Creating Physical Personalities For Agents with Faces: Modeling Trait Impressions of the Face

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Abstract. There are both physical and psychological aspects to personality. Psychological personality originates from within and is expressed through a variety of physical behaviors. Another aspect of personality, which has less to do with expressiveness than with perception, concerns what might be called the *physical personality*. Physical personality comprises those aspects of appearance, which, at zero acquaintance, give rise to an initial impression of personality and a concomitant set of reactions and expectations in others. With the goal of understanding how embodied agents, specifically those with faces, can best utilize the perception of physical personality, the psychological literature on the person perception of the face is reviewed. It will be seen that modeling the person perception of the face would provide agents with a rudimentary sense of social self-awareness that would enable them to alter their faces so as to better advertise their intentions, legitimize their roles, and elicit or prohibit specific responses. A brief discussion of the ways in which the trait impressions of the face can be modeled is also presented.

Introduction

> *To be plain with you, friend, you don't carry in your countenance a letter of recommendation.*
>
> Dickens, *Barnaby Rudge*

Research into artificial personality for agents has focused primarily on internal or psychological aspects of personality: attitudes, drives, desires, and character traits. Typically, personality originates within the agent and is variously used to constrain emotional intensities and formulate goals and strategies [1, 2]. Although Castelfranchi, de Rosis, and Falcone [3] have furnished their agents with the ability of abducting the personality of other agents by observing and reflecting on their behaviors, models of psychological personality rarely incorporate the perception of personality.

Another aspect of personality is the *physical personality* of an agent. A term borrowed from drama theory [4], *physical personality* is defined in this paper as comprising those aspects of appearance, which, at zero acquaintance, form an impression of personality and which initialize a set of behaviors, expectations, and attitudes in others. As Berscheid and Walster have observed, "…our appearance telegraphs more information about us than we would care to reveal on a battery of personality inventories, intelligence tests, and character scales. From flame-colored hair through flat feet, few aspects of appearance fail to provide kernels of folk insight into another's nature." [5, p. 159] To date, designing the physical personality of an agent has been primarily a task relegated to the talents of artists. Providing an agent with the means of creating its own physical form, however, along with an ability to predict user reactions to it, would enable an agent to better advertise its intentions, elicit or prohibit specific responses, further legitimize its role, and furnish the agent with a rudimentary sense of social self-awareness. Unlike psychological models of personality, models of physical personality would require that the focus of attention be placed squarely on the perception of personality, especially on the attribution of certain personality traits to various physical characteristics.

Provided in this paper are a few thoughts on how key ideas in the person perception literature can be exploited in the creation of physical personalities for embodied agents, specifically for agents with faces. Not only do faces reveal evidence regarding the age, sex, physical condition, and current emotional state of a person, but they also provide clues regarding a person's personality, disposition, and attitudes. First, a panoramic overview of the literature on the trait impressions of the face is presented. The implication this material has for agents with faces is then explored. This is followed by a brief

discussion on how the person perception of the face can be modeled.

Trait Impressions of the Face

Fair or not, certain facial characteristics give rise to personality trait impressions in others. Literature and history are full of accounts where people are judged, for good or for ill, according to their facial features. One famous story is that of Charles Darwin, who was nearly rejected passage on the HMS Beagle because the captain, as Darwin recounted, "…doubted whether anyone with my nose could possess sufficient energy and determination for the voyage."[6] Although most today would scoff at the captain's methods of character assessment and recite such maxims as "never judge a book by its cover," evidence abounds that people not only judge others based on their facial features but also believe that the face provides valuable clues regarding a person's character [7]. There is even a growing body of evidence validating the accuracy and consistency, across cultures and races, of these assessments [8, 9].

Although several theories have been advanced to explain why it is that certain facial characteristics consistently elicit specific personality impressions, one major theory is that the perception of facial features has adaptive value and that those trait impressions that have the most influence are based on those facial qualities that demand the greatest attention for the survival of the species [10]. As Zebrowitz explains, "We could not function well in this world if we were unable to differentiate men from women, friends from strangers, the angered from the happy, the healthy from the unfit, or children from adults. For this reason, the tendency to respond to the facial qualities that reveal these attributes may be so strong that it is *overgeneralized* [italics mine] to people whose faces merely resemble those who actually have the attribute [11, pp. 14-15]." Two of the most researched overgeneralization effects are the attractiveness halo effect and the facial maturity overgeneralization effect. Two other overgeneralization effects that have received less attention but are nonetheless significant are based on emotion and gender [12, 13].

