Emotion

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What Emotion Does the "Facial Expression of Disgust" Express?

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The emotion attributed to the prototypical "facial expression of disgust" (a nose scrunch) depended on what facial expressions preceded it. In two studies, the majority of 120 children (5–14 years) and 135 adults (16–58 years) judged the nose scrunch as expressing disgust when the preceding set included an anger scowl, but as angry when the anger scowl was omitted. An even greater proportion of observers judged the nose scrunch as angry when the preceding set also included a facial expression of someone about to be sick. The emotion attributed to the nose scrunch therefore varies with experimental context.

Keywords: facial expressions, disgust, emotion recognition, context effect

What emotion does the "facial expression of disgust" express to observers? Disgust, obviously—or so say many articles in psychology. We say, not so fast.

The "facial expression of disgust" included in various standardized sets of emotional facial expressions is illustrated in Figure 1. As specified by Ekman, Friesen, and Hager (2002, Table 10-1), this expression consists of either or both of two action units: Action Unit (AU) 9, which wrinkles the top part of the nose, and AU 10, which raises the upper lip and thereby wrinkles the lower part of the nose. To provide a name more neutral than "facial expression of disgust," we call it the "nose scrunch." In many studies, observers were shown the nose scrunch and asked what emotion it expresses. Most observers selected *disgusted;* the median percentage in 20 samples from Western cultures was 82.6 (Russell, 1994). (The second most common choice was *angry*.) This near consensus is a key part of the evidence offered as support for the theory that certain facial expressions of specific discrete emotions are easily recognized by observers regardless of their age, sex, culture, language, or circumstance. On this theory, recognizing facial expressions of emotion is part of human nature. Near-consensus on the nose scrunch has been a cornerstone in modern theories of disgust (Rozin, Haidt, & McCauley, 2008). In this article, we do not consider other aspects of disgust, but focus exclusively on the claim that observers recognize disgust from the nose scrunch.

Rozin et al. (2008) outlined the importance of the emotion of disgust, including its hypothesized status as a basic human emotion and hence as a building block of other emotions; its role in avoidance of poisons, infections, and contaminants including social contaminants; its relation to psychiatric disorders, especially phobias and anxiety disorders; its diagnostic role in neurological disorders such as Huntington's disease; its role in determining which foods and other objects are sought and which avoided; and, increasingly, its role in moral decisions and actions.

In research on disgust, recognition of disgust from the nose scrunch has played a key role. It has been used to study (a) the universality of the recognition of emotion from facial expressions (e.g., Ekman, 1994; Izard, 1994; Russell, 1994); (b) the neural circuitry underlying disgust (e.g., Calder, Keane, Manes, Antoun, & Young, 2000); (c) children's understanding of emotion (e.g., Gagnon, Gosselin, Hudon-ven der Buhs, Laroque, Milliard, 2010); (d) the role of emotion recognition in children's cognitive and linguistic development (e.g., Blair, 2002), their health (e.g., Rieffe, Meerum Terwogt, & Jellesma, 2008), and their later school-readiness (e.g., Garner & Waajid, 2008); and (e) the link of disgust to psychopathology (e.g., Cisler, Olatunji, Lohr, 2009). The logic of these studies requires the assumption that people, including adults, children, and even toddlers, interpret the nose scrunch as disgust specifically.

Here we offer evidence that this simple, replicable, theoretically intelligible, commonsensical, and highly cited finding regarding recognition of disgust from the nose scrunch may depend on the method used to gather the data. In that method, the observer typically sees a set of (still photographs of) facial expressions, all of which are purported to be easily recognized signals of specific so-called basic emotions. Be that as it may, each is an intense and prototypical facial expression. The observer is also given a short list of emotion labels and asked to select the one that fits best. According to the theory behind this type of study, the list of emotion labels corresponds one-to-one to the list of emotions conveyed by the faces shown. Thus, the number of emotion labels equals the number of types of facial expression.

