The effect of embodiment in emotional responses to AI-generated and human-made art

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Abstract

This study investigated the effect of embodiment on emotional responses to AI-genereated versus human-made art. Art is an important part of human life, with the ability to evoke a wide range of emotions. While emotional responses to human-made art are found in research, research on how AI-generated art evokes emotions remains limited. As AI is becoming more common in creating art, understanding its influence on emotions is important. The embodiment simulation theory suggests that adding embodiment influences emotional engagement in viewers. Thus, this study explores how adding an embodiment to AI-generated artworks and human-made artworks may affect emotional responses. Using a 2 by 2 design, participants viewed artworks with varying embodiment types (human arm or robot arm) and author types (AI-labeled vs human-labeled). The emotional responses were measured in four categories: positive, negative, epistemic, and aesthetic emotions. Results showed that author type did not significantly influence emotional responses. While embodiment had a significant effect on the aesthetic emotions but did not significantly affect the other emotional categories. These findings partially support the embodiment simulation theory, suggesting that embodiment can influence emotional engagement. Future research should explore the effect of different types of embodiment on emotional responses to art.

Key words: AI-generated art, human-made art, emotional responses, embodiment simulation theory

AI statement

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The effect of embodiment in emotional responses to AI-generated and human-made art

Art has been an important part of human life, serving as a way of self-expression and communication (Agius, 2018). Fine art encompasses various forms, including painting, sculpture, architecture, and print (Prowda, 2016; Hagtvedt et al., 2008). Commonly, art is defined as the practice of creating perceptible forms that communicate a feeling (Hagtvedt et al., 2008). Specifically, the experience of art is connected to perception and understanding, with its ability to evoke emotions (Pelowski et al., 2016; Gerger et al., 2014; Hagtvedt et al., 2008). Beyond its cultural significance, visual art positively impacts health and mental well-being, can stimulate participation in culture, and increases creativity (Stuckey & Nobel, 2009; Marciszewska & Marciszewski, 2021; Parker, 2008). Emotional expression plays a key role in art, as creators channel their feelings into their artworks to connect with viewers (Gao & Yin, 2024). However, these experiences have primarily been associated with human art, with limited research exploring responses to AI-generated art (Xu & Hsu, 2020).

The rapid rise of artificial intelligence (AI) in recent years has sparked discussion regarding the perception and value of AI-generated art in the creative field (Park et al., 2023). Artificial intelligence can be defined as the capability of a computer or computer-controlled robot to perform, create, or solve tasks that typically require intelligent beings (Paaß & Hecker, 2024). AI tools are increasingly used to create visual art, compose music, and write poems (Park et al., 2023). These systems allow both artists and non-artists to input detailed text prompts, which the AI then translates into images, with the option to generate them in various styles based on the prompt (McClelland, 2022; Lyu et al., 2022; Mustafa, 2023; Huang, 2024). In this context, AI-generated art refers to images created by AI systems using human-provided prompts. Platforms such as OpenAI's DALL-E, Midjourney, and Adobe Firefly are notable examples of

AI technologies capable of transforming text prompts into visual art (Smith et al., 2023; Messer, 2024). As AI-generated art is becoming more common, research has shifted to understanding how people perceive and evaluate these visual artworks (Lyu et al., 2022).

While human-made art is found to evoke emotions, it is less clear whether AI-generated art can evoke the same type or intensity of emotions. Emotional interaction, defined as the exchange between the creator and the viewer through the artwork, may be modified when the creator is AI (Gao & Yin, 2024). This study refers to human-made art as art entirely created by human artists, whereas AI-generated art involves the use of AI systems to create art. Research by Heider & Simmel (1944) found that viewers can feel intention in movements from non-human entities, such as from geometrical shapes. Additionally, Millet et al. (2023) found that AI-labeled art typically elicits less awe than human-made art, as creativity is often associated with human attributes, leading viewers to experience less awe in response to AI-labeled art. Similarly, Demmer et al. (2023) demonstrated that human-made art tends to elicit more positive emotions, such as happiness and amusement, suggesting that computer-labeled art elicits less intense positive emotions. This difference may stem from viewers' difficulty in recognizing AI as artists, leading them to perceive AI-generated art as lacking intentionality (Demmer et al., 2023). AI is often viewed as a tool rather than a creative entity, diminishing its ability to connect emotionally with the viewers (Lyu et al., 2022).