The Attractiveness Overgeneralization Effect

One would be hard-pressed to name one culture that did not in some way encourage its members to alter the appearance of their faces. Although religious motives and a need to mark social status are factors in facial elaboration, enhancing the aesthetic appeal of the face is paramount. As Ligget observes, "Beauty must be pursued at whatever price, because it confers on its possessor profound social influence, power and respect [7, p. 46]."

Modern research supports the claim that social benefits accrue to those who are most attractive. People respond positively to attractiveness and associate it with positive character traits. Attractive people are considered more socially competent, potent, and intellectually capable than those less attractive. They are also perceived as being psychologically more adapted. Facial abnormalities and unattractiveness, in contrast, elicit negative responses and are associated with negative traits [14]. Unattractive people are considered less socially competent and willing to cooperate [15]. They are also considered more dishonest, unintelligent, and psychologically unstable and antisocial. Negative reactions to unattractive people are also more severe [16].

The Facial Maturity Overgeneralization Effects

Perhaps no face is more capable of eliciting a favorable response than that of a baby. Humans and animals alike are disarmed and entranced by a youthful face [11, 17]. Even infants show a preference for such faces [18]. The favorable response to a baby's face is not just reserved for babies, however, but is generalized to adults whose faces resemble those of babies [11]. Babyfaced people are universally attributed child-like characteristics. They are perceived to be more submissive, naïve, honest, kind-hearted, weaker, and warmer than others. They are also perceived as being more helping, caring, and in need of protection [9, 19]. Mature-faced individuals, in contrast, are more likely to command respect and be perceived as experts [11].

Gender Overgeneralization Effects

Gender overgeneralization effects are strongly correlated with the effects of facial maturity [11]. Female faces, more than male faces, tend to retain into adulthood the morphological characteristics of youth [20] and are more likely to be ascribed characteristics associated with baby-facedness. Similarly, male faces, tending to be morphologically more mature, are perceived as having the psychological characteristics typically associated with mature-faced individuals.

Emotion Overgeneralization Effects

The effect on trait impressions of morphological configurations suggestive of emotional states has not received much attention, but there is evidence suggesting such configurations play a significant role in the formation of trait impressions. Take smiling for instance. People react positively to smiling faces and find them disarming and thus not very dominant [21]. In fact, facial dominance significantly declines where even a slight smile is discernible [22]. As would be expected, faces where the lips

naturally turn upwards are likewise viewed more positively; such faces are considered friendly, kind, easygoing, and nonaggressive [23]. In a similar vein, faces that have features indicative of anger or hostility, e.g., low-lying eyebrows, thin lips, and withdrawn corners of the mouth, are perceived to be more threatening, aggressive, and dominant [24].

Implications of Modeling the Trait Impressions of Faces for Agents with Faces

In *The Face and the Soul*, Patrizia Magli remarks, "Upon seeing a face, we immediately produce a symbolic framework that confronts us with a complex and ancient cultural experience." [25] Clearly, the person perception literature demonstrates that the face forms the locus of many of our stereotypes, prejudices, and cultural values. Once agents are endowed with faces, they enter this cultural arena. Like countless others who each morning prepare their faces to meet the world, so should agents consider the impressions their faces produce and take pains to prepare social masks that are appropriate to the social task. Modeling the person perception of the face would enable agents to physically advertise their intentions, further legitimize their roles, and provide an elementary sense of social self-awareness.

In many situations the intentions behind statements and actions are ambiguous. Physical personality serves to clarify intentions [26]. To illustrate this idea, consider the following scenario of a secretary assigned for the first time to the vice president of a company. He is a young married man. She has just been thanked for taking a dictation. Standing, she asks if there is anything else he would like her to do. When people are shown a photograph of the secretary along with a written description of the scenario and then asked what she means by her question, people vary in their responses depending upon which photograph they are shown. Some faces consistently suggest seductive motives, others ambitious intentions, and some a polite way of taking leave.

