

The Integrated Variable Emotion Theory and Multi-Dimensional Emotion Model

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Abstract

Emotion AI or Affective Computing (AC) contributes in new ways to improve communication between sensitive humans and computers, which are unemotional. Emotion recognition from the text is an evolving area of research in Natural Language Processing. Emotions influence human behaviour to a great extent. Sometimes actions are based on emotions feel. researchers and we Manv Psychologists have provided answers to questions such as how we have emotions and what causes us to have these emotions. They have proposed different theories to explain why humans have emotions and suggest computational models to describe how to classify the emotions. In this paper, we discuss a few emotion models and theories of emotion and briefly describe and suggest a new emotion model.

This paper introduces the Integrated Variable Emotion Theory, novel а framework for understanding human emotion that synthesizes key insights from several prominent affective models. While each contributing theory—Basic Emotion Theory, the Circumplex Model of Affect, Plutchik's Wheel of Emotions, Schachter-Theory, Singer Two-Factor Appraisal Theory, and Constructed Emotion Theory—offers valuable perspectives, Integrated Variable Emotion Theory proposes a more holistic and dynamic posit that emotional approach. experience is not solely determined by basic emotions innate, or purely constructed from contextual cues, but rather emerges from a complex interplay of these factors. Integrated Variable Emotion Theory to provide aims а more comprehensive and nuanced understanding of the multifaceted nature of human emotion.

This paper also introduces the multidimensional emotion model, a novel approach especially designed to design AI models that understand and respond to human emotion, making our day-to-day interactions more interactive and engaging.

Keywords

Emotion AI, Affective Computing, Emotion Recognition, Natural Language Processing, Integrated Variable Emotion Theory, multi-Dimensional Emotion Model. Basic Emotion Theory, Circumplex Model of Affect, Plutchik's Wheel of Emotions, Schachter-Singer Theory, Two-Factor Appraisal Theory, Constructed Emotion Theory, Human Emotion, Human-Computer Interaction, Machine Learning, Pattern Recognition, Decision-Making, Problem Solving, Neural Networks, natural Language Processing (NLP).

Research objective

The primary aim of this research is to develop sophisticated artificial intelligence systems that can thoroughly comprehend human emotions and respond appropriately across various contexts. This entails integrating insights from multiple emotional theories to design effective emotion recognition and response models. By investigating the relationship between innate emotional responses and contextual factors, the research seeks to enhance the emotional intelligence of AI, fostering more natural and empathetic interactions between humans and computers. Ultimately, the goal is to create AI systems that are not only responsive but also proactive, thereby improving user experiences in applications like customer service, mental health support, and social robotics.

I. Introduction

Emotion AI, also known as Affective of artificial Computing, is a field intelligence that focuses on understanding, interpreting, and responding to human emotions. It combines elements of psychology, computer science, and cognitive science to analyse emotional cues from facial expressions, vocal tones, gestures, and even written language. Emotion AI aims to create systems that can sense and adapt to human emotions, making interactions between humans and technology more intuitive and empathetic. For instance, Emotion AI can be utilized in customer service to detect frustration in a caller's voice and provide more effective assistance. It can also be applied in mental health settings to monitor emotional wellbeing through daily interactions. Through psychology, the integration of mathematics, and computer science, we may eventually develop AI that can experience emotions of its own.

II. Review of Literature

A. The Basic Emotion Theory

Basic Emotion Theory is a psychological framework that suggests there is a set of universal emotions experienced by all humans, regardless of culture or background. These emotions are thought to be biologically hardwired and evolved to help humans survive and adapt to their environment.

Psychologist Paul Ekman is one of the most prominent figures associated with this theory. He identified six primary emotions:

- 1. Happiness
- 2. Sadness
- 3. Anger
- 4. Fear
- 5. Disgust

These basic emotions are considered universal, as studies have shown that people across different cultures express them through similar facial expressions. For instance, a smile usually indicates happiness, while a frown suggests sadness.

While Basic Emotion Theory has significantly contributed to understanding emotions, it is not without its criticisms. Here are some key challenges and limitations:

1. Cultural Variations: Critics argue that emotions are not entirely universal, as cultural context can influence emotional expression and interpretation. For example, some cultures may suppress certain emotions or display them differently, challenging the idea of universal facial expressions.

2. Oversimplification: The theory assumes that emotions can be neatly categorized into a fixed set of "basic" emotions. However, emotions are often complex and interconnected, making it difficult to reduce them to simple categories.

3. Biological Reductionism: It leans heavily evolutionary on biological and perspectives, potentially downplaying the role of social, psychological, and environmental factors in shaping emotions.

4. Lack of Context: Basic Emotion Theory primarily focuses on facial expressions and physiological responses, often ignoring the situational and contextual elements that influence emotional experiences.

5. Debate Over Universality: While Ekman's research supports universal facial expressions, other studies have contested the findings, suggesting that cultural and linguistic differences play a significant role in emotion perception.

