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Artificial Creativity – Early Analyses of LLMs’ Creative Approaches

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Abstract

This study explores AI creativity through a two-pronged experiment: ChatGPT for language processing and MidJourney for text-to-image synthesis. Both models focused on expressing Ekman's six basic emotions. By manipulating ChatGPT's 'temperature' to vary linguistic creativity and using these outputs to guide MidJourney's image creation, the research examines the nuanced capabilities of AI in generating emotionally resonant artworks and linguistically complex prompts. The study's findings highlight two significant contributions of AI to creative domains: firstly, AI's ability to evoke specific emotions in viewers through art, effectively bridging the gap between synthetic cognition and human emotion; and secondly, AI's development of unique artistic styles, a result of assimilating and reinterpreting diverse artistic influences. These insights not only broaden our understanding of AI's creative capabilities but also point towards its potential to significantly enrich the artistic landscape.

Keywords: creativity, art, artificial intelligence (AI), human, emotions, ChatGPT, MidJourney

Introduction

In an exploration of creativity through the dual lenses of human and artificial intelligence, one is impelled to juxtapose the inherently organic, irrational processes of the human mind against the mechanistic, algorithmic operations of AI. On one

hand, human creativity is marked by its unpredictability, a function of the capriciousness of human thought and emotion, a variegated tapestry of cognitive processes driven by conscious reasoning, unconscious intuition, sensory perception, and individual emotional responses (Simonton, 2000); on the other hand, AI creativity is deterministic, reliant on pre-coded algorithms and the data it has been trained on, and while this might intuitively suggest a stifling of originality, this is not necessarily the case (Guadamuz, 2017).

Furthermore, it is of noteworthy significance to consider the dissimilar ontological basis of human and AI creativity. A human being's life experiences, cultural background, and even biological predispositions confer upon them a unique perspective that seeps into their creative endeavours; whereas an AI system, bereft of personal experiences and physiological sensations, operates on a purely abstract plane, processing data and producing outputs devoid of subjective interpretation (Boden, 1998). Yet, paradoxically, this abstraction can prove beneficial. With its ability to remain impartial, unswayed by the sentiments that might cloud a human creator's judgement, an AI can mine, synthesize, and create from vast swaths of data, engendering outputs that are both original and expansive (Kasparov, 2017).

Notwithstanding the distinguishing factors outlined previously, one should not discount the potential of a symbiotic relationship between human and AI in fostering creativity (Lubart, 2005). It is conceivable, and indeed evident in multiple contemporary instances, that AI can augment human creativity, acting as a tool to explore and expand the boundaries of human imagination; simultaneously, humans provide AI with the necessary guidance, curating the inputs and shaping the algorithms that determine AI's creative outputs (Oh et al., 2018).

The examination of human and AI-driven creativity reveals a fascinating chiaroscuro, marked by both stark contrasts and intriguing overlaps (Lubart, 2005). It compels us to reassess our preconceptions about creativity, to perceive it not merely as a divine spark confined to sentient beings, but as an emergent property that can arise from the interplay of deterministic algorithms and stochastic elements (Boden, 1998). Consequently, this exploration not only illuminates the manifold facets of creativity but also, in a broader sense, encourages us to reflect upon the evolving relationship between humans and the machines we create (Amabile et al., 1996).

Literature review

What is creativity: overview, definitions and concepts

The conceptualization of creativity is multifaceted. Nonetheless, nearly all definitions of creativity encompass the twin elements of novelty and value (Ford & Gioia, 2000; Sarkar & Chakrabarti, 2011). Novelty refers to the originality of the idea or product, while value refers to its usefulness or appropriateness in a particular context. These two characteristics form the bedrock of creativity, transcending disciplinary

boundaries and providing a common thread linking diverse conceptions of creativity (Boden, 2004).

In the realm of the social sciences, creativity is often considered as a sociocultural construct. This perspective posits creativity as a phenomenon that is not only shaped by, but also contributes to, the sociocultural milieu it is part of. It's not the mere novelty of an idea or product that defines its creativity, but rather its acceptance and recognition within a specific social group, culture, or field (Glăveanu, 2010). This view underscores the subjective, context-dependent nature of creativity.

An organizational perspective, meanwhile, typically situates creativity as an engine for innovation and growth. Here, creativity is considered as the ability to generate ideas, solutions, or products that are both novel and valuable for the organization. The emphasis is placed on the functional utility of creative outputs and their potential to foster organizational success (Woodman, Sawyer & Griffin, 1993).

In this context it makes sense mentioning Big-C Creativity, that refers to eminent, groundbreaking creativity—the type of creativity that leads to paradigm shifts and leaves a lasting impact on a field or society at large. Big-C Creativity is the domain of individuals who achieve breakthroughs, pioneer new concepts, or produce masterpieces (Sawyer, 2011). These are the Mozarts, the Einsteins, the Picassos of their respective fields—individuals whose creative contributions have shaped the course of history. This form of creativity is often associated with traits such as exceptional talent, expertise, persistence, and a high degree of motivation (Plucker, Beghetto & Dow, 2004).

