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Original Article

Facial disfigurement is treated like an infectious disease

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Abstract

The behavioral avoidance of people with facial disfigurement is well documented, but its psychological basis is poorly understood. Based upon a disease avoidance account of stigmatization, we conducted the first empirical test of whether facial disfigurement—naevus flammeus (a port wine stain) here—can trigger the same set of emotional and behavioral responses as a contagious disease (influenza). Ninety-eight participants contacted props, which they had seen used either by a healthy confederate or by a confederate simulating medical conditions affecting the face—birthmark and influenza. Behavioral avoidance (e.g., willingness to handle the prop) and facial display of disgust were recorded across five levels of prop contact varying from no contact to contact with the mouth. Behavioral avoidance and disgust displays, especially with oral contact, were equivalent in the birthmark and influenza conditions, with both significantly exceeding reactions to the healthy confederate. These results support the theory that humans have an evolved predisposition to avoid individuals with disease signs, which is mediated by the emotion of disgust. This implicit avoidance occurs even when they know explicitly that such signs—the birthmark here—result from a noncontagious condition.

Keywords: Disgust; Contamination; Behavioral avoidance; Facial expression

1. Introduction

Individuals with acne, psoriasis, or eczema, as well as people with cleft palates, facial birthmarks, or other disfiguring facial lesions, have all reported being avoided by others (Clarke, 1999; Hill & Kennedy, 2002; Hong, Koo, & Koo, 2008; Papadopoulos, Walker, Aitken, & Bor, 2000). This avoidance may take many forms, including difficulties in forming and maintaining interpersonal relationships (Clarke, 1999), as well as inequities in employment, education, and health care settings (Lanigan & Cotterill, 1989). Several authors have claimed that avoidance of people with facial lesions and disfigurement, amongst others, arises because such individuals trigger an innate disease avoidance system, which is primed to detect "disease-like" signs irrespective of their veracity (Kurzban & Leary, 2001; Oaten, Stevenson, & Case, 2011; Park, Faulkner, & Schaller, 2003). This disease-based account of avoidance makes one central prediction, which has yet to been tested. Specifically, people's reaction to an individual with a facial lesion should be the same as their reaction to an individual with a visible contagious disease. The experiment reported here tested this prediction (Crocker, Major, & Steel, 1998).

It has been suggested that behavioral avoidance may reflect the activation of a disease avoidance system that is predisposed to respond to signs of disease, irrespective of their accuracy (Kurzban & Leary, 2001). Disease can impact on an individual in a number of different ways, many of which may lead to deviations from the species-typical norm (Kurzban & Leary, 2001). For example, some diseases may disturb an individual's symmetry, creating marks, lesions, or discoloration of body parts, while others may produce behavioral anomalies as a consequence of damage to muscles or muscle control systems (Ewald, 1993). The human face may be a particularly important point of display for disease signs. The 25 diseases that currently (and historically) impose the highest human mortality and morbidity were recently identified (Wolfe, Dunavan, & Diamond, 2007). Of these 25 diseases, 16 present with readily visible *facial lesions* (rashes, bleeding under the skin, changes in color of the sclera), 20 present with fever (which will also include abnormal facial coloring and perspiration), 6 with a cough or

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nasal discharge, 5 with *abnormal movement or behavior* that extends beyond illness-related malaise (muscle spasms, torpor, psychosis), and 5 with changes to the *physical structure of the body* (swollen neck, cachexia, lipodystrophy). In total, all 25 diseases demonstrate one or more of these signs, with most (23/25) visible on the face (i.e., skin lesions, jaundice, fever, cough/nasal discharge).