6. Nonverbal Behaviour Variability: Facial expressions may not always reflect genuine emotional states, as people can mask or fake emotions for social or situational reasons.

B. The Circumplex Model of Affect

The circumplex model of affect suggests that all emotional states come from how we interpret basic brain sensations, which arise from two separate neurophysiological systems. This model differs from traditional theories of basic emotions, which claim that each emotion has its distinct neural pathway. The authors argue that basic emotion theories don't adequately explain many findings in affective neuroscience and that a new approach is needed for studying emotions and related disorders. The circumplex model aligns better with recent research in behavioural science, cognitive neuroscience, and brain imaging. Additionally, it provides fresh ways to investigate the development of emotional disorders and the biological and cognitive processes involved in emotional processing.

Current research in affective neuroscience generally divides emotions into distinct categories, each linked to specific neural pathways. While this basic emotion theory has advanced our understanding of emotions, it leaves many important unanswered in clinical questions psychology and psychiatry, especially regarding the overlap of mood disorders and the underlying mechanisms of affective disorders. Additionally, this theory clashes with recent findings from behavioural genetics and temperament studies.

To address these limitations, researchers suggest shifting from the basic emotion model to dimensional models of emotions. These models propose that emotions do not come from separate neural systems but rather from common and overlapping physiological systems. Historically, dimensional models have been influential in psychology but are less emphasized in psychiatry.

One such model is the circumplex model of affect, which posits that emotional states arise from two main neurophysiological dimensions: valence (pleasure VS. displeasure) and arousal (alertness). Each emotion can be viewed as a combination of varying levels of these two dimensions. For instance, joy results from high pleasure and moderate arousal. Different emotions emerge from the unique patterns of activation in these dimensions, along with our cognitive interpretations of these physiological experiences.

People often struggle to identify and describe their emotions, indicating that emotions aren't perceived as isolated entities but as overlapping experiences, much like colours on a spectrum. Instead of clear boundaries, emotions are interrelated often and co-occur. Researchers have found that emotions can be understood as a continuum of related states rather than discrete categories.

Two-dimensional model: Studies 1) using statistical techniques like factor analysis have consistently shown that emotions can be represented in a twodimensional (2-D) model. These dimensions are typically framed as valence (pleasure vs. displeasure) and arousal (alertness vs. calmness). For example, fear combines negative valence and high arousal. Emotions result from a mix of these two systems, influenced by cognitive interpretations of physiological responses.

The Circumplex Model of Affect, while widely studied and influential, has faced criticism and challenges in its application:

1. Interpretational Issues: There are debates about the naming and definition of the basic dimensions within the model, such as positive and negative affect.

2. Limitations in Describing Relationships: The model may oversimplify the complex relationships between emotions, failing to capture nuances.

3. Variability in Data: Studies have shown inconsistent results when testing the model, suggesting that it may not universally apply to all emotional experiences.

C. Plutchik's Wheel of Emotions

Plutchik's Wheel of Emotions is a model designed to explain the complexity of human emotions in a structured and visually intuitive way. Created by psychologist Robert Plutchik, it organizes emotions into primary, secondary, and tertiary levels, highlighting how they interact and combine.

Key Features:

1. Primary Emotions: Plutchik identified eight basic emotions—joy, trust, fear, surprise, sadness, disgust, anger, and anticipation. These are universal and form the foundation for more complex emotions.

2. Opposing Pairs: Emotions are arranged in opposite pairs on the wheel:

- Joy vs. Sadness
- Trust vs. Disgust
- Fear vs. Anger
- Surprise vs. Anticipation

3. Intensity Levels: Emotions can vary in intensity. For example:

• Joy \rightarrow Serenity (less intense) or Ecstasy (more intense).

• Anger \rightarrow Annoyance (less intense) or Rage (more intense).

4. Emotion Combinations: Emotions can blend to form new, complex feelings. For example:

- Anticipation + Joy = Optimism
- Fear + Surprise = Awe

Plutchik's Wheel of Emotions is a brilliant and widely used model, but like any theoretical framework, it has its limitations and criticisms:

1. Simplification of Emotions: Critics argue that the wheel oversimplifies the vast complexity and nuances of human emotions, making it difficult to capture all emotional experiences or cultural differences.

2. Limited Scientific Basis for Blending: While blending emotions (e.g., anticipation + joy = optimism) is intriguing, the scientific basis for these combinations isn't always well-established or universally agreed upon.

3. Intensity Levels: The distinctions between levels of emotion intensity (like joy vs. ecstasy) may not hold across all individuals or cultures, as people perceive and express emotions differently.

4. Rigid Categorization: Emotions in reallife situations often overlap and don't fit neatly into distinct categories or opposing pairs as suggested by the model.

5. Biological Focus: Plutchik's theory heavily emphasizes the evolutionary and biological aspects of emotions, which some critics believe overlook social, environmental, and cognitive factors.