In contrast, the construct of everyday creativity, also known as little c creativity, represents a departure from traditional conceptions of creativity that tend to privilege grand, world-changing ideas or creations—the "Big C" creativity often associated with eminent artists, inventors, and innovators (Beghetto & Kaufman, 2007). By contrast, everyday creativity, sometimes referred to as "little-c" creativity, recognizes the creative potential inherent in daily life and ordinary activities

While these two forms of creativity may seem drastically different, they are not mutually exclusive. Rather, they can be seen as points along a creative continuum, representing the range of creative potential (Beghetto & Kaufman, 2007). Little-c creativity serves as a foundation, a starting point that can, under the right conditions and with the right nurturing, evolve into Big-C Creativity. Understanding creativity in this manner allows for a more nuanced, inclusive perspective, acknowledging that while not everyone can or will achieve Big-C Creativity, the capacity for little-c creativity is inherent in all of us (Kaufman & Beghetto, 2009).

Human creativity: how it can be described and measured

Creativity models – definitions and assessments

There are multiple models and theories trying to measure and explain creativity from various perspectives. Among some of the most prominent models can be named Amabile's componential model (Amabile, 2011), the systematic model of Csikszentmihalyi (Csikszentmihalyi, 2015), theory of multiple intelligences (Gardner, 1995) and threshold theory (Runco & Albert, 1986).

Thus, Amabile's Componential Model was proposed by a renowned psychologist Teresa Amabile. The model posits that creativity emerges from the confluence of three factors: domain-relevant skills, creativity-relevant processes, and intrinsic task motivation. Domain-relevant skills encompass technical, procedural knowledge and talent in a certain field. Creativity-relevant processes refer to cognitive styles and personality traits that favor independent thinking and risk-taking. Intrinsic task motivation implies the inner drive to engage in a task due to its inherent interest, challenge or involvement (Amabile, 2011).

When it comes to creativity measurement, this model underscores the multidimensional nature of creativity and the importance of intrinsic motivation. However, the model may be hard to operationalize and measure quantitatively due to its reliance on intrinsic factors and subjective evaluations of creative performance (Amabile, 2011).

Csikszentmihalyi's Systems Model suggests creativity is an interaction among the individual, the domain, and the field. The individual refers to the person who makes a novel contribution; the domain denotes a set of symbolic rules and procedures, while the field represents the group of experts who act as gatekeepers to the domain (Csikszentmihalyi, 2015). The Systems Model offers a socio-cultural perspective on creativity, emphasizing that creativity is not just a personal attribute but also a function of the cultural and social context. From a measurement standpoint, this model provides a broad framework for evaluating creativity. However, its wide scope might make it difficult to apply specific measurement tools as it encompasses not only individual characteristics but also domain and field attributes, which can be more challenging to assess (Csikszentmihalyi, 2015).

Finally, the Threshold Theory of Creativity posits a relationship between intelligence—as often measured by IQ—and creativity. Specifically, the threshold hypothesis suggests that above a certain IQ level—approximately around 120—there isn't a significant positive correlation between intelligence and creativity (Akhtar & Kartika, 2019). In other words, having an IQ above this 'threshold' does not necessarily mean that a person will exhibit higher levels of creativity (Preckel, Holling & Wiese, 2006).

This perspective stems from empirical observations suggesting that while individuals with lower IQ scores generally display lower creativity, those with high IQs exhibit a wide range of creativity. This dispersion of creativity at high intelligence levels implies that factors other than intelligence become more critical in determining creativity once an individual's IQ surpasses the threshold (Shi et al., 2017). This might include traits such as openness to experience, risk-taking, persistence, and intrinsic motivation, among others (Erbas & Bas, 2015). Nonetheless, some researchers argue that the creativity-intelligence relationship may not be as simple or linear as the threshold model suggests. They point out that creativity and intelligence are multifaceted constructs that can manifest in diverse ways across different domains or tasks (Mumford, 2003). Therefore, the relationship between them may vary depending on the specific facets or domains being considered. Moreover, the choice of creativity measures and the context in which creativity is expressed may also influence the observed relationship (Shalley & Gilson, 2004).

Creativity and emotions

The transformative power of creativity lies in its ability to express and evoke emotions, weaving a rich tapestry of human experiences into diverse forms of art. This process involves leveraging the artist's skill, knowledge, and experiences to shape raw creative energy into a structured form. At this stage, the artist's emotions often permeate the work, providing depth, context, and personal resonance. The reception of art is deeply personal, colored by the viewer's experiences, perceptions, and emotional state (Roberts, 2007). It is at this stage that the emotional impact of the creative work is realized, as the viewer engages with the artwork, interpreting and responding to its themes, forms, and symbols. Art possesses the power to evoke a broad range of emotions, from joy and wonder to sadness and fear. The emotional impact of art can be immediate and visceral, as with a shocking image or a stirring piece of music, or it can unfold more subtly, as with a complex literary narrative or a nuanced performance (Brook, 2022). This emotional engagement can foster empathy, elicit introspection, provoke thought, and even inspire action, making art a potent emotional catalyst. In addition, the emotional impact of art can extend beyond the immediate response. Artworks that resonate deeply often linger in the mind, their themes and images recurring in thoughts and dreams (Greene et al., 2001). This ongoing emotional engagement can deepen and enrich the viewer's understanding of the artwork, leading to new insights and perspectives over time. In essence, the nexus between creativity, art, and emotion is a dynamic and reciprocal one (Cetinic & She, 2021).