Consider an alternative perspective. Suppose that the nose scrunch does indeed convey some emotional information, but not the emotion of disgust specifically. The nose scrunch is a puzzle, and the observer actively tries to solve the puzzle with what information is available. In the study method just described, the list

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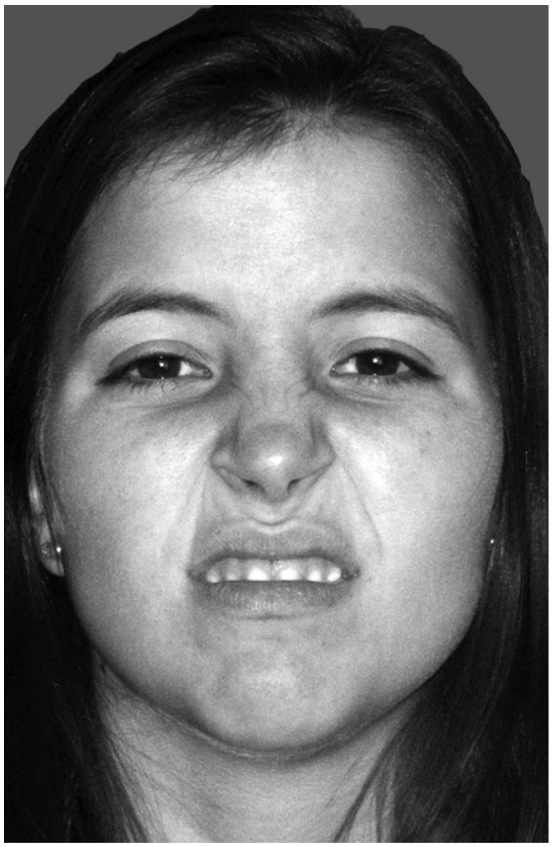

Figure 1. An example of the prototypical nose scrunch. The nose scrunch with both Action Units (AU) 9 (wrinkling of the upper nose) and 10 (raising of the upper lip and wrinkling lower nose) (Ekman, Friesen, & Hager, 2002). In the nose scrunch, other action units occasionally appear, but are considered neither necessary nor sufficient to diagnose disgust. The photograph shown here was not shown to participants in the research reported in this article.

of emotion response options is one clue to help solve the puzzle by providing a short list of the emotions that the experimenter expects as an answer. The equal number of expression types and labels is another clue: Each different type of facial configuration will likely have a different emotion label. When the observer sees the "facial expression of anger" —an intense scowl in which the expresser is sometimes bearing her teeth—the observer assigns that face the *angry* label. The big smile is assigned the *happy* label; the about-to cry-face is assigned the *sad* label. What of the nose scrunch? The person with a scrunched nose looks unhappy, perhaps disapproving or even angry, but the label *angry* is already taken by the angry scowl. The label *disgusted* remains and the nose scrunch remains. Someone scrunching the nose could be smelling something foul, and that something could be disgusting. *Disgusted* is a reasonable fit to the nose scrunch, and so the observer assigns the nose scrunch to the *disgusted* label.

Imagine this same scenario but with the angry scowl omitted. The observer does not eliminate the *angry* label before seeing the nose scrunch. *Angry* and *disgusted* remain as possible labels. The person with a scrunched nose looks disapproving, and so some observers assign the nose scrunch the *angry* label.

Finally, imagine this last scenario again, but, this time, an additional face is included in the preceding set: someone who appears about to vomit. This picture is easily assigned to the *disgusted* label. So, in this case, the process of elimination lowers the chances that the *disgusted* label will be assigned to the nose scrunch. Once the various faces are assigned, what remain are the nose scrunch and the *angry* label.