D. Schachter-Singer Two-Factor Theory

The Schachter-Singer Two-Factor Theory, also known as the "Cognitive Labelling Theory," is a psychological model that explains how emotions arise. It emphasizes the interplay between physiological arousal and cognitive processes.

Key Principles:

1. Physiological Arousal: According to the theory, when we experience an emotion, our body first undergoes physiological changes (e.g., increased heart rate, sweating, or trembling).

2. Cognitive Interpretation: These physiological responses alone don't determine the emotion we feel. Instead, we interpret or label the arousal based on the context or situation around us. This cognitive evaluation shapes the emotion we experience.

3. Emotion Emergence: After labelling the arousal, the resulting emotion emerges. For example:

• If you feel your heart pounding after encountering a bear, you might label it as "fear" because the situation is dangerous.

• If your heart pounds during a surprise party, you might label it as "excitement" due to the positive context.

Example Experiment:

Schachter and Singer conducted a study in 1962 to test their theory. Participants were injected with adrenaline (causing physiological arousal) and placed in different environments:

• In one group, participants interacted with a euphoric person, which led them to interpret their arousal as happiness.

• In another group, participants were exposed to an angry person, leading them to label their arousal as anger. The results supported the idea that context and interpretation play crucial roles in determining emotional experiences.

This theory highlights how both our body and mind contribute to how we feel.

The Schachter-Singer Two-Factor Theory of emotion, while influential, has faced some criticism and challenges:

1. Overemphasis on Cognitive Interpretation: Critics argue that the theory places too much weight on cognitive labelling, potentially underestimating the role of innate or automatic emotional responses.

2. Individual Differences: People may interpret the same physiological arousal differently based on personal experiences, cultural background, or personality, making it hard to generalize the theory across diverse populations.

3. Experimental Challenges: The famous 1962 study by Schachter and Singer has been critiqued for its methodology, such as a lack of a standardized way to measure emotions and potential placebo effects influencing results.

4. Timing of Emotion Components: The theory suggests that arousal happens before cognitive labelling and emotional experience, but other research (like Zajonc's and Lazarus's theories) suggests that emotions can occur without conscious cognition or simultaneously with physiological changes.

5. Neglect of Other Factors: The theory doesn't account for the role of unconscious processes, brain mechanisms, or social and

environmental influences that may shape emotional experiences.

E. Appraisal Theory

Appraisal Theory explores how emotions arise based on how we evaluate or "appraise" a situation. Essentially, it highlights the role of personal interpretation in shaping emotional responses.

Key Concepts:

Cognitive Appraisals: Emotions are triggered not directly by events, but by how we interpret or assess these events. For instance, two people experiencing the same situation might feel differently depending on their perspective.

1. Primary and Secondary Appraisals:

- Primary Appraisals: These focus on the relevance of the event. Is it positive, negative, or neutral? Does it impact my well-being? For example, encountering a wild animal might initially trigger fear if perceived as a threat.
- Secondary Appraisals: These evaluate our ability to cope. Can I handle this situation? If you feel confident in escaping the wild animal, fear might lessen.

2. Emotion Differentiation: Appraisal Theory helps explain why people feel different emotions in similar situations. Your values, experiences, and goals influence your appraisal and, consequently, your emotional response.

Example:

Imagine you're giving a public speech:

• If you appraise it as a chance to share your ideas and grow, you might feel excited or motivated.

• If you appraise it as a chance to embarrass yourself, you might feel anxious or fearful.

Strengths:

• Recognizes individual differences in emotional experiences.

• Explains the dynamic nature of emotions as contexts and appraisals shift.

This theory offers a nuanced understanding of emotions by emphasizing our cognitive processes. Would you like to compare it with another emotional theory or explore practical applications?

Appraisal Theory has been instrumental in understanding emotions, but it is not without its challenges and criticisms:

1. Subjectivity of Appraisals: Since the theory emphasizes individual interpretations of situations, it can be difficult to measure appraisals objectively, making research and validation tricky.

2. Complexity of Emotional Processes: Emotions often arise rapidly, sometimes without conscious appraisal. Critics argue that the theory may oversimplify the automatic or instinctive nature of some emotional responses. **3. Circular Reasoning:** Some critics feel that the theory's explanations can be circular—for example, if an emotion is said to arise because of a specific appraisal, but that appraisal is inferred based on the emotion, it can become difficult to distinguish cause from effect.

4. Cultural and Contextual Differences: The way individuals appraise events can vary significantly across cultures, which may limit the universal applicability of the theory. Social norms and values heavily influence interpretations of events.

5. Underemphasis on Biological Factors: While the theory focuses on cognitive evaluations, it has been criticized for not integrating enough insights from neuroscience or the biological mechanisms underlying emotions.