The impact of creativity on basic emotions (Paul Ekman model)

According to Paul Ekman, the pioneer in the study of emotions, there are seven primary emotions - anger, surprise, disgust, enjoyment, fear, sadness and contempt. Anger, typically a response to perceived threats or injustices, is a potent emotion that can drive action and communication (Ekman, 1972). Surprise, triggered by

unexpected events or information, can range from pleasant astonishment to unsettling shock (Ekman, 1972). Disgust, associated with aversion and revulsion, often serves as a protective response against harmful substances or morally repugnant actions (Ekman, Friesen & Tomkins, 1971). Enjoyment, manifested in states of joy or pleasure, is crucial for positive reinforcement and overall well-being (Ekman, 1970). Fear, a response to perceived danger or uncertainty, plays a vital role in survival by preparing the body for potential threats. Lastly, sadness, typically experienced in response to loss or disappointment, can facilitate emotional healing and social bonding by promoting introspection and eliciting empathy (Ekman, 1970). Together, these six basic emotions paint a vibrant tableau of human emotional life, guiding our reactions to the world around us and shaping our interpersonal interactions and inner experiences. Each of these emotions, according to Ekman, is universal in human cultures and is associated with distinct universal facial expressions.

Starting with anger, creative pursuits can offer a constructive outlet for this intense emotion. Through expressive forms like writing, painting, or music, individuals can channel and externalize their anger, transforming it into tangible artifacts that allow for introspection and emotional catharsis (Kim, Zeppenfeld & Cohen, 2013). Authors also point out that this creative process can also lead to a shift in perspective, helping individuals to understand and navigate their anger more effectively. (Kim, Zeppenfeld & Cohen, 2013).

On the flip side, the experience of surprise can be intricately tied to creativity, as creative works often hinge on the element of unpredictability or novelty (Becattini et al., 2017). The ability of an artist to elicit surprise can elevate a creative piece, making it memorable and impactful. Simultaneously, the act of creating can also incite surprise within the artist, as the creative process often involves unanticipated discoveries and novel combinations of ideas (Martindale, 1998).

With regard to disgust, the impact of creativity is multifaceted. Artistic expressions can capture and reflect feelings of disgust, offering an avenue for social commentary or personal expression. Conversely, challenging or provocative creative works can elicit disgust, pushing the boundaries of comfort and convention and sparking critical thought and dialogue (Silvia, 2009).

Enjoyment, perhaps, is one of the most readily associated emotions with creativity. The joy of creating, of immersing oneself in the flow of the creative process, can be immensely fulfilling. Moreover, creative works—be it a captivating novel, a beautiful painting, or a stirring piece of music—have the power to evoke deep feelings of enjoyment and appreciation in their audience (Csíkszentmihályi, 1996).

Regarding fear and sadness, creative expression can serve as a therapeutic tool, helping individuals to process, express, and cope with these difficult emotions. Through creative narratives, symbolic representations, or expressive performances,

individuals can externalize their fears and sadness, leading to emotional release and healing. On the other hand, creative works can also evoke fear or sadness, stirring empathetic responses and promoting emotional understanding (Zhao et al., 2018).

In sum, the interplay between creativity and Ekman's primary emotions is profound and multifaceted. Creativity has the power to both elicit and express these emotions, offering a versatile tool for emotional exploration, communication, and transformation (Csíkszentmihályi, 1996).

Creativity and AI: what we know about it up to date

AI's creative capabilities have been a focus of intense research, with machine learning models increasingly demonstrating the ability to generate content that appears creative—from visual artworks, music compositions, to literary prose. However, despite the impressive achievements, the understanding and evaluation of AI's creativity remain complex and contentious issues (Pedregosa et al., 2011).

A significant standpoint revolves around the concept of computational creativity, which posits that AI systems can be genuinely creative (Lamb, Brown & Clarke, 2018). Proponents argue that AI, especially advanced machine learning algorithms, can generate novel and valuable outcomes—two key criteria for creativity—by identifying patterns, extrapolating from existing data, and producing unique combinations or variations. On the other side of the spectrum is the perspective that while AI can mimic or simulate creative behavior, it lacks true creativity (Pedregosa et al., 2011).

Nonetheless, here comes the idea of co-creation and of using AI as tool for expression of human lived experiences, intrinsic motivations, and subjective interpretations (Kasparov, 2017).