Moreover, most studies about AI have solely focused on the aesthetic evaluation of AI-generated art rather than the emotional responses they elicit, revealing a bias against AI-labeled artworks (Millet et al., 2023; Park et al., 2023; Ragot et al., 2020; Bellaiche et al., 2023). AI-labeled art is often perceived as less creative and emotionally less impactful than human-made art, even though viewers often struggle to distinguish between the two (Park et al.,

2023). However, Chamberlain et al. (2018) found that incorporating AI artists in the form of a robot arm embodiment led to more positive aesthetic evaluations compared to only using an AI label. Embodiment refers to the physical presence of the creator, whether human or robotic. A more positive evaluation may arise from the viewer's ability to observe the AI's process of creating the art (Chamberlain et al., 2018). This raises questions about how embodiment, whether human or robotic, might influence emotional responses by providing insight into the process of creating art.

Furthermore, embodiment plays a role in how viewers engage with artworks and is often reflected in the creations of artists (McClelland, 2022; Taylor et al., 2012). The movements, such as brushstrokes, convey information that can deepen the viewer's appreciation by revealing aspects of the creative process (McClelland, 2022; Taylor et al., 2012). According to embodied simulation theory, observing actions like brushstrokes triggers mental stimulations in viewers, allowing them to "feel" the artist's creative process and intentions (McClelland, 2022; Freedberg & Gallese, 2007). This sense of embodiment enhances their connection to the artwork by allowing them to "feel" the creative process of the artist. These visible gestures, such as brushstrokes, not only provide sensory information by seeing the shapes and textures but also activate motor areas in the brain. Through the embodied simulation, the viewer visualizes the artist's movements mentally, connecting with the artist's intention and movements during the creative process (Gallese, 2019; Gallese, 2017). Moreover, actively perceiving the creation process through brush movements has been shown to increase viewers' liking of the artwork and may elicit more positive emotional responses (Ticini et al., 2014). This suggests that embodiment in art stimulates viewers to "feel" the actions and emotions in an artwork (Sherman & Morrissey, 2017; Gallese, 2017). However, the absence of a physical creator in AI-generated art may limit

emotional engagement as viewers struggle to connect and sense intentionality. Incorporating an embodied creator into AI systems might stimulate emotional engagement with these works (McClelland, 2022).

Although there is growing interest in AI-generated art, the existing research has focused on aesthetic evaluations such as likeability and creativity rather than emotional responses to the artworks. The role of an embodied creator, whether human or robotic, in influencing viewers' emotional engagement with AI-generated art remains unexplored. Research suggests that observing an artist's physical involvement in the creation process can enhance the viewer's emotional connections to the artwork. Understanding how embodiment affects emotional responses to AI-generated art may help reduce the bias toward AI and create a connection between the viewer, the artist, and the artwork. To address this gap, this study will explore the following research question: "*What is the effect of embodiment in AI-generated versus human-made artwork on viewers' emotional responses?*"

Theoretical framework

Art

Art has been an important part of human history for thousands of years, with early artistic creation dating back at least 40,000 years, and serves as a way of self-expression and communication (Agius, 2018; Mather, 2020; Stamkou et al., 2024). Creative expression of visual arts such as drawing, painting, sculptures, and photography often reflects human thoughts and expressions (Oudgenoeg, 2024; Stamkou et al., 2024). The creation of visual art, such as an artwork, is a process through which artists express their ideas. This process involves a few fundamentals, such as arranging light, colors, and composition, but it is primarily driven by the creative decisions of the artists (Lyu et al., 2022). According to Hagtvedt et al. (2008), artworks

are often perceived as tangible manifestations of human emotions. Similarly, Tan (2000) defines art as human-created artefacts designed to fulfil a range of functions, including aesthetic, religious, entertainment, or functional use. These definitions make art' one of the most complex and expressive human achievements (Tan, 2000).

