HCD research®

FACIAL CODING

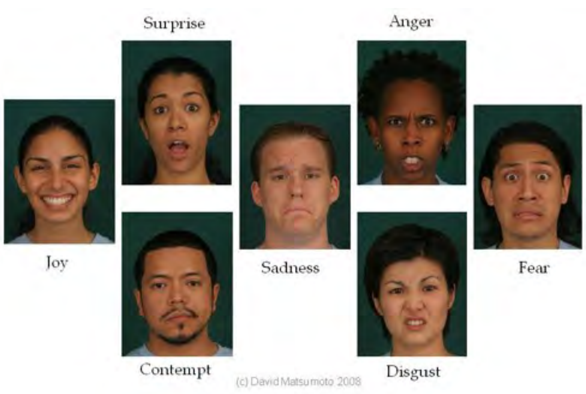
Facial Coding is a process used in research to collect and categorize emotional reactions via facial expressions.

The Basics

The face can provide a lot of information, both verbally and nonverbally, about how humans interact with the world. Facial coding is one of the most well-known methods for collecting data about emotions. The face contains 43 muscles that are mostly controlled by the facial nerve. The muscles in the face can create facial expressions, which are often a part of how we communicate. People of different ages, cultures, and languages use facial expressions to convey information. Expressions are an integral part of how we interact as humans. Questions about feelings and emotions have fueled several discussions, motivating researchers of multiple fields to advance methods of emotion detection.

A lot of literature has been dedicated to debating the connection between facial expressions and emotions. Due to ambiguity surrounding the topic, it has sparked both speculation and debate about how to define emotions. Evolution, categorization, dimensions and constructs of emotion have inspired several types of diverse theories trying to explain it. One of the most well-known attempts at organizing the vast concept of emotions involved research conducted by Paul Ekman and Wallace Friesen. During their research, Ekman categorized seven universal emotions: joy, anger, surprise, fear, contempt, sadness and disgust. These facial expressions are used in the foundational bases of the Facial Action Coding System (FACS) used in most facial coding software. Facial landmarks, such as mouth, eyebrows, and the tip of the nose, are regions of the face that are utilized to better detect the expressions.

Figure 1



The seven basic emotions: Joy, Surprise, Contempt, Sadness, Anger, Disgust, and Fear.

Each of the seven expressions has anatomic features of action units that are used to infer information about the facial expression (Ekman, 1992). Action units are associated with certain muscles or muscle groups that are termed with certain numbers (Ko, 2018). For example, the frontalis, pars medialis muscle, which is the muscle that raises the inner brow, is AU1. Algorithms embedded in the software make it possible to detect muscle movement, and thus, infer an emotional expression is being displayed. Each of the facial action units is intended to provide information about how to decipher between microexpressions, macroexpressions, and subtle expressions. Macroexpressions are impressions that can be notable in daily life. The duration of macroexpressions range between 0.5-5 seconds long, unlike microexpressions which are less than 0.5 seconds long and are more challenging to detect. The third type of expression associated with facial coding is known as subtle expressions, which are better known for the intensity of the emotion rather than the time. Subtle expressions usually have a low intensity and occur at the onset of an emotion. Timing can have a huge impact on facial expressions. Research in Holland focused on the different timing of facial expression responses to sensory stimuli. This research works to contribute to the growing literature analyzing perceived satisfaction from eating. The research conducted has a multimodal approach by including biometric features such as skin conductance, heart rate and skin temperature in conjunction with facial expression analysis. According to their findings, sad and angry facial expressions impact the sensory-specific satiety, aka the consumer's satisfaction or fullness (He, Boesveldt, Delplanque, de Graaf, & De Wijk, 2017). The timing of facial expressions is challenging to account for since it is rapidly changing. It is impossible to know what is causing the facial expressions to change (aside from just asking the participant). This vagueness leaves a lot of room for assumptions and not a lot of space for very conclusive results. Pairing facial expression analysis with additional measures helps to bridge the gap of uncertainty.

A Few Theories of Emotions

Ekman and Friesen were not the first, nor the most recent, theorists of emotion. The complexity of emotions is a part of why there is such a massive number of theories attempting to explain it. Dating back to the 1800s, Charles Darwin hypothesized that feelings and emotions were intertwined with survival. Darwin also believed that the ability to sympathize and empathize with other beings (both human and animal) was another survival trait that evolved over time. The rationale included the idea that by interacting with other creatures, for example, reacting to sounds such as hissing or spitting, was a way to avoid danger (Barrett, 2011). Following Darwin's idea that emotions are responses to events, William James and Carl Lange developed a theory that external stimuli caused physiological reactions to be interpreted, resulting in an emotion (Thanapattheerakul, Mao, Amoranto, & Chan, 2018). For example, if you hear growling and see a bobcat on a hike, your heart may begin to race and your palms might become sweaty, which aligns with the experience of feeling fear. Supporters of Ekman, Friesen, Darwin, James, and Lange also have subscribed to the suggestion that facial expressions can have a direct effect on an emotional experience. According to what is known as the Facial Feedback Hypothesis, if you smile, then you will feel happier as compared to if you frown or have a neutral face. Although Facial Feedback Hypothesis is well known, putting it into practice in real-life can lead to odd social situations (i.e. smiling at a sad news segment). Proceed attempting the Facial Feedback Hypothesis with caution.