While the face may be a useful indicator of a person's health status, it is far from perfect. Not all diseases manifest in clearly visible facial (or other) symptoms. Not all rashes, sores, and disfigurements indicate an active infection (Ewald 1993). Moreover, all humans deviate to some degree from the species-typical norms because of injury or genetics (Kurzban & Leary, 2001). Together, this "noise" makes it difficult to tell whether or not a particular facial sign is truly indicative of infection—a signal detection problem. A disease avoidance module functions to process a given type of stimuli or inputs—e.g., correlates of parasite infestation. These inputs constitute the "proper domain" of the module (Sperber, 1994). To recognize inputs belonging to its proper domain, a module uses formal conditions that an input has to meet in order to be accepted and processed. All inputs meeting the input conditions of a module constitute its actual domain. These input conditions can never be perfectly adequate. Some items belonging to the proper domain of the module may fail to satisfy them—a genuine illness may not exhibit detectable disease signs (false negative or "miss"; Haselton & Buss, 2000). Some items not belonging to the proper domain of a module may nevertheless satisfy its input conditions—a benign disease sign such as a birthmark (false positive or "false-alarm"; Haselton & Buss, 2000). Faced then with an ambiguous disease sign, a person can err by a false alarm (a healthy person is erroneously perceived to be sick) or a miss (a sick person is erroneously perceived to be healthy). Error Management Theory (Haselton & Buss, 2000; Haselton & Nettle, 2006) suggests that, in such cases, people will act to reduce the error that poses the greatest threat to one's fitness. Thus, humans should be biased toward false alarms because false rejections are potentially fatal (Haselton, Nettle, & Andrews, 2005; Kurzban & Leary, 2001). Accordingly, we are likely to be particularly reactive to signs of disease, especially if the threat of disease is highly salient or if we feel particularly vulnerable to disease (Functional Flexibility; Schaller & Duncan, 2007; Schaller & Park, 2011).

This has obvious and far-reaching implications for social perception and behavior. Simply because people may display some superficial form of nonnormality, we may respond to them—even if they are perfectly-healthy—as though they are carriers of some contagious disease (Schaller & Duncan, 2007). A large literature suggests that facially disfigured people experience behavioral avoidance, and many of these findings are *consistent* with the operation of false-alarm biases. For example, Rumsey, Bull, and Gahagan (1982) conducted a naturalistic study that measured the personal space afforded to a disfigured or nondisfigured confederate by public pedestrians in a busy street. The study employed two types of disfigurement: a birthmark under the right eye (permanent disfigurement), and trauma scarring and bruising (temporary disfigurement). They found that members of the public stood further away from the confederate in the disfigured conditions than in the no disfigurement condition. Moreover, pedestrians tended to stand even further from the permanently disfigured confederate (birthmark) relative to the temporarily disfigured confederate (see Rumsey & Bull, 1986 and Houston & Bull, 1994, for similar findings).

While the data above provide a strong case that people with facial disfigurements are avoided and that this avoidance *may* result from "false alarms" generated by a disease avoidance system, this account has not been tested before. As we outlined in the opening paragraph, our central prediction is that participants will demonstrate the same reaction to an individual with a facial disfigurement as they will to a person with a visible contagious disease. A key component of this reaction is disgust, an emotion that seems to be selectively triggered by pathogen threats (Oaten, Stevenson, & Case, 2009). Moreover, the more intimate the contact with the pathogen threat and the more likely the prospect of oral incorporation of that "threat," the greater the experienced level of disgust (Fallon & Rozin, 1983). If the pathogen threat contacts another object, this object may become "contaminated," and it too may then engender disgust. This has been observed in laboratory settings by participants' reluctance, for example, to drink juice that had been in contact with a *sterilized* cockroach (Rozin, Millman, & Nemeroff, 1986) or to wear a laundered jumper previously worn by a person reported to have HIV/AIDS (Rozin, Markwith, & Nemeroff, 1992). Disgust-based disease avoidance should be both automatic and fairly impenetrable to cognition to ensure that all disease signals, false or real, are acted upon (Oaten et al., 2009). If genuine disease threats induce disgust and can contaminate other objects, which too can induce disgust and especially so if these objects come near the mouth, then these types of *reactions* should be common to both *genuine* disease threats and to *apparent* disease threats (i.e., false alarms).

