Micro-expressions: A Study of Basic Reading and The Influencing Factors on Production and Recognition

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Abstract. In response to nonverbal communication in psychology, micro-expression research has gained widespread attention as a relatively new but growing field. As technology advances, researchers have developed computer-based tools and software to assist in analyzing micro-expressions. These tools use facial recognition and machine learning algorithms to more accurately detect and categorize micro-expressions. This article introduces the definition and basic types of micro-expressions by integrating related literature and further analyzes the four influencing factors including gender, cultural differences, occurrence background, and psychological states on the production and recognition of micro-expressions. Due to the limited research so far, we will establish the connection with micro-expressions with the help of facial expressions or emotions. Furthermore, three perspectives on micro-expression recognition are presented, including social safety, clinical therapy, and teaching efficiency, to illustrate the application of micro-expression recognition in current life. Finally, we suggest directions for future research on micro-expressions on interdisciplinary cooperation with other fields like brain science and so on.

Keywords: Micro-expressions, Emotions, Production, Recognition, Application.

1. Introduction

Micro-expressions play an important role in life as an effective basis for judging people's true feelings, especially in the social field. Moreover, micro-expressions are intuitive expressions reflecting emotions thus understanding the connotation of micro-expressions is more conducive to analyzing the relationship with various factors such as emotions. The use of micro-expressions is influenced by a variety of factors, with most people reacting more obviously to negative emotions, while the influence of gender culture does not show a large gap. In addition to that the occurrence background of person has some significant changes on micro-expression display. The finding of the study could be used as a foundation for recognizing the content of micro-expressions and for the future applications of micro-expressions.

1.1. Definition of micro-expressions

People are increasingly recognizing the significance of micro-expressions in conveying emotional states and the techniques for proficiently discerning these emotions. Micro-expressions are fleeting, involuntary facial expressions that inadvertently slip through when individuals attempt to conceal or repress their genuine feelings. These can manifest as subtle movements of the entire face or as isolated muscle contractions. Through extensive exploration, it has been revealed that specific facial expressions associated with a single emotion can occur within a time frame ranging from 0.5 seconds to 4 seconds. Some may persist throughout the entire face, while others transpire too swiftly to be precisely measured, confirming the existence of micro-expressions.

1.2. Type of micro-expressions

The existing studies have found that the main categories of micro-expression are happiness, sadness, anger, disgust, fear, and surprise so no micro-expression beyond the basic expressions have been found. In contrast to regular facial expressions, micro-expressions are of shorter duration, as they are spontaneous and unmanageable emotional displays. Furthermore, an increasing body of research has unveiled that facial expressions do not align in a one-to-one manner with specific

emotions. Instead, certain emotions are often amalgamations of multiple facial expressions. The acquisition of skills to discern emotional cues within facial micro-expressions is imperative for effectively navigating interpersonal interactions both in personal and professional domains [1].

1.3. Reading micro-expressions

Scientists have also shown that micro-expression occurs when people are unable to suppress or hide emotion and that the actions they are trying to control can lead to involuntary facial movements. It is the ubiquity of facial expressions and the presence of micro-expressions that require us to learn to read other people's emotions, which can benefit different types of people. In the analysis of facial expressions, a comprehensive approach should be adopted, encompassing two key dimensions. Firstly, it is essential to take into account the inherent personality traits of the individuals being analyzed. Secondly, one should pay meticulous attention to the nuanced psychological shifts that manifest through subtle changes in expression. During the intricate process of recognizing and assessing micro-expressions, it is crucial to acknowledge that definitive conclusions may not always be drawn in a singular instance. This is due to the fact that micro-expressions may stem from habitual or genuine emotional responses, leading to inherent variations in their interpretation.

2. Factors influencing micro-expressions

The factors that influence the production and recognition of micro-expression will be introduced from four aspects, including gender, cultural differences, occurrence background, and psychological states. Due to limited direct research on micro-expression itself, the influencing factors will be explored indirectly by analogy with facial expressions. Facial expressions and micro-expression are both non-verbal forms of communication that convey emotions and feelings. They are relevant because involve the movements of facial muscles.