Not all people agreed with the notion that emotions are caused by physiological responses. Walter Cannon and Philip Bard critiqued the James-Lange theory by noting that a physiological reaction doe not just occur for one sole reason (Thanapattheerakul et al., 2018). For example, doing cardio can raise your heartrate just as much as being in the presence of a bobcat. Cannon and Bard also noted that you can experience an emotion prior to having a bodily reaction. The brain receives a message from the thalamus to trigger a physiological response, while simultaneously getting a signal to trigger an emotional response according to the Cannon-Bard theory.

Another model, known as Cognitive Appraisal Theory, has a different timeline for the sequence of events involved in feeling emotions. This concept, attributed to Richard Lazarus, claims that an emotion is the result of a thought about the stimulus. If you encounter a bobcat, your brain has a thought that you are in danger. The thought causes the sense of fear, as well as a flight-or-fight physical response (Thanapattheerakul et al., 2018). More recently, Lisa Barrett proposed the Theory of Constructed Emotions. This new theory has stirred the pot due to two of its claims: emotions are not universal and emotion circuits do not exist (Siegel et al., 2018). Barrett's research suggests that the brain can anticipate how to construct an emotion based on past experiences. The brain adapts by making predictions to make sense of an experience. Therefore, we are culturally primed to react emotionally in certain ways (Siegel et al., 2018). Barrett makes the argument that we interpret our physiological experiences (such as a churning stomach) and our surroundings together to result in our emotional responses. The example Barrett uses involves walking into a bakery anticipating the smell of fresh cookies. Your stomach may turn preparing to digest some goodies. The physiological response of the stomach churning influences the brain to trigger the notion of hunger. That same churning stomach can be experienced in a hospital while waiting for test results, where the brain establishes a sense of worry or anxiety. Those emotions can lead you to react in a variety of ways, from taking deep breaths to crying. Hence, the emotion is a subjective based interpretation of a physical context (Siegel et al., 2018). The notion that we have control based on our predictions within emotional intelligence is an innovative concept that is both encouraging and thought-provoking. The Theory of Constructed Emotions challenges the established "basic emotions" set forth by Ekman and Friesen. Barrett's work reminds researchers to remain objective when developing theories that attempt to categorize emotions.

Scary Spinoffs

Facial coding is advertised as a nonintrusive method that objectively observes how to interpret emotional expressions via data processing through a webcam, tablet, laptop, phone, or GoPro. From a global level, facial coding can provide valuable insight. However, facial coding is not able to determine if a valence is genuine or posed. If you critically think about the logic behind utilizing a tool that heavily relies on validity via expressions, it is easy to recognize that the camera can be fooled. Actors do it every day.

Being openminded to novel concepts is important during research and development. However, there is a difference between being malleable versus manipulative during a learning process. Ekman's theory has inspired a lot of buzz in the media to detect emotions. Some companies have taken the initiative to extrapolate scientific theories to meet the needs of their market. To appease the wants of the clients, companies create compound emotions inspired by psychological research (Ko, 2018). Unfortunately for Ekman, the top seven emotions are not always the most useful for sales. Companies often seek out very specific words or ideas that simply cannot be determined by just a face. Rather than explain the loopholes of facial coding, companies monetize emotional analysis by claiming their gadgets can determine how a person feels. The truth is that there is no way to determine with just a face if you are confused, scared, lying, in love, etc. Reading anything that remotely suggests "47% of your face is experiencing satisfaction," should raise some questions. Scientists are consistently trying to explore how the body works. Getting a blanket statement without explanation is fishy. The subjective concepts that clients want to target often stray from the objectives of facial coding. It is both unethical and misleading to promote a business or product can conjure a certain emotion.

Facial coding relies on positive and negative valences to interpret the facial response. There is no defined method to suggest that anything beyond positive or negative equates to certain emotions. Ekman's theory revolves around the major bias associated with the seven emotions for valence. It is important to note that most of the emotions are negative, apart from "joy." This imbalance in positive and negative valences raises questions about the accuracy in how emotions are calculated using this measure. It is also extremely daunting to try and categorize expressions since an emotion can be presented differently from face to face. As previously noted, emotions are strongly influenced by social norms and cultural differences. Ekman's seven basic emotions may not be your most commonly expressed emotions. That is why it is crucial to be skeptical of companies that subscribe dutifully to Ekman's model. To make some extra cash, companies are selling fallacies that (1) do not work and (2) tarnish any just research within the field. Beware of companies that have a magic black box methodology. Metrics such as valence or intensity should be calculated and readily available to better understand the study. Spinoffs have repercussions for not only consumer neuroscience, but also the overall scientific community.