The present study set out to test this prediction of reaction similarity by comparing participant responses to confederates feigning "real" disease signs (e.g., influenza symptoms) or "false alarms" (e.g., facial birthmark) and to a healthy control. Under the guise of an imitation study, participants handled three different props (e.g., towel, harmonica, snorkel mask) across five levels of proximity (e.g., no contact, contact with hand, contact with head, contact with face, and contact with mouth) and across three medical conditions (influenza, birthmark, healthy control). In accordance with the predictions of a disease avoidance account, we hypothesized that participants would make less contact with the props previously used by confederates displaying signs of disease—regardless of whether these signs were real (e.g., influenza) or "false alarms" (e.g., birthmark)—relative to the healthy control. In particular, we anticipated a greater number of facial and behavioral displays of disgust in the influenza and birthmark conditions relative to the healthy control, and especially as the level of prop contact became more intimate (e.g., oral).

2. Method

2.1. Participants

Ninety-eight Macquarie University students (72 female, 26 male) participated for course credit. Age ranged from 18 to 50 years (M=20.36, S.D.=4.87). The study was approved by the University Human Research Ethics Committee.

2.2. Overview and design

The aim of the study was to evaluate participants' reactions to the three experimental conditions: influenza, birthmark, and healthy control. Using a fully within-subject design, participants were asked to imitate tasks performed by three confederates each of whom was featured on a different video clip. When a clip was played, participants were videotaped while they simultaneously attempted to imitate the actions of the confederate. These actions involved various levels of contact with a prop, *the same* prop that participants were asked to use in their imitation of the confederates actions. This allowed us to ascertain whether participants' reaction to props used by the confederates with the birthmark and influenza were similar (i.e., avoiding placing the prop near the mouth, facial displays of disgust to the prop, wiping the prop before touching it, etc.), but different from that of the healthy control.

2.3. Materials and measures

2.3.1. Test environment

The experiment was conducted in a small room (see Supplementary Material, available on the journal's website at www.ehbonline.org.) equipped with a television, video recording equipment, a table, and the props used in the video clips shown to participants. Extra items including recording equipment and shirts worn by the confederates were strategically placed in the room to enhance the impression that the confederates had recently been in the room prior to each participant's arrival. The imitation task video clips featuring the experimental confederates were played on a Palsonic DVD player and screened on a Samsung television (68-cm screen). Participants were videotaped from the torso up using a Sony MiniDV Handycam that was mounted on a small tripod above the television. The props (towel, harmonica, and snorkel mask) were stored and presented to participants in individual boxes so that the experimenter did not have any physical contact with them. This ensured that the only information that participants had about the props" prior contact history was from the video clips seen during the experiment.

2.3.2. Imitation video clip stimuli

Twenty-seven unique "imitation training" video clips [i.e., 3 (confederate identity: person 1, 2, and 3)×3 (medical condition: control, birthmark and influenza)×3 (prop: harmonica, towel, and snorkel mask)] were produced. Video clips were counterbalanced across participants such that they were viewed in equal frequency on average, with the lowest number of viewings=3 and the highest number of viewings=4.

Each participant viewed three video clips. These three video clips always featured a different confederate in each clip, a different medical condition in each clip, and a different prop in each clip. Each video clip (approximately 1-min duration) featured a confederate (e.g., control, birthmark, or influenza) performing a sequence of five imitation tasks (involving varying amounts of contact ranging from "no contact" to "oral contact") using one of the three props—harmonica, towel, or snorkel mask. Each imitation task lasted approximately 5 s with a 5-s interstimulus interval during which the prop was placed back into the storage container. The sequence of the five imitation tasks was presented in a fixed contact order—no contact, hand, head, face, and oral (see Supplementary Material, available on the journal's website at www.ehbonline.org). Participants who imitated "oral contact" had also sequentially completed the previous four contact levels (no contact, hand, head, and face). We suspected that the prospect of oral contact might be undesirable for many participants and so implemented a fixed contact order to record how far participants were "willing to go" in the imitation task.

The three Caucasian male confederates were all aged in their mid-20s and were similar in appearance, with medium builds and clear complexions, and were cleanly shaven. Each confederate wore a blue polo shirt and blue jeans. In all video presentations, their demeanor and expression were consistently neutral except for the influenza versions in which they appeared drowsy, and coughed and sniffled occasionally. The appearance of the confederates across medical conditions is shown in the Supplementary Material (available on the journal's website at www.ehbonline.org). Each confederate appeared either as a healthy control (no makeup), with a birthmark (large port wine stain on left cheek), or with influenza symptoms (pale face, red runny nose, and bleary eyes). A professional makeup artist applied the requisite cosmetics. Pilot testing (n=12) indicated that the three confederates were not significantly different without makeup with respect to ratings of health appearance (F<1).