These scenarios assume that the emotion seen in the nose scrunch varies predictably with the prior faces seen in the study. That is, that the nose scrunch does not come preinterpreted (Fridlund, 1994), but is interpreted each time it is seen, in a way influenced by the preceding faces. In contrast, the theory of basic emotions leads to a different prediction because it assumes that the nose scrunch is a universal emotion signal easily recognized as disgust whatever the circumstances. Guided by the theory of basic emotions, much research on disgust therefore presupposes that the method used reveals rather than helps create the observers' interpretation of the nose scrunch. That method was much used in the past and continues to be used (e.g., Jack, Blais, Scheepers, Schyns, & Caldara, 2009).

Study 1

Children (5–14 years) chose an emotion label for the nose scrunch. They selected one emotion label from a set of seven, much as in prior studies on facial expressions. Before encountering the nose scrunch, the child saw and labeled three or four other prototypical facial expressions. Children were randomly assigned to one of three Anchor Face conditions: Anger Scowl Anchor, Anger Scowl Omitted, Sick Face Anchor. In addition, children were randomly assigned to either the Multiple Posers Condition (each face posed by a different woman) or the Same Poser Condition (all posed by the same woman). The exemplar of the nose scrunch was different in these two conditions.

Method

Participants. Participants were 120 children (54 males) between the ages of 5 and 14 years. The sample was 37% Caucasian, 8% Asian, 2% African American, and 1% Pacific Islander; the remainder did not report ethnicity.

Materials. Eleven different facial expressions posed by adult women were used. For the Multiple Posers Condition, five photographs from the Pictures of Facial Affect (Ekman & Friesen, 1976) showed prototypical facial expressions (happiness smile, MF1-6; anger scowl, SE4-9; fear gasp, PF2-30; surprise startle, JM1-16; disgust nose scrunch, NR2-7); each expression was posed by a different woman. The Facial Action Coding score for the nose scrunch NR2-7 was AUs 4 + 7 + 9 + 25 (furrowed brow, raised lower lid, nose wrinkle, lips parted); this score met the criteria set by Ekman et al. (2002, Table 10-1) to be classified as signals of disgust.

For the Same Poser Condition, the five photographs were prepared by our lab and all posed by the same woman—a professional actress; these poses were modeled on the Pictures of Facial Affect and matched the criteria specified by Ekman et al. (2002, Table 10-1). The Facial Action Coding score for this exemplar of the nose scrunch was AUs 7 + 9 + 18 + 23 (raised lower lid, nose wrinkle, raised upper lip, compressed lips); this score met the criteria set by Ekman et al. (2002, Table 10-1) to be classified as a signal of disgust.

The same professional actress posed one additional expression that was used in the Sick-Face Anchor condition for both Poser conditions: a new facial expression called the "sick face" in which the model was asked to look sick, as if she were about to vomit: AUs 6 + 10 + 25 (raised upper lip, raised cheeks, lips parted).

Procedure. The participant saw four or five faces, one at a time, and rated each face before seeing the next. The order of the faces was same for all children: happiness smile, surprise startle, fear gasp, Anchor Face, nose scrunch—where "Anchor Face" was replaced by an anger scowl, no face, or the sick face.

The child was told, "You will see several different faces. Please circle the one best word that describes the emotion of the person in the picture." The list was: *angry, disgusted, embarrassed, happy, sad, scared, surprised*. For the younger children, the list of words was read to them and help offered if they hesitated. The list was the same for each face judged.

Results

Neither sex nor age of participant yielded significant main or interaction effects and were omitted from subsequent analyses.

Children's choice of emotion for the nose scrunch depended on the Anchor Face condition, as illustrated in Figure 2 (A). When the anger scowl had been seen, the children were most likely to select *disgusted* for the nose scrunch. When the anger scowl had been omitted, the children were most likely to select *angry*. When the anger scowl had been omitted and a sick face had been seen, this last effect was exaggerated with even more children selecting *angry*. That these effects were reliable is shown by a comparison of children's responses (*angry, disgusted*) in the three conditions, χ^2 (df = 2) = 28.15, $p < .001$.[1] The conditions also differed reliably in pairwise comparisons: The number of children who labeled the nose scrunch as *disgusted* was significantly greater in the Anger Scowl Anchor condition than in the Anger Scowl Omitted condition, $\chi^2(df = 1) = 13.31$, $p < .001$, and in the Sick Face Anchor condition, $\chi^2(df = 1) = 24.77$, $p < .001$. The Anger Scowl Omitted and Sick Face Anchor conditions differed marginally, $\chi^2(df = 1) = 2.77$, $p = .09$.