When an artist uses AI as a tool, it amplifies their creative capabilities, enabling them to generate novel patterns, intricate designs, and complex structures that might be difficult or time-consuming to achieve manually. Simultaneously, the artist, as the initiator and curator of the AI-driven creative process, imbues the resulting artwork with their personal experiences, ideas, and feelings. (Boden, 1998).

Critics argue that AI's "creativity" is fundamentally derivative, grounded in the patterns and structures inherent in the training data. When AI systems create art, they leverage existing works, extracting patterns and features from a dataset of human-created art, and generating new combinations or variations (Kasparov, 2017). Herein lies a critical point of contention: while AI can adeptly manipulate and combine elements from existing works, its process lacks the personal, emotional, and cultural contexts that permeate human creativity (Boden, 1998). Without conscious awareness or emotional engagement, AI's outputs, however novel or aesthetically pleasing, are mere products of sophisticated computation, lacking the depth and richness of human-created art (Lamb, Brown & Clarke, 2018).

The theory of Generative Adversarial Networks (GANs) offers a significant contribution to this debate (Karras et al., 2018). GANs, composed of two neural networks—the generator and the discriminator—competing against each other, have demonstrated impressive abilities to generate highly realistic images, music, and text. Some argue that the creative process of GANs mirrors aspects of human creativity, with the generator acting as the innovator producing novel ideas, and the discriminator serving as the critic evaluating the quality and novelty of these ideas (Cádiz Macaya, Cartagena & Parra, 2021).

Another notable concept in this discourse is the notion of co-creativity, which suggests a collaborative model where AI and humans work together to enhance the creative process (Heusel et al., 2017). In this view, AI serves as a tool or a partner that augments human creativity, providing new possibilities for creative expression and innovation. This perspective highlights the potential of AI to broaden the creative landscape, while acknowledging the irreplaceable role of human ingenuity and subjectivity (Jeon et al., 2021).

Finally, ethics is another critical aspect that needs careful consideration as we further delve into the realm of AI and creativity. Questions about the originality, ownership, and responsibility of AI-generated creative works are becoming increasingly pertinent (Gafni et al., 2022). As AI continues to push the frontiers of creativity, we must ensure that these advances are accompanied by thoughtful, inclusive, and robust ethical frameworks.

Creative AI: contradiction or new development?

Proponents of AI's creative potential often point to the concept of generative creativity (Fleming et al., 2007). Here, creativity is defined as the generation of novel, unexpected, and valuable outcomes. From this perspective, advanced AI systems, such as machine learning algorithms and Generative Adversarial Networks (GANs), indeed possess a form of creativity (Chen et al., 2018). These systems can process vast amounts of data, identify patterns and structures, and generate outputs that are both novel and, in many cases, aesthetically pleasing or conceptually intriguing. This capability has been demonstrated in a range of fields, from visual arts, music, to literature and beyond.

Critics, however, raise fundamental questions about the nature and source of AI's "creativity" (Herremans & Chew, 2018). They argue that, despite the novelty and value of its outputs, AI lacks key elements inherent to human creativity—namely, consciousness, intentionality, and emotional understanding. According to this view, true creativity requires more than just the ability to generate new combinations or extrapolations (Ramstead et al., 2016). It involves a deep, subjective understanding of the world, a capacity to imbue creations with meaning and emotion, and a sense of purpose or intent behind the creative act. From this perspective, AI's "creativity" is seen as a form of sophisticated mimicry, impressive in its technical prowess but

fundamentally lacking in the depth and richness that characterize human creativity (Ryff, 1989).

A related debate revolves around the concept of originality in AI-generated creative works. Some argue that AI, by its nature, can only produce derivative works, as its outputs are grounded in the patterns, structures, and styles inherent in the training data. Others, however, point out that human creativity, too, is deeply influenced by existing cultural, artistic, and intellectual traditions (Acar et al., 2017). They contend that originality does not necessarily entail a complete break from the past, but can involve novel reinterpretations, combinations, or extensions of existing elements—a process that AI is well-equipped to perform.

An emerging perspective in this discourse is the notion of co-creativity, which proposes a model of creativity that involves a synergistic interaction between AI and human agents (Summerville et al., 2017). This view acknowledges both the impressive capabilities of AI and the irreplaceable role of human consciousness, intentionality, and subjectivity. Co-creativity emphasizes the potential of AI as a tool or a partner that can enhance and expand human creative possibilities, rather than as a competitor or a threat.

However, the advent of AI in the creative domain also raises significant concerns. One prevalent worry is the potential devaluation of art and creative works (Bengio, 2007). As AI becomes increasingly adept at generating content that mimics human creativity there is a fear that the market might become flooded with AI-generated works, thereby diluting the value of human-created art (Miller, 2019).

Empirical part

ChatGPT and MidJourney: overview of two AI models

ChatGPT-4 is an advanced language model developed by OpenAI. Built upon the foundational GPT (Generative Pretrained Transformer) architecture, ChatGPT-4 belongs to the fourth iteration of this model series. As a language model, the primary function of ChatGPT-4 is to generate human-like text based on the input it receives. It is trained using a large corpus of text data and learns to predict the next word in a sentence by understanding the context of the preceding words. This mechanism equips it with the ability to generate highly coherent and contextually appropriate responses. (OpenAI, 2023).