The videos were prepared in the experimental room, which added to the impression of their having been made prior to the participant's arrival (and, accordingly, the confederates having had recent contact with the props).

2.3.3. Behavior measures

Three behavioral measures were coded from video recordings of the participants performing each imitation trial. First, level of *prop avoidance* was scored from zero to four based on the highest (most intimate) level of prop contact reached (0=*no contact* to 4=*oral contact*). Second, a *disgust face* score (0=absent, 1=present) assessed whether any facial expression of disgust (e.g., grimaces, wrinkled nose, upturned mouth) was present at each level of prop contact. This was then summed, yielding a score from 0 to 4. Third, the occurrence of *disgust-related behavior* (0=absent, 1=at least one occurrence) such as wiping props before contact and rapid withdrawal was used as an additional behavioral measure of disgust and contamination concerns. This was ascertained for each level of prop contact and summed to yield a score from 0 to 4.

2.3.4. Self-report questionnaires

Three "trainer evaluation" forms were completed immediately after the final video clip trial as a manipulation check to ensure that the medical conditions were effectively portrayed. This included a brief open-ended description of each confederate. After completing these descriptions, participants were then shown A4 color screenshots of the relevant confederates (see Supplementary Material, available on the journal's website at www.ehbonline.org) so that they could rate how healthy (1=*very unhealthy* to 7=*very healthy*) they appeared. To gauge knowledge and opinion regarding the two experimental medical conditions—influenza and birthmarks—opinions of contagion, fatality, and disgust relating to influenza and facial birthmarks were rated on a 7-point scale ranging from 1 (*definitely not*) to 7 (*definitely is*).

A "Personality and Imitation" questionnaire adapted from the Autism Quotient (Baron-Cohen et al., 2001) was developed to enhance the face validity of the experimental cover story. The 12 items related to imitation, attention to detail, and imagination were rated on a 4-point scale from 1=*strongly disagree* to 4=*strongly agree*. No data from this questionnaire were coded.

2.4. Procedure

A cover story was used to mask the true aim of the study and reduce the potential for demand characteristics or socially desirable behavior. Participants were led to believe that they were involved in a study investigating the social and personality factors involved in imitation. To ensure that participants who arrived early did not become suspicious of the cover story (more below), the experimenter met the participant in a corridor away from the experimental room. Upon entering the room, participants read and signed the decoy "imitation and the social mind" information and consent form which contained no specific mention of disgust and disease avoidance. Participants then completed the decoy imitation questionnaire.

Before the first video imitation trial, the experimenter read the instructions to the participant. Participants were instructed to watch and at the same time imitate the "trainer" in the video. It was emphasized that the trainer on the video they were about to watch *had just used the prop* in front of them. Participants were informed that they were not obligated to perform any of these imitations if they felt "uncomfortable" doing so. To facilitate the cover story, superfluous instructions regarding imitating mirror directions and left/right movements were also included prior to the first video. The experimenter was outside the room while the participant performed the imitation task. Participants were given 1 min (timed by the experimenter) to complete each imitation task. In between each imitation trial, the experimenter reentered the room to change the prop and video. The experimenter also reiterated the instructions "follow the trainer as best you can…if you don't feel comfortable doing the imitation just don't do it…[looking and pointing at prop]. The only person that has used this is the person on the next video."

Participants were video recorded (from the torso up) during the imitation phase of the experiment so that any avoidant behavior (directed toward contact with the prop), or facial or behavioral displays of disgust could be later coded. One research assistant coded all of these data, and a second coded a random 33% of the data set. Both coders were blind to experimental conditions. Interrater reliability was strong for the three behavioral/emotional measures: prop contact level, Cohen's κ=1.00, p<.0005; occurrence of disgust facial expression, κ=0.77, p<.0005; and disgust behaviors, κ=0.82, p<.0005.

After the video imitations, participants completed the manipulation checks—trainer evaluations—for each confederate. Finally, participants were verbally debriefed and provided with an updated information and consent form that detailed the real purpose of the study. All participants reconsented to participation via the updated form.