Emotional responses to art

Art has the ability to evoke different emotions in the viewer, ranging from joy and awe to sadness and nostalgia (Schindler et al., 2017; Nummenmaa & Hari, 2023; Stamkou et al., 2024; Van Paasschen et al., 2015). These emotional responses are not only essential to the aesthetic experience but also influence aesthetic judgments, as they encompass more than just evaluations of liking or beauty (Schindler et al., 2017; Chatterjee & Vartanian, 2014). Emotional responses play an important role in making aesthetic judgments about art (Eskine et al., 2012). The current study focuses on differences in emotional responses to AI-generated and human-made art.

A way to explain how viewers respond to art is through the aesthetic triad framework, which suggests that emotional responses are an important aspect of the aesthetic experience of art (Chatterjee & Vartanian, 2014). The triad consists of three systems: sensory-motor, emotion-valuation, and knowledge-meaning systems. The sensory-motor system involves the perception of visual features, such as texture, color, and composition, as well as the movements and gestures found in the artwork. These gestures engage the motor system; this engagement taps into the mirror neuron system and can be linked to the embodiment simulation theory that builds on the sensory-motor foundation (Chatterjee & Vartanian, 2014).

The emotion-valuation system processes the evaluation of how art makes viewers feel when engaging with the artwork. The emotional responses can range from positive emotions such as liking and pleasingness to more complex emotions such as awe, wonder, shame, or anger

(Leder et al., 2004; Silva, 2005). An artwork is often evaluated as positive when it evokes positive emotions. For example, artworks judged as pleasing are often associated with more positive emotions, while artworks that are perceived as lacking meaning or quality tend to elicit more negative emotions (Leder et al., 2004). Depending on the viewer and context, art can also evoke mixed emotions. For example, an artwork evaluated as beautiful can still be able to evoke positive or negative emotions, such as sorrow or joy, separating aesthetic evaluations and emotional responses to artworks (Chamberlain, 2022).

The knowledge-meaning system helps viewers shape their experience with an artwork. Through the context, artist or artwork's backstory, title, or value of the artwork, viewers form judgments about whether they like the artwork and if they perceive the meaning behind it (Chatterjee & Vartanian, 2014; Chamberlain, 2022). Moreover, prior knowledge of art, style usage, or how artists work can bias how viewers interpret and judge the artwork (Chatterjee & Vartanian, 2014). For example, presenting artwork in an artistic context can help evaluate even "disgusting" images as art (Chamberlain, 2022).

A tool designed to measure these emotional responses evoked by artworks is the Aethemos scale (Schindler et al., 2017). The scale divides the emotional responses into four categories: aesthetic emotions, pleasing emotions, epistemic emotions, and negative emotions. Aesthetic emotions are the feelings viewers feel when evaluating an artwork on appreciation and liking (Schindler et al., 2017). Positive emotions are commonly associated with the pleasing aspects of the experience. These are influenced by the aesthetic qualities of the artwork, such as its composition, color, and theme (Schindler et al., 2017; Kemp & Cupchik, 2007). On the other hand, negative emotions can arise due to the subjective nature of art, which may not resonate with every viewer (Schindler et al., 2017). For instance, boredom, fear, or confusion may occur if

the artwork fails to capture the viewer's interest or when they struggle to comprehend its meaning (Schindler et al., 2017). Furthermore, epistemic emotions such as interest, curiosity, and surprise often emerge when an artwork encourages viewers to engage with it, understand its elements, or discover its meaning (Schindler et al., 2017).

