified formula for perceived expression intensity can be represented in the following way:

Perceived expression intensity

= Physical expression intensity

+Attractiveness bias. (Eq.1)

Thus, from this perspective, even attractiveness bias effects in expression perception, if female attractive person present expression with low physical intensity, the perception bias can not be observed.

In order to determinate which hypothesis is correct, we intend to control the physical expression intensity

by computer morphing technology in study 2. Thus, if attractiveness bias effect in expression perception, perceived expression intensity will have direct correlation to attractiveness because of fixed physical expression intensity. If attractive bias does not effect, the perceived expression intensity will approximately keep constant regardless of attractiveness. Therefore, if statistical interaction between attractiveness and expression intensity can be found with the controlled expression intensity condition, the second hypothesis should be supported. Otherwise, the result should support the notion that attractiveness bias does not affect expression perception.

3 Study 2
3.1 Design

Although physical expression intensity of face can be controlled when identical computer-made expression template is applied to the face (See Figure 3), it is impossible for all target persons to keep absolute identical naturalness level. Different face configuration will influence morphing effect, which will be reflected in the naturalness. High un-natural expression may produce unpredictable perception distortion for intensity. Thus, in study 2, subjects will also be instructed to rate expression intensity and naturalness. Firstly, naturalness will be computed to evaluated perception discrepancy introduced by computer morphing program between two groups. At the case of no significant difference of naturalness between two groups, the expression intensity will be computed to assess attractiveness bias.

3.2 Subjects

Subjects were 8 Japanese undergraduate students (paid) and 10 Chinese doctoral students (unpaid). All participants have normal or corrected-to-normal vision.
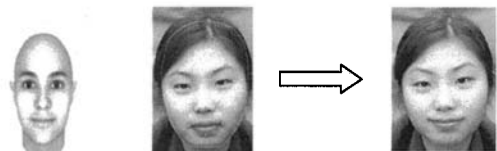

Figure 3 Controlled physical expression intensity by expression template.

3.3 Stimuli

Two subsets were selected from the original photo set. One subset is composed of the 10 top attractive person and the 10 top unattractive person(F(1, 19)=441, p<0.000),and additionally the other subset is constructed by the other 17 target persons randomly selected from the original photo set. Fixed physical intensity of smile expression were created for these two subsets using a graphics morphing program based on Face Action Code System(FACS).

3.4 Apparatus and Procedures

As in the first experiment

3.5 Result

As in the experiment 1, the data normalization and response code preprocessing have been conducted before further analysis.

A breakdown (Expression intensity, Naturalness, and Attractiveness) of two subsets is respectively presented in tables 2 and 3. An ANOVA of attractiveness and expression intensity for top 10 attractive persons and 10 unattractive persons has revealed a significant interaction $(F(1,19)=11.37, p=0.003)$, no significant difference of naturalness$(F(1,19)=.531, p=0.467)$ has been found between attractive group and unattractive group.

For other random selected 17 persons, also, no significant interaction $(F(1,16)=0.936, p=0.349)$ between naturalness and attractiveness was found. An ANOVA of attractiveness and expression intensity do not reach the 5% critical significance $(F(1,15)=3.03, p=0.108)$. However, a ascendant linear curve can be approximately fitted by data distribution (See Fig. 4).

Table 2. Mean Rating and Standard Deviation of Attractiveness and Distinctiveness of 10 top attractive and unattractive persons

Face Dimensions		Smile Expression		F(1,19) Test
		Top 10 Attractive	Top 10 Unattractive	
EI	M	1.20	0.85	F=11.37,
	SD	0.20	0.25	p=0.003
Naturalness	M	1.11	1.10	F=0.531,
	SD	1.05	0.26	p=0.467

Table 3. Mean Rating and Standard Deviation of Attractiveness and Distinctiveness of 17 random selected persons

Face Dimensions		Divided by attractiveness		F(1,16) Test
		attractive group(9)	unattractive persons(8)	
EI	M	1.21	0.97	F=3.03,
	SD	.025	0.302	P=0.108
Naturalness	M	1.002	1.147	F=0.936,
	SD	0.292	0.325	P=0.349

We think the reason is that the relative psychometric distance of attractiveness among these persons is not so distinct compared to top 10 attractive persons and top 10 unattractive persons. On the other hand, two extremes (marked by a circle) affects data distribution, if these two points are ignored, An ANOVA can reveal a significance $(F(1,14)=5.617 \ p=0.034)$ between attractiveness and expression intensity

4. Discussion:

The results reported in this paper may appears at first glance contradictory; In the first experiment, no significant difference between attractive group and unattractive group were found, but in the experiment 2, the halo effect was successfully replicated and confirmed that attractive person can obtain more perceived expression intensity with the identical physical expression intensity.

One way to reconcile these two results is that expressive habituation of physical expression intensity, which is often overlooked and rarely manipulated, can potentially influence perceived expression intensity. Due to the reduced physical expression intensity of smile expression on attractive female persons, the attractiveness bias becomes unclear in data distribution.

But what sorts of mechanisms may account for these findings? One simple explanation is that female attractive person does not prefer to perform fierce facial muscle movement to distort face configuration,

10 attractive persons vs. 10 unattractive persons

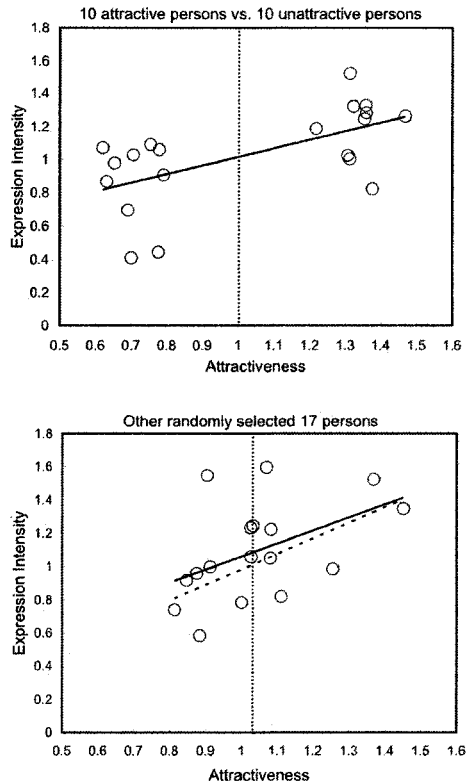**Other randomly selected 17 persons**

Figure 4 Expression Intensity as a function of attractiveness. Top panel is for 10 top attractive persons vs. 10 top unattractive persons. Bottom panel is for other 17 persons. The vertical dotted line divides data points into two sub-sets according to attractiveness.   In the bottom panel, if the two extreme data points (marked by circle) are ignored, the fitting result is dotted line, otherwise, solid line is fitted.

Besides, just as Argyle (1972) has argued that attractive people can judged more positively than unattractive person. Being instinctively conscious of the attractiveness advantage in the social communication, attractive female person can realized that the smile with low physical intensity can be compensated by female attractiveness.

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