Participants were then asked at what point during the experiment, if at all, did they become aware of the study aims. All participants reported no insight into the true aims of the study. As a final manipulation check, participants were asked whether they believed that the medical conditions portrayed in the videos were realistic. All participants reported that the imitation cover story, make-up, and videos appeared real.

3. Results

3.1. Manipulation checks

In the trainer description, all participants described the healthy target using terms unrelated to health such as "male" (75/98), "brown hair" (66/98), and "blue shirt" (39/98). No participants used descriptors indicative of poor health. The birthmark target was described similarly to the healthy target but with a "birthmark on his left cheek" (82/98); however, all participants mentioned the birthmark when questioned during debrief. Participants described the influenza target as appearing sick (88/98) with terms such as "sick/ill" (56/98), "cold or flu" (47/98), or "coughed" (30/98).

Participants also rated the health appearance of the three confederates. A one-way analysis of variance (ANOVA) with medical condition as the within-subjects factor found a significant main effect for medical condition, $F_{1.78,\ 172.85}$=90.75, p<.0005 (Greenhouse–Geisser adjusted). Planned contrasts revealed that the healthy condition (M=6.1/7) was rated significantly more healthy looking than the birthmark condition (M=5.2/7), p<.0005, as well as the influenza condition (M=4.0/7), p<.0005, and the birthmark target was rated significantly more healthy than the influenza condition, p<.0005.

In addition, health appearance ratings for birthmark were correlated with prop contact, r_{97}=0.31, p<.01, and behavioral displays, r_{97}=−0.33, p<.01, and health appearance ratings for influenza were correlated with facial expressions, r_{97}=−0.26, p<.01 (all remaining correlations were similarly signed, but nonsignificant). There were no significant correlations for health appearance ratings for the healthy control.

Results from our manipulation checks on explicit opinion of the experimental conditions indicated that influenza (M=6.4, S.D.=0.81) was rated as more *contagious* than a birthmark (M=1.3, S.D.=0.82), t_{97}=41.97, p<.001. Similarly, influenza (M=3.7, S.D.=1.49) was considered as more *lethal* than a birthmark (M=1.4, S.D.=1.03); t_{97}=13.37, p<.001, and they also rated influenza (M=4.6, S.D.=1.56) as significantly more *disgusting* than a birthmark (M=2.8, S.D.=1.73); t_{97}=8.59, p<.001.

3.2. Prop avoidance

Fig. 1 summarizes the number of cases for each point of contact (e.g., hand, head, face, and mouth) across the three medical conditions (influenza vs. birth mark vs. healthy control). Participants received a score of between 0 (no contact) and 4 (oral contact) for each medical condition on the basis of the highest level of contact they made with each prop. The mean prop contact score was 3.8 (S.D.=0.4) for the healthy condition, 3.6 (S.D.=0.7) for the birthmark condition, and 3.5 (S.D.=0.7) for the influenza condition. A one-way repeated-measures ANOVA on these data with medical condition as the within-factor was significant, $F_{1.86,\ 180.85}$=8.99, p<.0005 (degrees of freedom were corrected using a Greenhouse–Geisser estimate). Planned contrasts on these data revealed that significantly more intimate prop contact (e.g., oral) was made in the healthy condition compared to the birthmark condition, p=.001, and to the influenza condition, p<.0005. However, there was no significant difference between the mean level of prop contact for the birthmark and influenza conditions, p=.48.

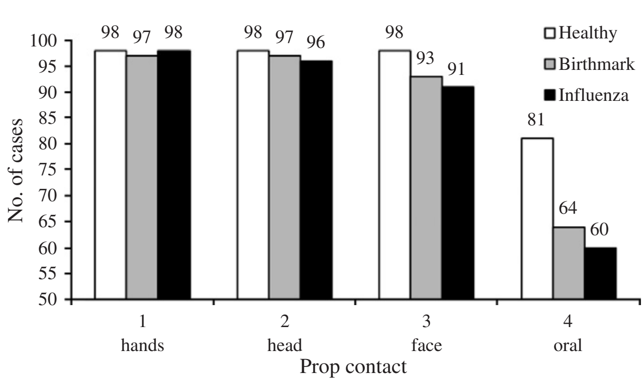

Fig. 1. Frequencies for level of prop contact×medical condition.