The effect of Anchor Face replicated in each of the Poser conditions: Multiple Posers: $\chi^2(df = 2) = 15.73$, $p < .001$; Single Poser: $\chi^2(df = 2) = 14.74$, $p < .001$.

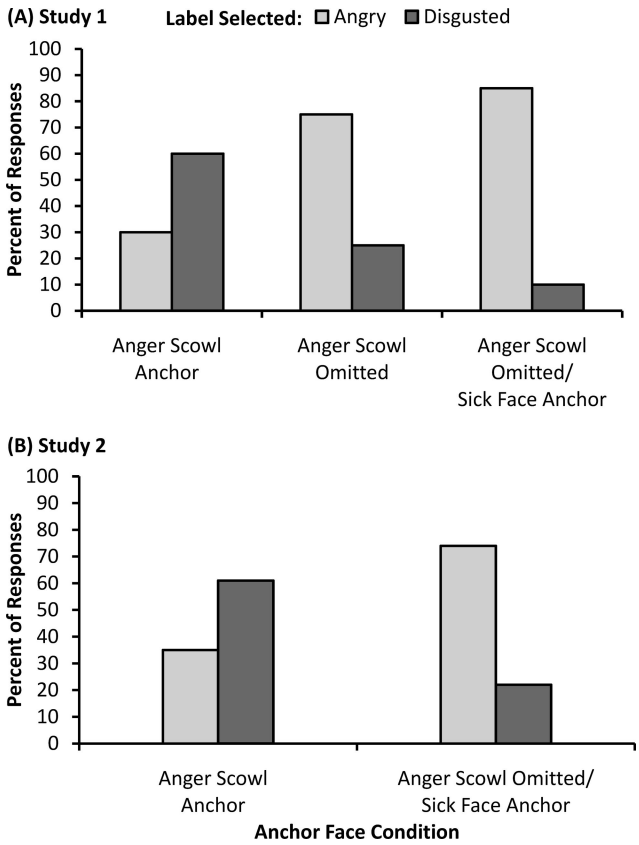

Figure 2. (A) Percentage of children in Study 1 and (B) adults in Study 2 who chose the labels *angry* or *disgusted* for the nose scrunch when the nose scrunch was preceded by an anger scowl, when the anger scowl was omitted (a condition not included in Study 2), and when the anger scowl was replaced by the sick face.

Study 2

Study 1 was part of a larger project on children, but it left open the question of whether the observed effects of anchor faces occurred with adult observers. Answering this question was the principal purpose of Study 2. A second purpose was to examine whether the effect of the anchor face observed depended on the anchor face immediately preceding the nose scrunch as it had in Study 1. Thus, in Study 2, adults chose an emotion label for the nose scrunch when the anchor face immediately preceded the nose scrunch or when two other faces were interposed. The Anger Scowl Omitted condition was not included. Thus, the anchor face was either the anger scowl or the sick face.

Method

The method was identical to that of Study 1 except as noted.

Participants. Participants were 135 adults recruited on the Boston College campus (75 males; M_{age} = 22.5) between the ages of 16 and 58 years. The sample was 50.4% Caucasian, 8.9% African American, 8.9% Hispanic, 8.1% Asian, 4.4% "Other", and 1.5% Native American; the remainder did not report ethnicity.