Art's ability to evoke emotions also depends on how closely artworks mimic real-life experiences. For example, an image of someone approaching with a knife might evoke fear, whether seen in a painting or a photograph (Gerger et al., 2014). Artworks with negative themes, such as aggression or alienation, are perceived as more emotionally complex compared to those with lighter, positive themes like social gatherings (Kemp & Cupchik, 2007). However, even when the artwork's content features negative scenes or objects, art tends to evoke mostly positive emotions (Nummenmaa & Hari, 2023). For instance, Eskine et al. (2012) found that experiencing fear when watching an art can lead to enhanced liking of the art. Additionally, colors in artworks have also been found to evoke certain emotions, such as the color red, which is associated with anger, whereas the color yellow is associated with happiness. Each distinct color in an artwork may evoke distinct emotions (Lin et al., 2018).

Despite the research on how human-created art evokes emotions, research on AI-generated art remains limited. As AI increasingly contributes to the creative business, understanding its potential to evoke similar emotional responses as human-generated art can be beneficial (Xu & Hsu, 2020; Park et al., 2023).

Embodiment simulation theory

Embodiment simulation theory, linked to the aesthetic triad, suggests that when observing an action, the human mirror system is activated, causing similar brain areas to activate as if the viewer were performing the action themselves (Freedberg & Gallese, 2007). This theory

describes a process where the brain and body systems "mirror" what we see others doing, allowing viewers to create a connection through embodiment (Gallese, 2006; Gallese & Sinigaglia, 2011). This mechanism connects perception and execution, allowing viewers to mentally experience the actions seen (Gallese & Sinigaglia, 2011). Thus, the feeling of physical involvement in an artwork provokes a representation of the action seen in the artwork, enhancing the emotional responses to the work. This suggests that physical involvement is an important aspect of the aesthetic experience of art (Gallese, 2017). Embodied simulation plays a crucial role in the experience of art by potentially creating a connection between the viewer and the artists (Gallese, 2017). Research has shown that even static images can trigger this action simulation in the brain. For example, viewing an image of a hand reaching to grab an object activates the motor repression of grabbing (Freedberg & Gallese, 2007).

Embodiment simulation theory in art

Freedberg & Gallese (2007) propose that the gestures of artists during the creation of an artwork, such as brush movements, activate the motor representations in the viewer's brain, influencing emphatic engagement with the artwork. Mirror neurons respond to these actions, allowing viewers to mentally visualize the creation process without having to physically perform them (Gallese, 2017; Freedberg & Gallese, 2007). This mechanism explains why people may feel a sense of empathy or connection when perceiving movements in artwork. Through embodied simulation, viewers experience the artist's actions, which enhances their sensory engagement with the artwork (Gallese, 2017).

Beyond gestures, visual elements such as shapes and textures in an artwork influence emotional responses. These elements activate sensory processing, allowing viewers to feel the physical movements of the artwork, such as its shape and texture. Through the embodied

simulation, viewers can mentally perceive the artist's intention by connecting through the visual elements in the artwork (Gallese, 2019). For example, studies found that curved lines and symmetrical shapes, such as circles, are mostly associated with positive emotions, while sharp asymmetrical shapes, such as triangles, tend to be associated with negative emotions (Manippa & Tommasi, 2021; Van Paasschen et al., 2014; Lin et al., 2018). According to the embodied simulation theory, these responses are connected to the sensory processing, as viewers “feel” the visual elements of the shapes (Gallese, 2019). As the curved shapes evoke different feelings than the sharp shapes (Manippa & Tommasi, 2021; Van Paasschen et al., 2014).

The perception of the creation process, such as observing hand movements or brushstrokes, may enhance viewers’ emotional engagement and appreciation (Taylor et al., 2012; McClelland, 202). Witnessing these actions activates motor representations in the brain, helping viewers connect with the effort and intention behind the artist's creation of the artwork (McClelland, 2022). Even implicit movements, such as the marks and strokes visible in the final artwork, evoke similar responses (Freedberg, 2019). Ticini et al. (2014) found that actively perceiving artistic gestures increases viewers’ liking of the artwork. Leder et al. (2004) showed that when viewers have an increased appreciation or liking of the artwork, the emotional responses evoked can be experienced as positive. This suggests that embodiment in art stimulates viewers to “feel” the actions and emotions in the artwork (Sherman & Morrissey, 2017; Gallese, 2017).