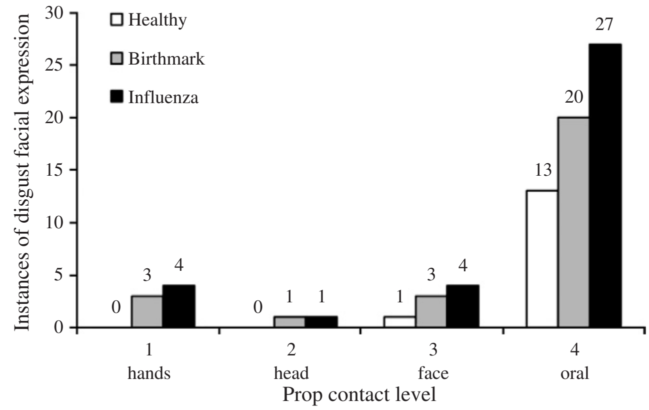

Fig. 2. Instances of disgust facial expressions at each level of prop contact.

3.3. Disgust facial expressions

Fig. 2 summarizes the number of instances of disgust facial displays for each point of contact (e.g., hand, head, face ,and mouth) across the three medical conditions. Participants were scored either 0 (disgust expression absent) or 1 (disgust expression present) for each medical condition across each level of prop contact. These scores were then summed such that participants could have a total score ranging from 0 (no disgust expressions) to 4 (disgust expressions present at each level of contact). The mean disgust facial expression scores were 0.14 (S.D.=0.38) for the healthy condition, 0.28 (S.D.=0.51) for the birthmark condition, and 0.37 (S.D.=0.58) for the influenza condition. A one-way repeated-measures ANOVA on these data with medical condition as the within-factor was significant, $F_{2,\ 194}$=6.03, p=.003. Planned contrasts revealed that significantly more facial expressions of disgust occurred while imitating the influenza condition compared to the healthy control, p=.001, and the birthmark condition compared to the healthy control, p=.032. However, there was no significant difference in the occurrence of disgust facial expressions between the influenza and birthmark conditions, p=.19.

3.4. Disgust-related avoidance

Fig. 3 summarizes the number of instances of disgust behavioral displays for each point of contact (e.g., hand, head, face, and mouth) across the three medical conditions. Participants were scored either 0 (disgust behavior absent) or 1 (disgust behavior present) for each medical condition across the levels of contact level. These scores were then

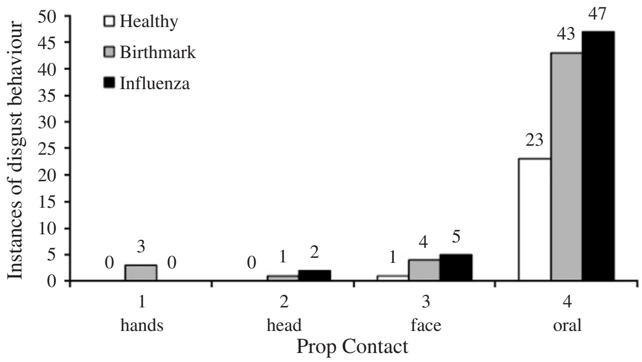

Fig. 3. Instances of disgust-related behavior at each level of prop contact.

summed such that participants could have a total score ranging from 0 (no disgust behavior) to 4 (disgust behaviors present at each level of contact). The mean disgust behavioral display scores were 0.24 (S.D.=0.45) for the healthy condition, 0.52 (S.D.=0.68) for the birthmark condition, and 0.55 (S.D.=0.66) for the influenza condition. A one-way repeated-measures ANOVA on these data with medical condition as the within-subject factor revealed a significant main effect, $F_{2,\ 194}$=10.05, p<.0005. Planned contrasts revealed that significantly more disgust behaviors occurred when imitating the influenza condition versus the healthy control, p<.0005, and the birthmark condition versus the healthy control, p<.0005. There was no significant difference in instances of disgust behaviors between the influenza and birthmark conditions, p=.62.