Procedure. For 74 of the participants, the anchor face was presented in the second position (happiness smile, Anchor Face, surprise startle, fear gasp, nose scrunch). For the other 61 participants, the anchor face was in the fourth position, immediately before the nose scrunch (happiness smile, surprise startle, fear gasp, Anchor Face, nose scrunch). The Anger Scowl Omitted condition was not included in Study 2.

Results

Sex of participant did not yield significant main or interaction effects and was omitted from subsequent analyses.

[1] When the χ^2s were repeated with three types of responses (disgusted, angry, other), they were also significant, but these analyses violated the assumptions of χ^2 because more than 20% of the cells in the table had frequencies of less than 5.

Choice of emotion for the nose scrunch depended on the Anchor Face condition, as illustrated in Figure 2(B). When the anger scowl had been seen, the participants were most likely to select disgusted for the nose scrunch. When the anger scowl had been omitted and a sick face had been seen, participants were most likely to select *angry*. That these effects were reliable is shown by a comparison of responses (*angry, disgusted*) in the two conditions, $\chi^2(df = 1) = 21.32$, $p < .001$. The number of participants who labeled the nose scrunch as *disgusted* was significantly greater in the Anger Scowl Anchor condition than in the Sick Face Anchor condition, $\chi^2(df = 1) = 11.36$, $p < .001$.

The effect of Anchor Face replicated in each of the Poser conditions: Multiple Posers: $\chi^2(df = 2) = 15.73$, $p < .001$; Single Poser: $\chi^2(df = 2) = 14.74$, $p < .001$.

The effect of Anchor Face replicated in each of the Anchor Position conditions: Anchor in 2nd position: $\chi^2(df = 1) = 17.17$, $p < .001$; Anchor in 4th position: $\chi^2(df = 1) = 5.59$, $p < .05$.

General Discussion and Conclusion

When the Anchor Face was an anger scowl, the majority of observers saw disgust in the nose scrunch. This result replicates the oft-repeated finding that observers see disgust in the nose scrunch. But that finding depends on the oft-repeated method with a little-noted feature: Typically, the nose scrunches are seen after other faces including some anger scowls. When, in the present study, the set of preceding faces did not include an anger scowl, the majority of observers saw the nose scrunch as angry. We know of no prior judgment studies of the nose scrunch that systematically excluded the anger scowl, but the results in the current study were large and reliable. This effect replicated across sex, age, position of the anchor face, whether posers were the same or different individuals, and exemplars of the nose scrunch.

In the Anger Scowl Omitted (Study 1) and Sick Face Anchor (Studies 1 and 2) conditions, the proportion of participants who selected *angry* for the nose scrunch would ordinarily be used to justify concluding that the nose scrunch expresses anger. We do not interpret our results as showing that the nose scrunch really expresses anger, but, by the same logic, neither can the results of the Anger Scowl Anchor condition be interpreted as showing that the nose scrunch really expresses disgust. It follows then that prior data from the many studies showing a highly reliable selection of *disgusted* for the nose scrunch cannot rightly be interpreted as showing that the nose scrunch really expresses disgust to observers (see also Pochedly, Pieloch, Widen, & Russell, 2012; Widen & Russell, 2012).

A counterargument might be offered that showing a large number of prior facial expressions in various random orders would lessen the effect demonstrated here, and therefore the prior evidence, which sometimes did indeed use a large number of prior faces in various random orders, can be interpreted as showing that the nose scrunch does indeed express disgust to the observer. This question is resolvable only through empirical means, but we doubt that this solution can suffice. First, Study 2 showed that whether the anchor face proceeded immediately or not was not important, but that what faces are included in the prior set was important. When multiple exemplars of each type of facial expression are shown in various random orders, relatively few cases will present the nose scrunch before any anger scowl. Thus, most trials will likely resemble our Anger Anchor Face condition rather than our Anger Face Omitted condition. Second, it is unclear in principle just which expressions must be included and which excluded in the prior set. Typically, only prototypical expressions of so-called basic emotions are included, but in the nonlaboratory world, there are many less prototypical ones. In no prior study has our sick face been included, and Figure 2 shows that including it influenced the emotion seen in the nose scrunch. What other faces need to be included in the prior set? The strategy of different random orders of many prior expressions obscures rather than reveals the process whereby an observer interprets a facial expression.