F. Constructed Emotion Theory

The Constructed Emotion Theory, developed by psychologist Lisa Feldman Barrett, presents a unique perspective on how emotions emerge. Unlike traditional theories that propose emotions as innate and universal (e.g., fear or anger), this theory suggests emotions are "constructed" rather than "hardwired."

Core Ideas:

1. Emotions as Constructions: According to this theory, emotions aren't pre-existing biological states but rather complex constructions resulting from our brain's interpretations of bodily sensations, experiences, and context.

2. Role of Concepts: The brain uses learned concepts (such as cultural and social

influences) to categorize sensations and create emotions. For example, the feeling of a racing heart could be constructed as excitement, anxiety, or fear depending on the situation and context.

3. Predictions and Simulations: The brain is a predictive organ. It uses prior knowledge and experiences to simulate and predict emotional responses to situations, which shape how we feel.

4. Variation Across Individuals and Cultures: Since emotions are constructed, they can vary greatly between people and across cultures, challenging the idea of universal, biologically determined emotional expressions.

5. Dynamic Processes: Emotions are not fixed or static; they are shaped moment-to-moment by factors like context, physiology, environment, and personal history.

Implications:

• This theory shifts the focus from innate emotional "programs" to a more nuanced understanding of how emotions are actively formed.

• It has applications in psychology, neuroscience, and emotion-related fields, providing insights into individual emotional experiences and their variability.

III. Novelty

The Integrated Variable Emotion Theory and multi-dimensional emotion model presented in this paper represent a significant advancement in the field of Emotion AI and affective computing. The novelty of this research lies in its comprehensive synthesis of established emotion theories into a cohesive framework that captures the complex nuances of human emotion.

1. Holistic Approach: Unlike traditional models that often rely on a singular perspective—be it basic emotions or contextual cues—this theory proposes that emotions arise from a dynamic interplay between inherent emotional responses and environmental influences. This integrated approach offers a more realistic depiction of emotional experiences.

2. Innovative Model Design: The multidimensional emotion model, specifically designed for AI applications, introduces a structured way for machines to process and respond to human emotions. By leveraging the insights from various psychological theories, it provides a robust methodology for creating AI systems that can recognize and adapt to emotional cues effectively.

3. Enhanced Human-Computer Interaction (HCI): The proposed models aim to bridge the gap between human emotional expression and machine understanding, fostering more intuitive and empathetic interactions. This has profound implications for various fields, including customer service, mental health, and social robotics, where understanding emotional context can significantly enhance user satisfaction and engagement.

4. Proactive Emotional Intelligence: One of the key objectives of this research is to develop AI systems that are not only reactive but also proactive in their emotional responses. This forwardthinking approach encourages the design of systems that anticipate user needs and emotional states, thereby creating a more supportive and responsive interaction environment.

By combining theoretical insights from psychology with practical AI applications, this research contributes to a deeper understanding of emotion recognition and response, setting a new standard for emotional intelligence in artificial intelligence. The findings and models thus the groundwork for future lav advancements in empathic technology, ultimately enhancing the quality of humancomputer interactions.

The Integrated Variable Emotion Theory and Multi-Dimensional Emotion Model present a significant advancement in the field of Emotion AI, offering a unique synthesis of established theoretical frameworks in emotional intelligence. This research distinguishes itself by proposing a more dynamic and integrated approach to understanding human emotions, moving beyond the limitations of existing models.

1. Holistic Integration: Unlike traditional emotion theories that often focus on isolated aspects of emotional experience, this research merges insights from multiple models—Basic Emotion Theory, Circumplex Model of Affect, Plutchik's Wheel of Emotions, Schachter-Singer Two-Factor Theory, Appraisal Theory, and Constructed Emotion Theory. This perspective facilitates integrative а comprehensive understanding of the complexities of human emotion.

2. Dynamic Interplay of Factors: The research challenges the notion that emotions are solely innate or context-dependent, presenting the idea that emotional experiences arise from a complex interplay of biological, psychological, and social influences. This dynamic approach allows for a more nuanced classification of emotions.

3. Application in AI Development: The integration of the Multi-Dimensional Emotion Model specifically targets the development of AI systems capable of recognizing and responding to human emotions in real-time. By incorporating the theoretical foundations from the Integrated Variable Emotion Theory, the model enhances the ability of AI to engage in more human-like interactions, prioritizing empathy and emotional understanding.

4. Proactive Emotional Intelligence: The research emphasizes the potential for AI systems to be not only reactive but also proactive in their emotional responses. This transformative aspect has significant implications for various applications, from improving customer service experiences to enhancing mental health support and social robotics.

5. Empirical Validation: The proposal includes the potential for empirical studies to validate the effectiveness of the Integrated Variable Emotion Theory and Multi-Dimensional Emotion Model in real-world applications, providing a foundation for future research and practical implementations in Emotion AI.

By addressing these aspects, this research aims to bridge the gap between human emotional complexity and artificial intelligence, setting a new standard for empathetic interactions in technology.