3.5. Correlations between behavioral measures of avoidance and disgust

Table 1 summarizes the correlations between the three behavioral measures—prop contact, facial expression, and behavioral displays—for each target condition. There was a significant negative relationship between prop contact, facial expression, and behavioral displays in relation to the influenza target, and significant negative correlations between prop contact and behavioral displays for the birthmark target and healthy control. There were also moderate positive correlations between facial expressions and behavioral displays for the birthmark target and healthy control.

Table 1
Correlations between behavioral measures of avoidance and disgust

Behavioral DVs (Prop contact, expression, behavioral display)	Target condition		
	Healthy *r*	Birthmark *r*	Influenza *r*
Prop contact—expression	−0.18	−0.08	−0.25*
Prop contact—behavioral display	−0.82**	−0.88**	−0.86**
Expression—behavioral display	0.33**	0.21*	0.33**

*p<.05; **p<.01.

4. Discussion

This study is the first to test the prediction that facial disfigurement, in the form of a port wine stain, can trigger a disease-avoidance-like response. We predicted that both a birthmark and influenza would generate broadly the same reaction, characterized by facial expressions of disgust and avoidance of contact with items touched by the confederate, and that these effects would be most pronounced when they involved oral contact. Consistent with our prediction, participants demonstrated disgust at the prospect of contacting props touched by the birthmark and influenza confederates, and avoided contact with these props especially when the contact was more intimate (i.e., face, mouth). These reactions to the confederates with influenza and a birthmark would seem to be implicit because, when asked at the end of the study, participants reported influenza as being more *contagious* (M=6.4 vs. 1.3) and more *lethal* (M=3.7 vs. 1.4) than a birthmark. Thus, even though participants knew the birthmark confederates were noncontagious, they responded to them as though they were and in a largely identical manner to the confederate with an infectious disease.

A significant issue in any study is considering limitations and alternate explanations for the observed effects. One potential shortcoming is that the study lacked a comparison target that posed some sort of disease-irrelevant threat—e.g., criminal. People might want to avoid physical contact with someone, not only because of disease concerns, but also because of disease-irrelevant "contamination" concerns or fears (people are reluctant to wear a jumper previously worn by a person with HIV/AIDS; they also do not want to wear a jumper previously worn by a serial killer, Rozin et al., 1992). The identification of such a control is problematic because it must not be confounded with illness or disease, and the relevant information—in our example, criminality—needs to be relayed in the (facial) *appearance* of the confederate, as with our healthy, birthmark, and influenza targets.

In addition, our data showed there was no correlation between prop contact and expression for the birthmark target—while there was for the influenza target—and it might be inferred that disgust did not motivate the reduced prop contact for the birthmark target. We suggest that this is conclusion unlikely, as it is inconsistent with the observed behavioral data; that is, there was no difference at the aggregate level for prop contact, expression, or behavior across the influenza and birthmark targets. A more parsimonious explanation involves social demand. For example, expressed disgust was greater for the influenza and birthmark targets, relative to healthy target, for participants who engaged in prop contact. However, expressed disgust was attenuated for the healthy and birthmark targets, relative to the influenza target, for participants who did not engage in prop contact. It might be then that *contact* provides license to express disgust towards a person with a birthmark or influenza; however, the *prospect of contact* does not and may be limited toward more substantive disease signs (e.g., pale skin, sniffling, coughing, sweaty appearance).

As this study involved deceiving participants as to the intended aim, we examined whether any participant may have identified the true purpose of the study. As noted previously, no participants reported any insight into the study aims. Although we could not find any evidence of such knowledge, it is still plausible that participants may have had some knowledge; if they did, could this account for the observed outcome? This seems unlikely because social demand should significantly attenuate avoidance (e.g., Snyder, Kleck, Strenta, & Mentzer 1979). Therefore, awareness would likely reduce the magnitude of the observed effect. Perhaps more tellingly, the avoidant behaviors evident here, and directed to the birthmark condition, mirror reports of avoidance from people with these and similar conditions (Clarke, 1999; Hill & Kennedy, 2002; Hong et al., 2008; Papadopoulos et al., 2000).