What distinguishes ChatGPT-4 from its predecessors is the sheer scale of its model size and the richness of the training data it has been exposed to. It's designed to understand a wide range of prompts, generate detailed responses, and handle deeper conversational context. However, despite its capabilities, it's essential to note that as of its training cut-off in September 2021, it doesn't possess real-time awareness or access to data beyond this point. (OpenAI, 2023).

ChatGPT-4, like all AI models, is a tool and not a conscious entity. It doesn't have beliefs, desires, or emotions, and while it can generate text on various topics, it doesn't possess personal experiences or opinions. It's a reflection of the data it was trained on and operates solely within the constraints of its programming and training (OpenAI, 2023).

MidJourney is an innovative AI model designed to transform textual inputs into stunning pieces of visual art. Leveraging the power of artificial intelligence, MidJourney employs advanced machine learning algorithms to interpret text-based prompts and translate them into artistic imagery. This AI model represents a significant stride forward in the sphere of AI-generated art, with its results spanning a wide array of styles and themes, which are as diverse as they are captivating (Wankhede, 2023).

In its operational mechanism, MidJourney does not rely on traditional grammar or sentence structure. Instead, it interprets input prompts based on specific word choices, where each word carries a profound influence on the final output. The model's behavior is influenced by the intricacy of the input and how descriptive the prompts are, thus enabling users to produce unique images by creatively manipulating their textual inputs (Wankhede, 2023).

One of the distinctive attributes of MidJourney is the way it brings an element of unpredictability and surprise into the process of art creation. The images it generates are seldom completely controlled or expected, as the model's interpretation of input prompts can be quite diverse and sometimes even surprising. It has the potential to create a wide range of outputs, from abstract representations to intricate realistic visuals, all determined by the ingenuity and creativity of the input prompts. This unique feature lends an exploratory and experiential dimension to the process of AI-assisted art creation (Wankhede, 2023).

Experiment description

In order to investigate the nuances of artificial intelligence creativity, we constructed a two-fold experiment utilizing the capabilities of two advanced models: ChatGPT, a language processing model, and MidJourney, a text-to-image synthesis model. The latter was tasked with producing imagery based on one-word prompts that corresponded to Ekman's six basic emotions: anger, disgust, fear, happiness, sadness, surprise and contempt. These prompts were used to stimulate the AI's creative process, and the resulting artwork was evaluated for its capacity to visually express the intended emotion.

On the other hand, for ChatGPT, the challenge was different, due to its orientation towards language rather than imagery. We leveraged its language processing capability by asking it to generate more intricate prompts corresponding to each of Ekman's emotions, following the guidelines provided for MidJourney's prompts (2023). These newly created prompts were then fed to MidJourney, which

consequently generated new images. To further add complexity to the experiment, we manipulated the “temperature” parameter in ChatGPT, intending to observe the effects of this alteration on the linguistic creativity of the prompts, and subsequently, the imagery produced by MidJourney.

The concept of “temperature” is an important factor in the functioning of models like GPT-4. In the context of AI language models, temperature is a hyperparameter that controls the randomness of the AI's responses. A lower temperature, such as 0.2, makes the model's output more focused and deterministic. It makes the model more likely to choose the most probable output for each step, leading to more coherent and conservative text. This can be beneficial for generating grammatically correct and logical responses, but it may also lead to repetitive or less creative outputs. On the other hand, a higher temperature value, such as 0.8 or 1.0, introduces more randomness into the model's output. The model is less likely to choose only the most probable outputs and more likely to consider less probable options, leading to more diverse and potentially creative responses. However, this can also result in outputs that are less consistent or make less sense in certain contexts.



This unique experiment bridges the gap between the domains of text and image, exploiting the innovative potential of AI creativity in a novel manner.

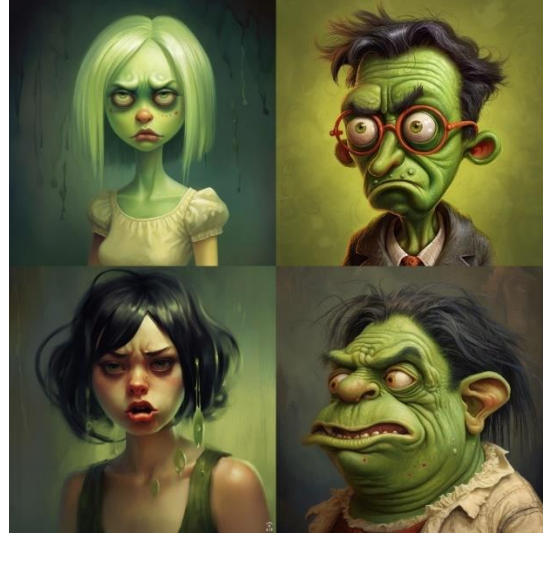

MidJourney: analysing single word prompt outcomes against creativity definitions



The assessment of Mid Journey's creativity abilities in this research takes on an intriguing two-step process. Initially, the AI model is presented with succinct, emotion-oriented prompts such as "anger" or "happiness". These terms, rooted in Ekman's theory of basic human emotions, are intended to stimulate the model's creative algorithm, prompting it to generate corresponding imagery. By doing so, the research explores the capacity of the AI to conceptualize and articulate emotional states in a visually creative medium, essentially transforming abstract emotional constructs into tangible, interpretable art forms.