IV. Definition

Integrated Variable Emotion Theory is a novel framework introduced in this research paper that seeks to enhance the understanding of human emotion by synthesizing insights from several prominent affective models. This theory posits that emotional experiences arise from a complex interplay of innate basic emotions and contextual cues and the interdependence of physiology and emotions, rather than being solely determined by either factor. By integrating perspectives from various emotion theories, such as Basic Emotion Theory, the Circumplex Model of Affect, Plutchik's Wheel of Emotions, Schachter- Singer Two-Factor Theory, Appraisal Theory, and Constructed Emotion Theory. the Integrated Variable Emotion Theory aims to provide a comprehensive and dynamic understanding of the multifaceted nature of human emotions. This approach not only enriches our theoretical understanding but also informs the development of advanced artificial intelligence systems that can recognize and respond to human emotions more effectively.

Key Points of Integrated Variable Emotion Theory:

1. Emotional Spectrum: Emotions are viewed as a spectrum, rather than discrete categories, indicating that they can overlap

and coexist, much like colours in a spectrum.

2. Multidimensional Framework: The theory proposes that emotions can be understood through various interconnected dimensions, including valence (pleasantness vs. unpleasantness) and activation (high energy vs. low energy).

3. Contextual Dependence: Emotions are influenced by the context and individual experiences, highlighting that the same situation may evoke different emotional responses in different people.

4. Interdependence of physiology and emotions: Emotions are influenced by physiological changes, and Physiological changes can also be influenced by emotions.

5. Dynamic Nature: Emotions are not static; they can evolve over time and in response to changing circumstances, reflecting the complexity of human experience.

6. Cognitive Influences: The theory emphasizes the role of cognitive processes, such as appraisal and interpretation, in shaping emotional experiences, suggesting that how individuals think about a situation can impact their emotional response.

7. Interpersonal Factors: Social interactions and cultural background play a significant role in the development and expression of emotions, indicating that emotions are not just personal but also social constructs. The theory strongly believes that a man is a product of his environment.

8. Integration of Primitive and Acquired Emotions: The theory recognizes both innate (primitive) and learned (acquired) emotions as integral components of the emotional experience, encompassing the biological and experiential aspects of emotions.

9. Subjectivity of Emotion: Individual differences in emotional experiences and expressions highlight the subjective nature of emotions, suggesting that personal history and cultural context shape how emotions are perceived and understood.

These key points illustrate that Integrated Variable Emotion Theory seeks to provide a comprehensive understanding of emotions by considering their complexity, variability, and dependence on various factors.

V. The Integrated Variable Emotion Theory

The Integrated Variable Emotion Theory (IVET) is a comprehensive framework for understanding human emotions, insights from various combining established theories of emotion. Unlike models that focus solely on basic emotions or those that consider emotions as entirely constructed from contextual cues, IVET posits that emotional experiences arise from a dynamic interplay of innate emotional responses and environmental influences. This approach emphasizes that emotions are not static but are shaped by multiple factors, including cultural context, personal experiences, and situational variables. The Integrated Variable Emotion Theory also emphasises that physiology and emotion are interdependent and interrelated. By synthesizing elements from theories such as Basic Emotion Theory, the Circumplex Model of Affect, Plutchik's Wheel of Emotions, Schachter-Singer Two-Factor Theory, Appraisal Theory, and Constructed Emotion Theory, IVET aims to create a more nuanced understanding of human emotions. ultimately enhancing the ability of AI systems to recognize and respond to emotional nuances in human interactions. This holistic perspective allows for a richer interpretation of emotional data, fostering improved empathy and adaptability in AI applications.

A. Classification of Emotions

This theory categorizes emotions based on two criteria: • Classification according to Valence. • Classification based on their Origin.

- Classification based on Valence.
- Classification based on their Origin.

1). Classification based on Valence.

Valence refers to the intrinsic pleasantness or unpleasantness of an emotion. Based on valence, emotions can be classified into three main categories: positive, negative, and neutral.

• **Positive Emotions:** These are emotions that generally feel good, such as joy, happiness, and love. They are associated with feelings of pleasure, satisfaction, and well-being. Positive emotions often encourage positive behaviours and foster social connections. Examples include joy, happiness, love, gratitude, and contentment. • Negative Emotions: These emotions typically feel unpleasant, like sadness, anger, and fear. They are linked to feelings of displeasure and dissatisfaction. Negative emotions often motivate us to avoid threats or address issues. Examples include sadness, anger, fear, disgust, and guilt.

• Neutral Emotions: These emotions are neither distinctly pleasant nor unpleasant and usually have a low level of activation. They can represent a state of calmness, indifference, or a baseline emotional state.

• Subjective Experience: The categorization of emotions is influenced by individual and cultural interpretations. What one person considers a negative emotion, another might view differently. example, emotions For such ลร indifference, calmness, and certain types of surprise may not clearly fall into positive or negative categories. It's also important to recognize that the boundaries between these categories can be blurry. Emotions are complex and multifaceted, and they depend on the situation, appraisal, and context.