The two studies reported here are subject to limitations. The method used was one commonly found in the study of recognition of emotion from facial expressions, but, of course, other methods could conceivably yield different results. For example, Nabi (2002) found that the words *disgust* and *anger* overlap in appraisal patterns in the folk use of these words. She suggested that what researchers mean by disgust might be better captured by the phrase *grossed out*. Our hypothesis is that the perception that a person with a scrunched nose is grossed out will vary with what prior faces are seen, but this hypothesis remains to be tested.

The scenarios imagined in the introduction flowed from an account on the perception of emotion from facial expression called a dimensional-contextual perspective (Russell, 1997). The present data did not validate that perspective, but were consistent with it. Present data were also consistent with—indeed, extend—previous research in which the emotion seen in one face depends on other faces seen (Russell & Fehr, 1987; Thayer, 1980). Results from this study also resonate with studies on context effects (Aviezer et al., 2008; Carroll & Russell, 1996): The emotion judged from a face depends on what other information the observer has about the expresser. (The present finding might thus be termed a "context effect," but the context is the methodological context to which the observer is subjected rather than the expresser's context. The latter is a legitimate source of information about the expresser's emotion, whereas methodological context is not.)

In short, the set of preceding faces powerfully influences the emotion that an observer perceives to be expressed by the nose scrunch. Could the set of preceding faces shift the perception of the nose scrunch to any emotion at will? We doubt it. In Study 1, 95% of responses to the nose scrunch were either disgust or anger; in Study 2, 96%. We cannot think of a set of prior faces that would make the nose scrunch look happy. Does the set of prior faces influence observers' judgments of other facial expressions? Most studies of other facial expressions rely on extreme versions of facial expressions posed with the purpose of conveying a single emotion. Such expressions are least likely to be influenced by prior faces, although one study did find the prototypical posed "surprise face" was judged differently after different prior faces (Russell & Fehr, 1987). In this article, we used phrases such as *the anger scowl* for the reader's convenience, but it remains to be seen if the emotion conveyed by that expression depends on the set of preceding faces. Spontaneous expressions, on the other hand, yield much less agreement from observers on the emotion implied (Naab & Russell, 2007). We anticipate that method would more easily influence judgments of spontaneous expressions (although, again, within limitations).

There are many other aspects of theories of discrete emotions not addressed here. Our study specifically addressed the emotion

that observers judge from the nose scrunch and did not address what facial expressions are produced by the emotion of disgust. Ours was a study of decoding rather than encoding. Indeed, theories of discrete emotion and facial expressions can likely be made to accommodate the present findings. For example, one approach would be to follow Rozin's lead in distinguishing different versions of the "disgust face" and examining the emotion perceived in each of them separately by observers (Rozin, Lowery, & Ebert, 1994). (Our work on the sick face is in line with this suggestion.) For example, AU 4 (furrowed brow) is one of the action units listed for anger by Ekman et al. (2002, Table 10-1). AU 4 is also listed as a possible action unit seen on the nose scrunch, although it is neither necessary nor sufficient. One of the two nose scrunches we showed participants in the studies reported here showed an AU 4, the other did not. Both showed the effect of prior faces. Perhaps nose scrunches without an AU 4 are less likely to be perceived as expressing anger, although the emotion perceived might still be relative to prior faces. If this approach is taken, dynamic rather than still faces would also be something to investigate.

Another (not incompatible) approach stems from the similarity that Izard (1977) noted among anger, disgust, and contempt, which together he referred to as a hostility triad. One might speculate that what the nose scrunch conveys is the hostility triad. If so, the hypothesis resonates with the analysis of Woodworth and Schlosberg (1954) that each facial expression conveys a range of emotions.

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