The creation of art is considered to be a complex process that involves a sequence of actions, with a range of possibilities available for artists to create (Daniel, 2020; Messer 2024). Art is typically an extension of the artist's experiences. Human artists are inspired by nature, sounds, discussion, and feelings engaging with the world (Messer, 2019). Which an AI is never

exposed to and does not process the same way humans do (McCormack et al., 2019). In contrast, AI is capable of generating artwork but does not engage with the world the same way as humans. Its creative process is guided by a human giving a prompt to create, as it lacks independent intention (McCormack et al., 2019). The artist's intention is woven into the artwork's expression, since intentionality is viewed as an effort to express emotions through creative outputs (Moura, 2023).

However, Heider & Simmel (1944) research shows that viewers can perceive intention in the movements of non-humans, such as geometrical shapes. However, as AI lacks a physical creator, it may be more difficult for the viewer to emotionally connect with the artwork, as AI is seen as more of a tool to help create (Coeckelbergh, 2023; Lyu et al., 2022). Leder et al. (2012) further suggest that aesthetic empathy and pleasure may come from bodily resonance between the viewer and the perceived movement of the creator. The embodied simulation theory suggests that introducing an embodied creator to AI-generated art might enhance emotional engagement (McClelland, 2022). This indicates that allowing viewers to observe the AI's creation process may lead to more positive emotions and evaluations of the artwork (Chamberlain et al., 2017).

Artificial intelligence in visual art

How people judge artificial intelligence has become a more popular issue (Chiarella et al., 2022). However, a gap remains as to how people emotionally engage with an artwork when AI is the artist (Di Dio et al., 2023). Artificial intelligence (AI) refers to the capability of a computer or computer-controlled robot to perform, create, or solve tasks that typically require human intelligence (Paaß & Hecker, 2024). In recent years, AI tools have become increasingly common and are now widely used to create visual art, compose music, and write poems (Park et al., 2023). These systems enable both artists and non-artists to input detailed text prompts, which the

AI then translates into images, allowing for varied stylistic outputs based on the prompt (McClelland, 2022; Lyu et al., 2022; Mustafa, 2023; Huang, 2024). AI platforms such as OpenAI's DALL-E, Midjourney, and Adobe Firefly are notable examples of AI technologies capable of transforming text prompts into visual art (Smith et al., 2023; Messer, 2024). Through the increased popularity of AI, the expertise traditionally required for creative tasks is no longer always needed (Moura, 2023). Consequently, AI and its advancements in generating realistic creative outputs have become an important area of research (Park et al., 2023; Smith et al., 2023; Messer, 2024).

Despite these advancements, research reveals a negative bias against AI-labeled art. Several studies found that AI-labeled works are often rated less favorably on likeability, beauty, and creativity than human-created art (Millet et al., 2023; Park et al., 2023; Ragot et al., 2020; Bellaiche et al., 2023; Chamberlain et al., 2018). Bellaiche et al. (2023) used exclusively AI-generated images and randomly labeled them as either human or AI-made, finding that AI-labeled images were rated less favorably on liking and worth of the image. In contrast, Ragot et al. (2020) included both AI and human-created images, which were labeled as AI or human, corresponding to the author, and found similar negative biases against AI labels. Chamberlain et al. (2018) further showed the existence of a bias against AI when viewers had to label if an artwork was AI or human-made, with AI images being aesthetically valued less. Furthermore, Park et al. (2023) and Neef et al. (2024) observed that viewers struggled to distinguish AI-generated art from human-made art. While viewers generally recognize AI-generated artworks as art, they often do not consider AI to be an artist (Mikalonytė & Kneer, 2022). Research suggests that compared to human artists, AI may not be perceived as an artist capable of investing effort and time to create deeply communicative artworks (Neef et al., 2024).