The second phase of the assessment process deepens this exploration by re-introducing the AI-generated artwork back into the Mid Journey model. This time, however, the model is asked to provide a textual description of the art pieces (always the left top art piece of each quadrant), elucidating the inspirational sources underpinning its creative output. By doing so, we hope to unearth the AI's potential stylistic influences and artistic preferences, offering a layered understanding of its 'artistic personality'. In essence, this self-reflective approach allows the AI to deconstruct its own creative process, revealing the intricate interplay between its algorithmic design and the creative choices it makes. The outcomes of the experiment are presented in the Table 1.

Table 1. Graphic representation and textual description of Ekman’s basic emotions from a single word prompt

Emotion	Graphic representation by MidJourney	Description by MidJourney
Anger		<p>The human male's face is painted in bright red and screaming, in the style of energy-filled illustrations, realistic genre scenes, hard-edged painting, dark amber and white, ravencore, paleocore, colorful explosions</p> <p>The image of an angry man screaming in the fire, in the style of realistic marine paintings, radiant clusters, paleocore, realistic hyper-detailed portraits, bold graphic illustrations, sculpted</p>
Happiness		<p>Daniel waldheim, 'retrospective exhibition' 2009, in the style of highly imaginative worlds, lowbrow, lively tableaus, sci-fi baroque, high detail, sky-blue and crimson, sepia tone</p> <p>A piece was created by dee john and jim muir at a summer party, in the style of surrealist dreamscapes, pieter-jansz van asch, naoto hattori, depiction of everyday life, geof darrow, naive childlike, steampunk influences</p>

<p>Disgust</p>		<p>A colorful image of this green zombie girl, in the style of grotesque caricatures, reylia slaby, victor nizovtsev, expressive character design, trish mistic, cartoon-like characters, sombre</p> <p>Zombie portrait by kate wilson, in the style of cartoon-like characters, digital art techniques, green, dark fairy tales, airbrush art, cute cartoonish designs, intense emotion</p>
<p>Sadness</p>		<p>ad girl portrait art hd pictures by mark, in the style of loish, gloomy metropolises, nightcore, drip painting, dark gray, michael malm, loose gestures</p> <p>a woman with black hair is crying, looking down at her hands, in the style of digital painting and drawing, anime-inspired characters, i can't believe how beautiful this is, soggy, melancholic symbolism, dark teal and light black, oil paintings</p>

<p>Fear</p>		<p>An image of a child crying for help in the middle of many monsters, in the style of mark henson, illusionary spaces, mark keathley, distorted bodies, david finch, ghostcore</p> <p>The dreaded hell scene fantasy photo by jim oolen, in the style of mark henson, emphasizes emotion over realism, raina telgemeier, jimmy lawlor, lithograph, dark gray, joyful chaos</p>
<p>Surprise</p>		<p>Red explosion by john allen wilson art 2156729 john allen wilson art 21, in the style of caricature-like illustrations, hyperrealism, emotional storytelling, blink-and-you-miss-it detail, caravaggesque, playful and colorful depictions, bloomcore</p> <p>Painting by charlotte sprice how to surprise, in the style of explosive and chaotic, exaggerated expressions, realistic hyper-detail, tenebrism effects, joyful chaos, red and bronze, colorful caricature</p>

<p>Contempt</p>		<p>A painting of a woman sitting in a chair as part of a group, in the style of alex gross, brucetimm, sam spratt, layered imagery with subtle irony, violent, grainy, vintage elegance</p> <p>A painting of women sitting next to each other in a chair, in the style of pulp comics, elegant, emotive faces, eerily realistic, american iconography, sharp attention to detail,</p>
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ChatGPT: creativity variations based on adjustment of AI temperature scale



In order to test ChatGPT creativity it was decided to adjust its temperature settings to assess variations in creativity. The adjustment of temperature in the context of artificial intelligence models has a substantial impact on the creativity of the output produced. In essence, the temperature parameter helps to tune the randomness of the AI's output, thereby influencing the novelty and variation in its creative processes.