2.1. Gender

Gender differences in micro-expression have always been a key consideration for psychologists. According to neuropsychological studies, women are more naturally expressive of non-verbal communication skills, such as the display of micro-expression, than men. Observations of facial electromyography have also shown that women make more frequent facial muscle movements and tend to show more positive aspects. Conversely, men exhibit a heightened receptivity to negative emotions, often manifesting their emotional states through negative or aggressive behaviors. [2]. Furthermore, if the process of interpersonal interaction is subdivided, the gender differences that exist between the speaker and the perceiver can also respond to the effect of micro-expression. Several psychologists have concentrated their research on discerning gender disparities within interpersonal emotional dynamics. They employ precise measurements and statistical analyses to shed light on the common societal stereotypes associated with emotions exhibited by different genders in social interactions. In addition to the exploration of micro-expression recognition, the dual-stream modeling technique stands out as a frequently employed research methodology to comprehensively investigate gender differences in micro-expressions. This approach involves one stream dedicated to acquiring gender-specific characteristics and another stream infused with micro-expression features, allowing for the synthesis of these two facets to effectively highlight the observed effects. Also, it has been found that, to some extent, women are more sensitive as expressers, and as perceivers, women are better at recognizing and finding the cause of changes in others' moods through details such as micro-expression, whereas men are more hostile and try to control others [3].

2.2. Occurrence background

Micro-expression is an extremely rapid facial expression thus individual factors have a great impact on its production. The occurrence background is the spatial and temporal location of the moment, which means time and place, and a collection of one's emotional context. Firstly, different

times and places naturally result in different psychological states. In a crowded public setting, individuals often engage in subconscious scanning of their surroundings, resulting in a heightened frequency of facial micro-expressions. Conversely, within a comfortable and familiar environment, both the body and mind tend to relax, leading to more natural facial micro-expressions. Furthermore, when individuals are in motion, their emotional state may differ from when they are stationary, such as while leisurely sipping a cup of coffee. The extent of tension in facial muscles can also exert an influence on the occurrence of micro-expressions to some extent. On the opposite end of the emotional spectrum, research has demonstrated that contextual emotional content plays a significant role in shaping micro-expressions. In particular, when there was a 50% similarity between the target emotion and the previous emotion, participants expressed negative and positive emotions differently regardless of whether the target was negative or positive. It was also observed through the results that happy faces were more accurately recognized after a positive initiation than after a negative initiation, while sad expressions were more accurately recognized after a negative initiation. In conclusion, when there is a large difference between the content of the emotion before and after, it leads to a large difference in the expression of the micro-expression [4].

2.3. Culture

Culture influences the expression of emotions in various ways so that indirectly affecting the production and recognition of micro-expression, as this can limit the expression and control of emotions in a given cultural context. According to the previous section, micro-expressions are quick and involuntary facial expressions that occur when an individual experiences a strong emotional reaction. As a more realistic expression of emotions, micro-expression is relevant to a greater extent, and thus in the absence of micro-expression research, more attention may be directed from emotions. Based on the research, high-arousal emotions are more valued and promoted than low-arousal emotions in Western or individualistic cultures. Westerners experience more high-arousal emotions than low-arousal emotions. In contrast, in Eastern or collectivist cultures, low-arousal emotions are more valued than high-arousal emotions. For expression, high arousal emotions are those that enhance nervous system activity when full of energy and thus trigger high arousal, whereas low arousal emotions are those that are preparatory to being in a weakened state. Specifically, Eastern cultures are the opposite of European and American cultures because they are relatively calm and introverted. When expressing emotions, Easterners pay more attention to the expressions around the eyes. Westerners' express emotions from the full face with a greater range of expressions. Easterners use their eyes more and have a smaller range of expression [5]. Therefore, this is from the perspective of facial muscle movement to reflect the impact on micro-expression. Another piece of neural evidence concerns cultural differences in positive facial micro-expression recognition. Psychologists used functional magnetic resonance imaging to track activity in neural circuits related to reward/emotion, value integration/identity, and attention while observing and evaluating targets with different positive facial micro-expression. The results illustrate that European Americans value excitement or calmness more compared to the Chinese. The reason for this is that Chinese culture makes Chinese people value a state of calmness more than excitement [6].

2.4. Psychological states

People's facial micro-expression is derived from inner emotional feedback. No matter the type of emotion, people's psychological states will have an impact on self-expression. Within the framework of the six fundamental emotions as established by current research, discernible characteristics emerge in the realm of micro-expressions. These characteristics, in conjunction with the frequency of various emotional states, serve as constraints that shape an individual's micro-expression patterns. Moreover, the expression of emotions and the conveyance of social cues in various daily life contexts are intrinsically intertwined with individual personality traits. As an important non-verbal communication system, micro-expression recognition can ensure interpersonal adaptation and control to a certain extent and ensure the stability and balance between self and the external environment.

The emotional context is the type of facial expression before and after the micro-expression, which means micro-expression is usually embedded in a range of expressions including positive, negative, and neutral expressions. Some emotional studies have found that when initiating different types of facial expressions, people who are in a happy moment respond more strongly to angry expressions. That is negative or sad emotions have less effect on target micro-expression than neutral or positive emotions [4]. Each individual possesses a distinctive psychological state, and as a consequence, their interpretation and comprehension of emotions are inherently unique.