It is reasonable to expect that people will use the physical forms of embodied agents in making sense of the actions and intentions of embodied agents, just as they do with people [27]. An agent's face will either clarify its intentions or complicate them. If an agent plans to assist, proffering a babyish face would better evoke in others the trait expectations of helpfulness, along with the other traits associated with babyfacedness: friendliness and a willingness to listen and serve. Similarly, by altering their level of attractiveness, agents could subtly announce their intentions to engage or disengage in social activity. An attractive agent publicizes a willingness to socialize, and its attractiveness will trigger reciprocating social responses. If an agent is forbidden to collaborate with others in certain situations, it could announce its disinclination to collaborate by assuming an unattractive visage. This would enable the agent to avoid the awkwardness of turning down an invitation to collaborate by reducing its chances of being invited in the first place.

In a similar vein, an agent wearing the appropriate mask would further legitimize its role. Those agents that are designed to enforce rules or command should be less attractive and more mature-faced. As already noted, agents designed to assist others should be babyfaced. Finally, as with so many products, embodied agents that function in recommender systems should be as attractive as possible [28]. Additionally, they should be mature-faced if advising as experts and babyfaced if giving testimonials [11]. In entertainment, embodied agents should take on facial forms appropriate to the role they are playing.

Agents could also alter their faces in order to elicit or inhibit responses. Billerter [29] has noted that robots are exposed by their vary nature to destructive acts. By virtue of being insensate and moving, they trigger aggressive behaviors in humans. To drive the latter point home, he quotes DeLillo: "You see, there's a primal joy in hitting a thing in motion. It's one of the oldest pleasures there is. Something moves, boo, you wing it. Beast, bird or human, the thing to do is to knock it down." [30] One moving object a human being rarely attacks, however, is a baby or small child, a fact that both the Masai of Africa and the Aboriginals of Australia use to good advantage by having a youth precede them whenever encountering potentially aggressive outsiders. In a similar fashion, robots and other agents preceded by attractive faces that are babyish in configuration would inhibit aggressive behaviors in human beings. Such a face would further announce the agent's need for protection and gentle handling. Additionally, babyfaced agents would elicit more forgiving behaviors whenever they make mistakes or fail to meet expectations since human beings are typically more forgiving of the mistakes made by children and, by extension, babyfaced individuals [31].

Another advantage of modeling trait impressions is that an agent would gain a sense of social self-awareness simply by virtue of being able to predict responses to its physical form. This awareness would grow as the agent adapts its physical self within a social world and learns from its failures and successes. Furthermore, if agents were given the means of perceiving and classifying the physical personality of other social agents, human and

otherwise, they could function as social mirrors for others, much as people do. Imagine an agent that could provide honest answers when asked how old, attractive, or trustworthy the user looks. Such mirroring would enrich user interactions with agents. It might also complicate interactions; as mirroring agents, they might need to learn, like their human counterparts, how to lie in order to get along.

Lastly, given the fact that people treat media in the same way they treat other human beings [27], it is also reasonable to assume that the time-honored adage "first impressions are lasting," will hold for embodied agents as well. In this regard, modern research gives credence to folk psychology. Studies show that the characterological impressions of a person based on physical appearance not only persist but also deepen over time [32]. What happens when first impressions are proven wrong? Reactions can be retaliatory. Zebrowitz and McDonald [31], for instance, found that when babyfaced defendants, normally assumed to be innocent, were proven at fault both in mock and actual small claims cases, they were treated significantly more harshly. This strongly suggests that violating expectations initiated by the physical personality of embodied agents could produce negative repercussions.

Notes on Modeling Trait Impressions of the Face

One way to model the trait impressions of the face is to alter the morphological characteristics that make a face attractive, babyfaced, or mature. This indirect approach requires that the nature of the morphological characteristics of these overgeneralization effects be understood.