The pattern of disgust and behavioral avoidance observed here is consistent with the disease avoidance account described in the Introduction. The facial birthmark seems to be treated as a disease cue—a false alarm in this case. This can be inferred from the similarity of response to influenza and also by the finding that participants rated the birthmark as less healthy looking than the healthy control. A likely explanation is that the facial birthmark was heuristically perceived as a sign of disease that triggered a disgust and contamination response. Relatedly, there was some degree of avoidance at the prospect of oral prop contact across *all* conditions. This might be because the mouth is a critical portal to disease and, therefore, it would be sensible to exercise caution especially under conditions where one is dealing with strangers whose infection history is unknown.

The anatomical location of the disease sign might also be important as this could influence the extent to which the sign is visible and therefore the magnitude of the elicited disgust and contamination response. The importance of the face as a specialized area of communication (both verbal and nonverbal) is well known (Argyle, 1972). Accordingly, facial abnormalities may attract especially negative responses relative to other forms of bodily distortion (Bernstein, 1976). Indeed, a recent study demonstrated that disfigured faces were more likely to hold attention relative to normal faces (Ackerman et al., 2009). This is not to say that bodily abnormalities may not also act as signs of disease, but these may be more easily concealed, an advantage that is not typically afforded to the face.

To date, while several authors have proposed that some form of disease avoidance system may be operative in humans, and one that may account for the avoidance of individuals with "disease-like" symptoms (Kurzban & Leary, 2001; Oaten et al., 2011; Park et al., 2003), this approach has received little empirical attention. This is the first study to include behavioral measures of disgust and contamination as potential drivers for the avoidance of objects *perceived to be contaminated* by bearers of noninfectious disease signs (e.g., birthmark) versus real disease signs (e.g., influenza). While past studies have demonstrated that people with facial disfigurements are avoided, (Houston & Bull, 1994; Rumsey & Bull, 1986; Rumsey et al., 1982), our data provide evidence that pinpoints specific psychological processes—disgust and contamination responses—that are linked to disease avoidance. In this regard, it is important to link these findings to the broader field of stigma research, and we note here that our conclusion of disgust propelling an implicit avoidant reaction to certain signs closely parallels Pryor and colleagues' dual process model of stigmatization (Pryor, Reeder, & Landau, 1999; Pryor, Reeder, Yeadon, & Hesson-McInnis, 2004). According to this model, avoidance has an initial implicit component—driven by emotions such as disgust and fear—and an explicit cognitive component, which may moderate this initial response. Our findings provide new support for the implicit component of this model.

We also demonstrated that the presence of a facial birthmark appears to motivate avoidance independent of contagion knowledge, suggesting that humans may have an implicit tendency to avoid people who appear sick. This is particularly important because it may suggest that educational programs designed to eradicate avoidance towards individuals with facial or other lesions may have little effect, unless people are able to consciously (and effectively) suppress their implicitly driven motivation to avoid. Indeed, it is interesting to note that people with psoriasis appear to show habituation to disgust faces, arguably because they encounter these reactions to their condition with sufficient frequency for this to occur (Kleyn, McKie, Ross, Montaldi, et al., 2009). This might suggest that attempts to suppress disease avoidant responses (disgust faces) may be difficult, even though there are likely to be significant social demand to do so. Understanding the cause of these types of avoidance, which as we noted in the Introduction have been extensively documented (Clarke, 1999; Hill & Kennedy, 2002; Hong et al., 2008; Papadopoulos et al., 2000), is an essential first step in mitigating their impact on people with these types of conditions. Needless to say, while we only studied one type of facial lesion here, it is possible that our results may not generalize and that the birthmark may be something special. However, as the psoriasis findings suggest, disgust reactions may be common, and there clearly is a need to determine whether the disease avoidance account can be extended to other similar conditions.

In conclusion, this manuscript presents evidence that people with visible facial birthmarks tend to evoke disgust and contamination concerns in a similar manner to those who actually harbor infection—such as influenza. This effect was strongest under conditions involving intimate contact. These results suggest that disgust and contamination play a role in driving the behavioral avoidance associated with the presence of facial birthmarks and that these reactions arise because this type of facial lesion is treated as a disease sign—a false alarm.

Supplementary Materials

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.evolhumbehav.2012.04.001.

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