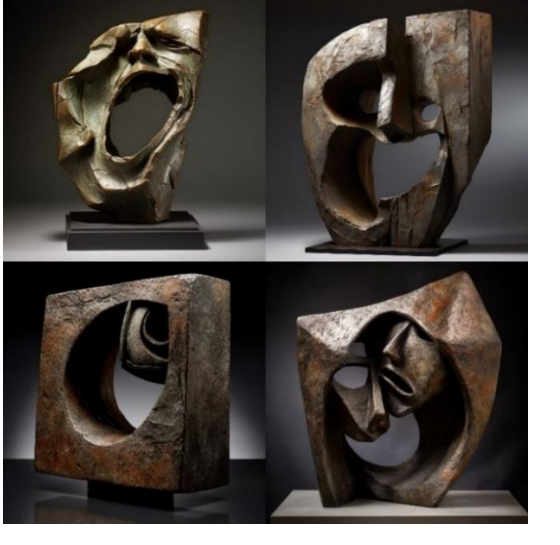

Chat GPT, temperature 1.




The AI was asked to come up with the prompt for each of six Ekman emotions based on the MidJourney guidelines for prompt generation (Attachment 1). Afterwards, the prompts generated by ChatGPT were given to MidJourney for a further image generation.

At a temperature of 1.0, the model maintains a balance between exploration and exploitation during the generation process. That is, it picks outputs that are both likely (according to its learned patterns from training data) and occasionally surprising, thus maintaining a moderate level of diversity in its responses. The outcomes of the experiment are presented in the Table 2.

Table 2. ChatGPT prompt, temperature 1 and related Graphical representation by Mid Journey

Emotion	ChatGPT prompt	Graphical representation by Mid Journey
Anger	<p>Construct an artistic rendering of 'anger', expressed through a dynamic, vibrant painting. This piece should depict a tempestuous seascape under a stormy sky, metaphorically representing the tumultuous nature of anger. Consider utilizing bold, intense colors to evoke a sense of turbulent emotion. The overall mood of the artwork should be raw and passionate, mirrored in the wild waves and dark skies of the seascape.</p>	
Enjoyment	<p>Create a tableau of 'enjoyment' through a sunny, outdoor photograph. Perhaps a group of friends on a beach, their faces alight with joy. Use natural, ambient light to enhance the feeling of warmth and happiness, with the azure sky and sea as a serene backdrop. The overall composition should be candid and filled with infectious joy, perfectly encapsulating the emotion of enjoyment.</p>	



<p>Disgust</p>	<p>Represent the emotion 'disgust' with a bold, thought-provoking sculpture. A distorted, abstract form might suffice to symbolize this complex emotion. Employing a material with an unsettling texture, like corroded metal or rough stone, might enhance the evocation of disgust. The overall mood should be unnerving and challenging, inviting viewers to confront and ponder this discomforting emotion.</p>	
<p>Sadness</p>	<p>Capture 'sadness' in the form of a poignant, monochromatic sketch. The subject could be a solitary figure in a bare room, their posture and expression the epitome of melancholy. The lack of color should emphasize the somber mood, allowing the viewer to fully engage with the emotion being portrayed.</p>	


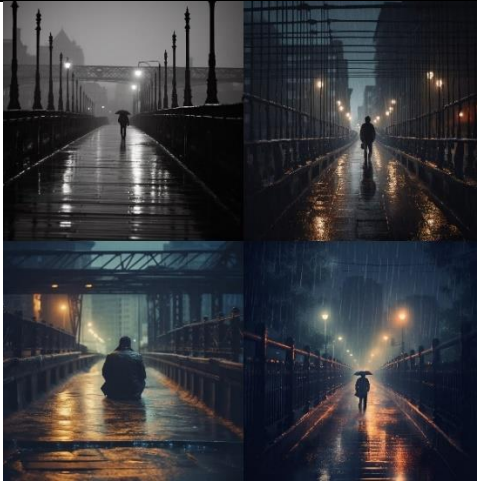

Fear	<p>Convey the sensation of 'fear' via an atmospheric digital illustration. Envision a character navigating through a dimly lit, eerie forest. The lighting should be minimal, perhaps a sliver of moonlight piercing through the dense canopy, creating an air of unease. The overall mood should be suspenseful and chilling, effectively portraying the emotion of fear.</p>	
Surprise	<p>Fashion an image that encapsulates 'surprise'. This could be an illustration of a character, animal or human, caught mid-expression in a startling event within a fantastical environment. Keep the colors bright and lively, and the mood energetic and unpredictably delightful, to underline the theme of surprise.</p>	
Contempt	<p>Manifest a stark representation of the emotion 'contempt'. Depict this emotion within the confines of a crisp, monochromatic photograph. The subject of this photograph should be an individual in the midst of an urban environment. Concentrate on the individual's expression, ensuring that it profoundly embodies contempt, with the urban backdrop acting as a stark contrast.</p>	


ChatGPT, temperature 1.5

As compared to temperature 1, a temperature of 1.5 increases the randomness in the selection process. With a higher temperature setting, the AI model is more likely to produce diverse and potentially unexpected outputs. It gives more weight to less probable predictions, thereby increasing the element of surprise and creative deviation in the generated responses. However, a significant increase in temperature could also lead to less coherence and grammatical accuracy in the output. The results of the experiment are presented in the Table 3.