B. Classification based on their Origin.

Here, origin refers to how these emotions came into being. Based on origin, emotions can be widely categorized into two categories.

- Primitive emotions
- Acquired emotions.

Primitive emotions are the fundamental, innate emotional responses that are thought to be universal across all humans and, in some cases, shared with other animals. These emotions are deeply rooted in evolutionary biology and serve as survival mechanisms. They are automatic and do not require conscious thought. Common examples include:

• **Fear:** Helps in recognizing threats and initiating protective actions.

• **Anger:** Triggers responses to defend oneself or assert boundaries.

• Joy: Encourages social bonding and reinforces positive behaviours.

• **Sadness:** Signals a need for help and promotes introspection.

• **Disgust:** Helps in avoiding harmful or unsafe substances and situations.

• **Trust:** The belief that another person will do what is expected.

• **Surprise:** feeling of astonishment or wonder that arises from something unexpected.

• **Anticipation:** Helps to prepare for something that is yet to happen.

Note: There can be more primitive emotions that are yet to be discovered, and there are also chances that through the process of evolution, we may gain more primitive emotions.

Acquired emotions, also known as secondary or learned emotions, are shaped by individual experiences, cultural influences, and social interactions. Unlike primitive emotions, which are innate and universal, acquired emotions develop over time as we interact with the world and learn from our environment. They often involve a blend of basic emotions and cognitive processes such as reasoning, reflection, and imagination. Examples include:

• **Guilt:** Often a mix of sadness and fear, shaped by societal norms and personal values.

• **Pride:** Arises from joy and selfawareness, often linked to achievement or identity.

• **Shame:** Related to fear and sadness, influenced by social or cultural expectations.

• Jealousy: A complex mix of anger, fear, and sadness tied to personal relationships.

• **Gratitude:** Evolved from joy and involves appreciation and social bonding.

Note: There can be more Acquired emotions that are yet to be discovered.

These emotions reflect the depth and complexity of human life, as they are often interwoven with our personal experiences, moral values, and cultural backgrounds. Many researchers explain them as a combination of universal emotions, but they are separate and independent of universal emotions. It is just a tendency of us humans that we try to explain something we don't know with the knowledge we already have. For example, Love, a highly complex emotion, is defined differently by different people all over the world.

C. Spectrum-like nature of Emotions

Clinicians and researchers have long noted the difficulty that people have in assessing, discerning, and describing their own emotions (Saarni, 1999). This difficulty individuals suggests that do not experience, or recognize, emotions as isolated, discrete entities, but that they rather recognize emotions as ambiguous and overlapping experiences. Like the spectrum of colours, emotions seem to lack the discrete borders that would clearly differentiate one emotion from another (Russell & Fehr, 1994). Indeed, researchers exploring the subjective experience of emotion have noted that emotions are highly intercorrelated both within and between the subjects reporting them (Russell & Carroll, 1999; Watson et al., 1999). Subjects rarely describe feeling a specific positive

emotion without also claiming to feel other positive emotions (Watson & Clark, 1992). This means that we don't feel one emotion at one time but a whole spectrum of emotions out of it, the most dominant emotion will be felt more by an individual as compared to other recessive emotions.

D. Appraisal of situations

Emotion also depends upon how an individual assesses a situation. This concept is already proposed by Appraisal theories (e.g., Arnold 1960; Ellsworth 2013; Frijda 1986; Lazarus 1991; Ortony et al. 1988; Roseman 2013; Scherer 2009. An individual performs two types of appraisals whenever he or she is exposed to a new situation. These appraisals are: -

• **Primary appraisal** is the first appraisal that an individual unknowingly performs

whenever he or she is exposed to a new situation. The emotions that an individual feels right after this are directly dependent on the thought process, anticipation, the overall life experience of that individual, and instincts. The resulting emotions usually have intensity. The intensity of resulting emotion after the appraisal can be so high that it could overwhelm the individual, which might cause a delay in performing the secondary appraisal or complete omission of secondary appraisal, as many people struggle to think properly because of sudden changes in a situation.

• Secondary appraisal is the second appraisal that an individual performs consciously. This appraisal focuses on our ability to cope with new situations. The intensity of the resulting emotion can vary depending on the ability of the individual.

E. Interdependence of Physiology and Emotions

As Schachter singer two-factor theory suggests that emotion can cause physiological changes like an increase in heartbeat, sweating, trembling, etc. This theory does not believe that emotions are first felt and then labelled. This theory believes that emotions are both inherent and acquired through experiences of life. This theory also believes that emotions can greatly affect the physiology of an individual, like extreme rage or fear can cause an increase in heart rate and an adrenaline rush at the same time sadness may cause a slower heart rate, tear production, a feeling of heaviness, and changes in breathing patterns (like sighs or shallow breathing). It can also dampen

energy levels and overall physiological activity. This shows that emotions not only affect our physiology, but different emotions have different impacts on our body.