Moreover, emotional responses to AI-labeled art may differ from human-created art. While AI-labeled art has been found to evoke emotions such as joy, amusement, and pleasure, studies suggest that human-created art often elicits stronger positive emotions and greater awe (Xu & Hsu, 2020; Millet et al., 2023; Gao & Yin, 2024). AI-labeled art may not evoke empathy in viewers since it does not have a physical artist that viewers can empathize with, taking their perspective (Neef et al., 2024). The lack of deeper emotional responses to AI-generated art may stem from the lack of visible presence of the artist's intention (Demmer et al., 2023; Oudgenoeg, 2024). AI might evoke more surface-level emotions, while human art may trigger a deeper emotional response. However, Chamberlain et al. (2018) found that incorporating AI artists in the form of a robot arm led to more positive aesthetic evaluations compared to only using an AI label. Adding an embodiment of the AI artist, such as a robot arm, may enhance the emotional responses by allowing viewers to actively perceive the creation process, creating a more empathic response toward AI (Chamberlain et al., 2018).

Additionally, viewers perceive AI as less creative and view AI as a tool rather than an artist (Demmer et al., 2023; Coeckelbergh, 2023; Lyu et al., 2022). This contrasts with the embodiment stimulation theory, which suggests that viewing the artist's actions influences emotional responses and creates a connection between the artist, artwork, and viewer (Freedberg & Gallese, 2007; Gallese, 2017). To bridge this gap, integrating the presence of a physical creator could enhance the responses to AI-generated art (McClelland, 2022).

Present study and hypotheses

As AI advances in the creative industry, this study suggests that embodiment might be a factor in enhancing how people emotionally respond and connect with art, specifically with AI-generated

art. Exploring how embodiment influences emotional responses to AI art will provide insight into how AI is perceived. Therefore, the following hypotheses are proposed:

As emotional responses are an important aspect of evaluating art, previous studies found that human-made artwork generally evokes deeper emotional responses compared to AI-labeled artwork (Xu & Hsu, 2020; Millet et al., 2023). This difference can be connected to the intentionality found in human-made art, which creates a connection between the viewer and the artists (Iosifyan, 2021). Research indicates that viewers are more likely to empathize with human artists, viewing their work as an expression of personal experiences and emotions (Oudgenoeg, 2024; Stamkou et al., 2024; Leder et al., 2004). The visible brushstrokes, textures, and movements in the artwork show the artist's intentionality. The embodied simulation theory explains that viewers can “feel” these movements, allowing viewers to connect more with the artwork (Gallese, 2019; Chatterjee & Vartanian, 2014). In contrast, AI-generated artworks are often rated less favorably, as they might lack intentionality or emotional expression of a human artist Mikalonytė & Kneer, 2022; Millet et al., 2023; Park et al., 2023; Ragot et al., 2020; Bellaiche et al., 2023; Chamberlain et al., 2018; Coeckelbergh, 2023). Since AI lacks a physical creator, viewers may struggle to form an emotional connection with the artwork, as they do not perceive the same expression of movements from the artists (Neef et al., 2024; Mikalonytė & Kneer, 2022). Thus, AI-generated artworks may not create the same emotional connection as human-made artworks (Coeckelbergh, 2023; Lyu et al., 2022).

H1: The human-labeled artworks will elicit stronger emotional responses than the AI-labeled artworks.

According to the embodiment simulation theory, viewers tend to engage empathically with seen actions, thereby feeling the intention and emotion behind the creator of the artwork

(Gallese, 2006; Gallese & Sinigaglia, 2011; Gallese, 2017). The gestures, marks, or strokes made by the artist are further enhanced when embodiment is present, as it enhances the viewer's connection to the artwork. The present embodiment activates the motor representation in the viewer's brain, influencing their empathic response towards the artwork (Gallese, 2017; Freedberg & Gallese, 2007; Sherman & Morrissey, 2017). Embodiment has been shown to increase the liking of artworks, as it fosters an emotional connection by allowing the viewers to "feel" the movements of the artist movements (Freedberg, 2019; Ticini et al., 2014). This process can enhance the experience of the viewer, creating an empathic response toward the artwork (Gallese, 2017; Sherman & Morrissey, 2017). Consequently, adding an embodiment element, whether AI or human, creates a connection between artwork, artist, and viewer and enhances emotional engagement.