Other concerns: QUALITY OVER QUANTITY

Facial coding has a few other hesitations that could influence the output if not handled correctly. Firstly, a huge selling point of facial coding is that it can be conducted anywhere because there just needs to be video equipment. Participants all over the world can partake in the same study and in naturalistic environments (let's say, a house, car, workplace, store, etc.). Technically, yes; however, a lot of flaws can arise from giving so much responsibility to the participant. Each environment has different variables that can influence the quality of the recording. It is easy to miss essential information if facial coding is not measured well. While facial coding can be conducted in any environment, components such as lighting, movement and camera angle determine the reliability of the recording.

Let's break down a few factors that have huge implications on any facial coding study. Lighting is a very important feature to assure success in facial coding, because the participant's face needs to be illuminated for the camera to pick up the facial expressions (Fasel & Luettin, 2003). Shadows or reflections can lead to inaccurate data collection. Ambient lighting should always be used over natural lighting. It is challenging to assure that each participant receives the same quality of lighting when a study is conducted in various rooms around the globe. Rooms also receive different amounts of lighting based on the number of windows and time of day. Ideally, participants are in a windowless room with strong general lighting when recording a facial coding experiment.

Another challenging feature to control in a satellite data collection is distance from the camera and camera angle (Fasel & Luettin, 2003). The face should be front and center in the frame to provide the best analysis. The distance between the camera and the participant should be consistent among all those partaking in the study. When using satellite locations, one can only assume that these rules are being followed.

Movement artifacts can really impact facial coding's ability to accurately record the participant. A stationary chair should be mandatory; however, the angle of the camera is hard to regulate unless the study is conducted in person. Similarly, participants should avoid talking, chewing, eating, and drinking during the facial analysis because it can influence the facial expressions and increase the opportunity for false recordings (Kring & Sloan, 1991).

With remote facial coding studies, there is no way to ensure that the participant is alone in a quiet room. Outside noises can influence how a participant responds to a stimulus since the room is not secluded. Conducting research in-house ensures certain variables remain consistent among all the participants, and if it doesn't, there is a much greater chance of the difference being noted and analyzed for further details. Facial emotions are easily influenced by outside factors, especially when in an abnormal situation such as being recorded for a study. The possibility of a car horn, dog bark, or a baby crying can trigger certain muscular reactions. Now, consider the possibility of having an additional distraction in the same room as the testing area. Having the additional presence of a pet or a child can severely change the outcome of the participant's expressions especially since the stimulus is no longer isolated. The facial expression can be influenced by the reaction to another distraction. Similarly, faces are reflective of whatever experience is being presented. If an advertisement has a lot of smiling faces, it is likely that the participant will smile as well. The response does not imply that the person is experiencing joy; it just means that the face is mimicking what is being viewed.

Some of the more obvious concerns include being able to visibly see the face. Glasses, bangs, heavy make-up, beards and facial jewelry are just some of the most common interferences when trying to display the face (Kring & Sloan, 1991). Because there are so many inconsistencies involved in facial coding, there is an extremely high rate of participants that need to be excluded from the final analysis. Dropout or throw-out rates are so high because of the combination of movement artifact, environmental discrepancies, and general lack of control. Researchers must be aware of these setbacks when running participants and take preventative measures to avoid potential issues. Facial coding studies are most beneficial when conducted in-house with a researcher overseeing the stimulus being presented.

A note about a more challenging facial coding measurement to avoid involves false positives during recordings. During a portion of any facial coding study, participants are instructed to keep his or her face neutral as a baseline measure. During this neutral baseline, there is no stimulus. A blank, neutral look can be misread, and the facial coding system will indicate that an emotion is present. This is something that the researcher should be aware of and use proper judgement when noting if an obvious inaccurate interpretation of a participant's face occurs. Being well-trained in determining the difference between a microexpression and a mistake is very important during this type of research. Oversight can lead to inaccurate data, and thus, muddy the outcome of the findings. If this is to occur, the researcher should correct the data to generate results relative to the specific participant's expressions rather than the overall database. The baseline will then become the neutral expression, allowing the findings to reflect any important changes (Fasel & Luettin, 2003). HCD Research strives to articulate the importance of strong administration of a study in order to collect data that can be useful in creating telling findings.

Takeaways

Facial coding, just like any type of validated research methodology, has advantages and disadvantages. By determining emotional information based on valences, facial coding can be useful in providing a global perspective of emotions when presented a stimulus. When a target population is a bit more challenging to record physiological data, such as infants or children, facial coding is a great alternative to remain noninvasive while still being able to observe changes over time. The valuable information provided by facial recognition can provide a stronger comprehensive picture when paired with other biometric sensors, depending on the type of research in question. Additional features, such as galvanic skin response to analyze emotional arousal or implicit testing to uncover associations, can help give a stronger overall understanding of how the participant interacts with the stimulus.

Having a strong combination of research features for a particular question is crucial when trying to conduct strong research. At HCD Research, we believe in providing strong research rooted in scientifically valid methodologies. The goal is always to utilize the right tools for the right question.

IF YOU ARE INTERESTED IN LEARNING MORE ABOUT FACIAL CODING OR OTHER TYPES OF CONSUMER NEUROSCIENCE METHODOLOGIES THAT MAY BE USEFUL FOR YOUR RESEARCH, PLEASE FEEL FREE TO CONTACT INFO@HCDI.NET OR CALL 908.788.9393.

CITATIONS

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