Table 3. ChatGPT prompt, temperature 1.5 and related Graphical representation by Mid Journey

Emotion	ChatGPT prompt	Graphical representation by Mid Journey
Anger	A fierce, angered person glaring intensely, with flames in the background	 <p>The image shows four distinct AI-generated portraits of people with intense, angry expressions. Each person is set against a background of bright, orange and yellow flames. The individuals vary in appearance, including different hair styles and clothing, but all share the same intense, glaring look.</p>
Enjoyment	A lighthearted person smiling radiantly, relaxing on a beach during sundown with bright and warm colors surrounding them	 <p>The image shows four distinct AI-generated portraits of people with joyful, smiling expressions. They are all depicted sitting on a beach, looking towards the ocean. The background is a vibrant sunset with warm orange, yellow, and pinkish hues. The individuals vary in appearance, including different hair styles, glasses, and clothing, but all share the same relaxed and happy demeanor.</p>

<p>Disgust</p>	<p>A disgusted figure pinching their nose, eyes squinted in distaste, surrounded by the stench of waste</p>	
<p>Sadness</p>	<p>A lonely person in tears, downtrodden by the weight of worries and the sober atmosphere in rain-triple dim lit bridge-street</p>	
<p>Fear</p>	<p>A trembling individual, eyes wide open with goosebumps, acknowledging doorstep of eerie haunted mansion enveloped beneath a cold blue eerie night</p>	

<p>Surprise</p>	<p>A gasping person, wide-eyed, and with hands over their mouth in shocked disbelief</p>	
<p>Contempt</p>	<p>An individual rolling their eyes, smirking, while displaying a dismissive attitude</p>	

Discussion

The results garnered from the implemented experiments present a compelling narrative around the modulating nature of AI creativity, contingent upon the type of user input. On the one hand, the experiments demonstrate the pivotal role of user guidance in steering AI's creative processes. By utilizing a single-word prompt, one imbues the AI with a higher degree of creative autonomy, allowing it to parse the prompt in its unique manner, unfettered by explicit directions. Conversely, detailed prompts funnel the AI's creativity along a specified trajectory, thereby creating a reciprocal relationship where the human can ascertain the degree of his creative

influence in the resultant art piece. It is in this symbiosis of human and artificial creative faculties that the promise of AI-augmented creativity truly unfurls.

Our second observation pertains to the dynamism of AI creativity in response to temperature variations of the language model, ChatGPT. In the scenario with a temperature setting of 1, the generated prompts exhibit an enhanced level of detail and descriptiveness, exuding an overall softer disposition. Notably, the prompts explicitly state the artistic medium for the emotional representation, leading to an eclectic mix of artistic forms and styles in the resultant creations. This finding underscores the potential of detailed, nuanced prompts in engendering diversity in AI-produced art, challenging conventional ideas of automated creativity.

In contrast, with the temperature setting heightened to 1.5, the generated prompts are considerably more succinct, straightforward, and arguably, possess a more radical character. The AI seems to forgo the request for a variety of forms and instead coalesces its descriptions around entities such as 'person' or 'individual'. Consequently, the ensuing art pieces present less diversity in terms of form, opting instead for more direct, emphatic expressions of the specified emotions. This outcome ostensibly contradicts the expectation of increased diversity with higher temperature settings, albeit underpinning the proposition that these settings might elicit more intense expressions.

In summation, the experiments delineate the complex dynamics of AI creativity influenced by both the nature of human input and model temperature adjustments. It brings forth the intriguing paradox where longer, more detailed prompts potentially enhance creative diversity, while shorter, direct prompts may lead to less diverse yet more specific depictions. It is in navigating these multifaceted dynamics that the future evolution of AI creativity lies, potentially ushering in a new era of co-creation between humans and artificial intelligence.

Conclusion

The intriguing outcomes from the empirical study underscore an essential characteristic of AI in the realm of creative art – its ability to evoke specific emotions in viewers. AI's capacity to conceptualize emotions such as happiness or disgust, and translate these into visual representations, hinges on its learning from vast datasets. These datasets can include countless human expressions of such emotions across various art forms. The resulting artwork, as the current study indicates, manages not only to represent the intended emotion, but also to elicit a corresponding emotional response in the viewer. This affirms that AI can, indeed, capture and convey an array of human emotions in a way that resonates with human viewers, in essence, bridging the gap between synthetic cognition and human emotion.

Further, findings that AI-created artworks possess unique artistic styles is an equally compelling revelation. It illustrates AI's potential to assimilate myriad artistic influences and generate distinct stylistic expressions. This could be attributed to the

extensive variety and richness of the artistic data it draws from during the training process, which subsequently allow it to devise novel combinations, variations, and interpretations. As such, AI's creative prowess extends beyond mere emulation or reproduction; it embodies the generation of unique and distinctive artistic styles. These findings expand our understanding of AI's creative capabilities, pointing towards a future where artificial intelligence might contribute substantially to the evolving landscape of artistic creativity.

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