H2: The artworks with embodiment (human or AI) will evoke stronger emotional responses compared to artworks without embodiment.

Research by Chamberlain et al. (2018) found that AI-labeled art is often perceived as less emotionally impactful due to biases toward AI and their lack of intentionality. Adding an AI label to an artwork creates a more negative evaluation of the artwork. Incorporating embodiment elements, such as a robot hand in the creation process, may reduce this bias and enhance the viewer's connection to the artists (Gallese, 2006; Gallese & Sinigaglia, 2011; Chamberlain et al. 2018). The embodiment simulation theory suggests that visualizing an artist's active creation and involvement can enhance emotional engagement (Gallese & Sinigaglia, 2011). Seeing the gestures and strokes made by an artist creates a connection and ability to feel the actions in the viewer, enhancing their liking to the artwork and thereby may be increasing their emotional responses (Sherman & Morrissey, 2017; Gallese, 2017). By giving the AI a physical artist

through embodiment, it can enhance the connection between the artist and the artwork. This may create increased liking and thereby show stronger emotional responses to AI-labeled artworks with embodiment than only using a label.

H3: AI-labeled artworks with embodiment will evoke stronger emotional responses than AI-labeled artworks without embodiment.

The evaluation of art is an aesthetic experience and helps engage the viewer with the artwork. Studies suggest that human-made artwork has a certain intentionality and ability to evoke emotions, which can be enhanced by embodiment (Chamberlain et al., 2018; Gallese & Sinigaglia., 2011; Iosifyan, 2021). Human artists are seen as intentional creators, expressing personal experiences and emotions through their work, creating an emotional connection with the viewer (Messer, 2019; Moura, 2023). Adding embodiment by showing the brushstrokes made by the artists can enhance the connection between the actions of the artist and the viewer, enhancing emotional engagement (Gallese, 2006; Gallese & Sinigaglia, 2011; Gallese, 2017).

However, Heider & Simmel (1944) found that non-human shapes can show intention. Thus, adding a robot arm as an embodiment element simulating the movements of a human artist may evoke similar emotional responses. While embodiment in AI-labeled artworks may improve the emotional responses, they may still be considered as a tool to use that is lacking intentionality and may not foster a deep connection with the viewer (Demmer et al., 2023; Coeckelbergh, 2023; Lyu et al., 2022). This aligns with research suggesting that human artists are perceived as more creative and able to evoke deeper emotional responses, suggesting that human-made artworks with human label and with embodiment are more emotionally engaging than AI-labeled artworks with embodiment (Xu & Hsu, 2020; Millet et al., 2023).

H4: Human-labeled artworks with embodiment will evoke stronger emotional responses than AI-labeled artworks with embodiment.

Method

The objective of the study was to test if embodiment had an effect on the emotional responses of the participants with AI and human-generated art.

Design

This study follows a between-subjects design with two independent variables: the labeling of the artwork's author (human-labeled vs. AI-labeled) and the embodiment condition (with embodiment vs. without embodiment). The dependent variables were the strength of the emotional responses (positive, negative, epistemic, and aesthetics) elicited by the artworks.

Participants

A total of 131 participants were recruited for this study through convenience sampling via the researcher's social network. The participants consisted of 36.6% male ($N = 48$), 60.3% female ($N = 79$), 2.3% were non-binary *(*$N = 3$), and 0.8% filled in other ($N = 1$). The conditions in the questionnaire were randomly distributed. Participants were aged between 18 and 35 years old ($M = 25.0$, $SD = 3.84$) and were asked about their education level and frequency of viewing art. Additionally, a background in art was not included in the search of participants.