What morphological characteristics make a face attractive? Some believe that there is no objective standard of beauty, that it is entirely in the eye of the beholder. To some degree this is true. In general, faces that are more familiar are considered more attractive [33], and there is evidence that moral judgments influence opinions of beauty [34]. However, the strong consensus in judgments of attractiveness, cross-culturally, cross-racially, and across age groups, indicates the existence of an objective standard of attractiveness [35]. There is even evidence of cross-species similarities in attractiveness judgments [36]. Pinning down the facial qualities and characteristics that make faces appealing, however, has proven to be a difficult task. To date, there is no theory of attractiveness that is generally accepted. Nonetheless, contemporary research into facial attractiveness indicates that straightness of profile, proportion [37], symmetry [38], and averaged faces [39] are important factors in attractiveness judgments.

In particular, averaging the pixels of a set of facial images, comprised of either the same individual or of different people, is one effective way of generating attractive faces [39, 40]. Furthermore, morphing the facial shape of a face towards the mean facial shape of a set of images enhances attractiveness, whereas morphing the facial shape further from the mean reduces attractiveness [41].

The morphological characteristics that mark a baby's face are large eyes relative to the rest of the face, fine, high eyebrows, light skin and hair color, red lips that are proportionally larger, a small, wide nose with a concave bridge, and a small chin. The facial features are also placed lower on the face [11, 42]. Across cultures, these same facial configurations characterize babyfaced adults [9, 42]. Even a single babyish facial feature can effect trait impressions [11]. For instance, faces with large eyes are considered warmer, weaker, more honest, credulous, and submissive [43, 44].

Other significant age related differences in faces concern developmental changes in craniofacial profile shape. Of particular note are differences in the relative size of the brain capsule and the slant of the forehead in relation to the chin. The infantile cranium is proportionally much larger than the fully mature cranium, and the infantile forehead protrudes whereas the adult forehead recedes. Another important characteristic is a dramatic increase in jaw size. Todd and Mark [45] have modeled facial maturity by using a cardioidal strain transformation. Applied to standard profile shapes, this transform has been shown to accurately approximate real growth. Furthermore, studies on the trait attributions of profiles that vary in the degree of cardioidal strain applied are consistent with findings on facial maturity [11, 46]. As craniofacial profile maturity decreases, so do perceived alertness, reliability, intelligence, and strength [19]. Moreover, infantile profile shapes are more lovable, less threatening [19], and elicit stronger desires to nurture and protect [46].

Yet another way to model the trait impressions of the face is to focus directly on those features that give rise to various trait impressions. Early investigations into the person perception of the face relied almost exclusively on measuring the relative distances of important facial key points. A major problem with using this approach to model the trait impressions of the face is deciding *a priori* which key points are most responsible for the elicitation of specific trait impressions [12, p. 2]. Processing faces using holistic techniques, such as an autoassociative neural network [47] or, equivalently, prinicipal component analysis (PCA) [48], offer a better alternative as they allow the classifier system to discover the relevant features *a posteriori*. Although neural networks have not

been put to task in modeling the trait impressions of the face, they have proven successful in modeling face perception in terms of gender [49], age [50], and facial expression [51]. This author is currently investigating the feasibility of applying this approach in modeling the trait impressions of the face. Preliminary results suggest that a PCA model may be capable not only of classifying faces along specific trait dimensions but also of generating novel faces with a high probability of producing a specific physical personality.

Reservations

Guided by the psychological literature on person perception, ways in which the physical personality of agents with faces can be modeled have been presented, along with a discussion of some of the advantages in doing so. There are, of course, a number of concerns that need to be addressed. It is possible, for instance, that altering the physical personality of an agent could lead to confusion and provoke adverse reactions from users [27]. There are also societal implications in modeling many of the stereotypes associated with physical personality. To some degree, exploiting the trait impressions of various physical characteristics would perpetuate these stereotypes. Nonetheless, as Reeves and Nass have argued, "It's easier to process what is expected than what is new or *counter*-stereotypical." [27, p. 169] As with human beings, an agent's physical form will be searched for clues regarding its psychological personality. The question becomes whether the physical personalities of agents will take advantage of these impressions to enhance human interactions and honestly advertise the nature of their attitudes, drives, desires, and intentions.

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