Not only do emotions affect our physiology our physiological changes also affect our emotions. For example, teenage children undergo various physiological changes that cause them to act erratically. And mood swings are also prevalent in girls who are undergoing menstrual periods. This proves that both physiology and emotions are interdependent and interrelated under certain conditions. This could lead to a vicious cycle in which physiological change caused by an emotion again causes a person to feel that same emotion. A person may remain stuck in this vicious cycle until he or she is helped by someone else. In some cases, depression can cause obesity, and it is seen that obese people have a higher chance of getting depression. So, a person having depression can get obese due to their depression, which will eventually cause him or her to fall more into depression. This cycle will continue until he or she receives help from friends, family, or an expert.

F. Contexts and Emotions

Emotions of a person are also affected by the context in which they are invoked. As this theory suggests, we feel emotions like a spectrum of light. Every context has its place in this spectrum of emotions, whenever an emotion is felt place of the shift to a new place depending upon the situation. For example, a person enjoying his birthday may feel terrified because of some accident that happened on his last birthday. The places of these contexts also change with time. For example, a friend of an individual hasn't met for a long time, suddenly meets him again, he may not feel the same intensity of affection for him, and if that individual doesn't remember him or her, it is more likely he will feel no affection for him.

Here, the word context is used to refer to any person, place, thing, animal, conversation, action, memory, thoughts, possibilities, etc, anything that could cause change in emotions that a person is currently experiencing.

Through, spectrum-like nature of emotions and the context in which we can explain why the emotion felt by a person is different for his sister, mother, and wife. Although these emotions are usually deemed to be affection, which does not justify why a person feels differently for different people, even though they are part of a family. Here, different relations act as contexts and are placed in different places in the emotional spectrum of that person.

G. Construction of Emotions

The Constructed emotion theory suggests that emotions are constructed based on individual experiences, cultural influences, and context. Just like the Constructed emotion theory, the Integrated variable emotion theory also suggests that emotions over a long period through various experiences, cultural influence, contexts, overall upbringing, etc. And this helps us to understand why people who have never experienced depression fail to define it. The Integrated variable emotion theory also proposes that different people feel different numbers of emotions. The lifelong experiences, cultural influences, and contexts can make a person more or less emotional person, for an indefinite period of time.

H. Empirical Evidence

Here are some empirical evidences related to the concepts discussed in the text regarding emotions, appraisal theory, physiology, and context:

1. Spectrum-like Nature of Emotions:

• Study by Russell and Fehr (1994): They conducted research demonstrating the interdependence of emotions, showing that subjects often reported overlapping feelings. For example, happiness and excitement can co-occur, indicating the spectrum nature of emotional experiences.

• Watson et al. (1999): Their research highlighted the high intercorrelation among emotions, reinforcing that people often do not experience discrete emotions but rather a blend, confirming the spectrum analogy.

2. Appraisal of Situations:

• Lazarus (1991): His work on cognitive appraisal established that emotions are profoundly influenced by individual assessments of situations. For instance, studies have shown that stressful situations assessed as threatening lead to different emotional responses compared to those assessed as challenges.

• Frijda (1986): Research shows that primary appraisals can generate strong emotional responses quickly, while

secondary appraisals involve more reflective thought, suggesting a sequence that aligns with emotion intensity.

3. Interdependence of Physiology and Emotions:

• Schachter and Singer (1962): Their twofactor theory study provided evidence that physiological arousal coupled with cognitive labelling leads to emotional experience. In experiments, participants experiencing arousal from adrenaline injections attributed different emotions based on contextual cues.

• Research on Depression and Obesity: Studies have shown a correlation between depression and obesity, supporting the idea that physiological conditions can influence emotional states. For example, a study published in the journal "Psychological Medicine" indicated that individuals with obesity have a higher incidence of depression, creating a feedback loop.

4. Contexts and Emotions:

• Research by Williams et al. (1997): This study demonstrated that external contexts, like reminders of past experiences, can significantly influence emotional responses. Participants who encountered contextual cues related to past trauma reported heightened anxiety, even if the current situation was neutral.

• Contextual Influences on Emotion Regulation: A study by Gross (1998) showed that individuals vary in emotional responses based on the context in which they perceive an emotion. Participants adjusted their emotional expressions differently depending on situational contexts, demonstrating the effect of environmental factors on emotions.

These empirical evidences underscore the complexity of emotions and how they are shaped by various factors, including individual assessments, physiological states, and contextual influences.