3. Application of micro-expressions

3.1. Society safety

Micro-expression is part of psychological stress micro-responses that cannot be hidden and are controlled by the mind, so their use is of great importance in clinical and public society. The development of a polygraph system is based on the detection of micro-expressions. The system is shown to detect facial micro-expressions by interpreting eight facial expressions: happiness, sadness, joy, anger, fear, surprise, disgust, and contempt so that accurate outputs can be extracted for evaluation in relevant fields [7]. The human face serves as a symbolic vessel, conveying information not only through its fundamental structural features and muscle tension but also via the dynamic shifts in facial expressions, such as smiles and frowns. Individuals have the remarkable ability to discern another person's emotions and intentions by perceiving their facial micro-expressions, even though these manifestations exist for mere fractions of a second. Within the realm of the judicial field, a discerning judge may possess the capability to discern whether a criminal is being untruthful based on the subtle micro-expressions exhibited on their face. In the field of security, security personnel may use micro-expression to determine whether someone has the intention of attacking to prevent it from happening.

3.2. Clinical therapy

In the clinical field, clinical psychologists may be able to observe patients, discover their micro-expression, and understand the patient's real attitude and thoughts about a particular thing or person thus reducing the treatment time. One avenue of research focuses on identifying patterns of micro-expressions in infants, with the ultimate goal of offering early intervention solutions for children with autism. Autism spectrum disorder is a profoundly intricate and pervasive neurodevelopmental condition, characterized by symptoms such as reduced responsiveness to their name, diminished eye contact, and limited engagement during joint-attention interactions, along with generally limited expressive behaviors. Studies have revealed that behavioral disparities in infants at high risk for autism spectrum disorders become apparent towards the conclusion of the first year of life and continue to amplify over time. This underscores the critical importance of initiating intervention and treatment within the first year of a child's life, as delaying treatment until the second year may prove less effective. Therefore, Psychologists have taken into account the factor of the social smile, because its effect is more intense and expressive, present in the first early interactions between child and caregiver, and social smiles are stronger and occur more frequently during the period of interaction than simple smiles, in which the infant's attention is focused on the smiling mother's face. This expressive nature has led the social smile to be considered as a possible early marker of later manifestations of the ASD phenotype, and the results also confirm that social smiles in children with autism show a significant degree of reduction in intensity and frequency [8].

3.3. Teaching efficiency

In addition, the application of micro-expression recognition in the field of education is better for improving the quality of teaching. The technology is used to analyze the changes in micro-expression and concentration of students in the classroom, to be summarized into an evaluation system. This research integrates the 3D learning state space with classroom micro-expressions and employs deep

learning techniques to proficiently accomplish face detection, tracking, localization, and micro-expression recognition. This approach enables educators to assess students' responses to varying learning materials and their adaptability to different levels of difficulty. Consequently, teachers can promptly adjust their teaching methods and strategies to cater to the individual needs and progress of their students. Students' facial micro-expression can be subdivided into three dimensions, namely, interest dimension, awareness dimension, and happiness dimension, in which a variety of expressions, such as confusion, disgust, and surprise, are forms of showing students' emotional changes. By incorporating both the students' expressions of happiness and the intensity of their emotional response, educators can gain valuable insights into the evolving emotions of their students. This holistic approach allows for a more rational and comprehensive assessment of students' learning status, enabling teachers to make informed and nuanced evaluations [9]. In more detail, automatic face detection and localization technology is an effective method for evaluating and centrally analyzing students' status in the classroom and combining it with cell phone software greatly improves the quality of teaching and learning [10].

4. Conclusion

Micro-expression is so closely related to human emotional information processing that people sometimes don't even realize they have it. As the present research delves deeper into the subject, we anticipate gaining a more holistic insight into the generation and identification of micro-expressions. This ongoing investigation is poised to enhance our understanding of the intricate interplay between micro-expressions and emotional expression. Moreover, by unraveling the impact of various factors on micro-expressions, we stand to facilitate their practical applications in various aspects of people's lives, including clinical treatment, societal interactions, and educational effectiveness. There are many mysteries of micro-expression in psychology. Although there are fewer direct studies on micro-expression nowadays, there have been many lateral approaches to micro-expression in terms of emotions or facial expressions and muscle movements. Researchers have developed some methods and tools such as high-speed camera technology and computer vision analysis to capture and analyze micro-expression. In future research, micro-expression recognition and analysis methods can be further improved to increase the accuracy and reliability in practical applications. In addition, micro-expression research can also be interdisciplinary cooperation with other fields, such as brain science, by combining brain imaging technology and micro-expression analysis to explore the neural basis of micro-expression. In conclusion, it is of great significance to promote the development of micro-expression research.

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