VI. Multi-Dimensional Emotion Model

The Integrated Variable Emotion Theory suggests that emotions overlap and do not have distinct boundaries separating one from another. Additionally, this theory posits that we can experience multiple emotions simultaneously, often with one emotion being more intense than the others. Explaining this concept using twodimensional models is nearly impossible, so a better approach is to consider higher dimensions. Although we cannot physically represent higher dimensions on paper, we can perform calculations in those dimensions, so computers and AI can do. Arrays, a data structure that stores a collection of data items usually of the same type in a single organized container, can support calculations in higher-dimensional spaces.

Multi-dimensional Emotion Theory proposes to use a coordinate axis to represent each emotion, and at different intensities. This multi-dimensional plane will be used to represent the overlapping spectrum of emotions. In this multidimensional plane, there would be various points referring to various contexts and a point representing the current emotional state. Whenever an emotion is invoked with respect to a context, the point representing the current emotional state will move towards the point that refers to that context by (S).

To calculate the amount of shift that the current emotional point will experience when moving towards an invoked context point in a multi-dimensional emotion space, you can use a formula based on the distance and a designated shift factor.

Let's define the variables first:

P(current): Current emotional point (vector)

P(context): Invoked context point (vector)

S: Shift factor (a value between 0 and 1 representing how much to move towards the context point) The formula to calculate the new emotional point P(new) can be expressed as follows:

P(new) = P(current) + S.(P(context)-P(current))

Where:

P(new) is the new emotional state after the shift.

S determines the proportion of the distance to be covered towards the context point. The value (S) lies between zero and one, which can be used to customise how much our emotional AI is. If (S = 1), the current emotional point moves completely to the context point; if (S = 0), it remains unchanged.

This formula effectively allows you to calculate the new emotional point by considering how far you want to move towards the context point based on the shift factor (S). Adjusting (S) alters the intensity of the shift.

Now, if another context point is invoked, then the previous context point changes its place to the coordinates of the current emotional point, then our current emotion point will move toward the new context point.

Illustration of Multi-dimensional Emotion Theory

Concept Overview:

Imagine a 3D space where each axis represents different emotions. For simplification, let's define three key emotions:

- X-axis: Happiness
- Y-axis: Sadness
- Z-axis: Anger

In this 3D emotion space, every point represents a combination of these emotions at varying intensities.

Initial Setup:

1. Current Emotional State (P(current)): Let's assume your current emotional point is at coordinates (2, 3, 1):

- Happiness: 2
- Sadness: 3
- Anger: 1

Invoked Context Point (P(context)):A new context is introduced, represented by the point (5, 1, 4):

- Happiness:5
- Sadness: 1

• Anger: 4

3. Shift Factor (S): Decide a shift factor, say S = 0.5, indicating how emotional our AI is.

Calculation:

Using the formula to find the new emotional point:

P(new) = P(current) + S.(P(context) - P(current))

Substituting the values:

Current Point: P(current) = (2, 3, 1)

Context Point: P(context) = (5, 1, 4) Shift Factor: S = 0.5

Calculating the change in each axis:

1. Delta in Happiness:

Delta X = S. (5 - 2) = (0.5). (3) = 1.5

2. Delta in Sadness:

Delta Y = S. (1 - 3) = (0.5). (-2) = -1

3. Delta in Ange:

Delta Z = S. (4 - 1) = (0.5). (3) = 1.5

New Emotional State:

Now, add these changes to the current emotional state:

New Happiness: (2 + 1.5 = 3.5)

New Sadness: (3 - 1 = 2)

New Anger: (1 + 1.5 = 2.5)

Thus, the new emotional point (P(new)) becomes:

P(new) = (3.5, 2, 2.5)

This represents your adjusted emotional state as you move partially towards the invoked context. Although this illustration uses a third-dimensional space but we can perform these calculations in higherdimensional planes as well to represent any number of emotions, each assigned to its own axis.

VII. Conclusion

In conclusion, the exploration of human emotions through the Integrated Variable Emotion Theory and the multidimensional emotion model offers a fresh perspective on understanding and interpreting emotional experiences. By integrating insights from various established theories, this research underscores the complexity and dynamic nature of emotions. Emotions are not merely responses derived from basic instincts or solely shaped by environmental context, rather, they arise from a rich interplay of both innate and situational factors. As Emotion AI continues to evolve, implementing a nuanced understanding of these emotional dynamics will be crucial for developing AI systems that can authentically engage with human users. Enhancing the emotional intelligence of AI not only promises to transform interactions across diverse sectors, such as customer service and mental health,

but it also has the potential to foster deeper connections between humans and machines. Future efforts in this field should continue to focus on refining emotion recognition technologies and improving the emotional responsiveness of AI, paving the way for more empathetic and effective human-computer interactions. By doing so, we can revolutionize the way technology understands and responds to our emotional realities, ultimately enhancing the quality of our daily experiences.

VIII. References

Here is a list of references that could support the research presented in this paper on Integrated Variable Emotion Theory and the Multi-Dimensional Emotion Model.

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These references provide foundational knowledge related to proposed theories and models, helping to ground this work in established research.