Measures

Demographic questions

Participants were asked about their educational level with the question, "What is your highest level of education completed?" Response options included: "High school graduate," "MBO," "HBO," "University bachelor's degree," "University master's degree," "Doctorate/PHD," and "Other, please specify." Additionally, participants were asked about their frequency of viewing

art using a scale by Beatty et al. (2020), with response options including “Daily,” “Weekly,” “Monthly,” “A few times a year,” and “Never.” Participants’ responses varied, with 1 participant reporting viewing art daily, 8 viewing art weekly, 14 reporting monthly, 94 reporting a few times a year, and 14 reporting never viewing art.

Emotional responses

To measure participants’ emotional responses, the Aesthemos scale developed by Schindler et al. (2017) was employed. The scale has a broad range of emotions that can be employed across various domains, such as art (Schindler et al., 2017). The scale consists of 21 emotions, each represented by two items; for example, items such as “delighted me” and “made me happy” fell under the emotion joy, while “made me aggressive” and “made me angry” were categorized under angry (see Appendix A for the full list of emotions). Each item on the scale was rated based on how strongly participants felt the emotion toward the artwork. Participants were instructed to rate each item on a 7-point Likert scale, with 1 indicating “totally disagree” (a weak emotional response) and 7 indicating “totally agree” (a strong emotional response). Additionally, all emotions were presented randomly in statements to the participants.

All 21 items were analysed to determine what range of emotions the artworks evoke. The scale consists of four categories: positive emotions, negative emotions, aesthetic emotions, and epistemic emotions. The Aesthemos scale identified “joy,” “humor,” “vitality,” “energy,” and “relaxation” as positive emotions, which were assessed together to determine whether the artwork evokes positive emotions. In contrast, negative emotions such as “feeling of ugliness,” “boredom,” “confusion,” “anger,” “uneasiness,” and “sadness” were grouped to measure if the artworks evoke negative emotions. Additionally, feelings such as “feeling of beauty/liking,” “fascination,” “being moved,” and “awe” were used to assess the overall aesthetic emotions

toward the artworks. Finally, epistemic emotional responses, including “surprise,” “interest,” “intellectual challenge,” and “insight,” were assessed as they relate to the process of finding meaning during the viewing of an artwork. The emotions “nostalgia” and “enchantment” were not included in the study, as they are considered to evoke mixed emotions, which can have both positive and negative consequences. Additionally, Schindler et al. (2017) found no clear support for incorporating these emotions into the aesthetic emotions scale, as they did not pair with the other emotions within the aesthetic emotion scale.

The Aesthemos scale generally demonstrates good reliability, with 21 subscales, each consisting of two items, all showing a Cronbach's alpha value between 0.70 and 0.85. However, the “awe” and “relaxation” items both demonstrated lower reliability ratings (Schindler et al., 2017). In the current study, a reliability analysis was conducted by grouping the items together based on their corresponding emotions. The items for positive emotions showed a Cronbach's alpha of 0.87, negative emotions showed a Cronbach's alpha of 0.82, the epistemic section showed a Cronbach's alpha of 0.81, and the aesthetic section showed a Cronbach's alpha of 0.91, all indicating good reliability. Schindler et al. (2017) found that the scale covers a broad range of emotions, thereby demonstrating good validity. For an attention check, participants were asked midway through the emotional response questionnaire to select “totally agree.” Participants who failed to select “totally agree” were excluded from the data analysis.

Manipulation check

To verify whether participants paid attention to the stimuli, they were asked, “What artist's label was shown in the artwork you just viewed?” Response options included “The artwork was labeled as AI-made,” “The artwork was labeled as human-made,” and “There was no label/I did not notice.” Additionally, participants were also asked, “Did you see an arm in the show video?”

“The artwork featured a robot arm,” “The artwork featured a human arm,” or “I did not see an arm in the artwork.”

These checks aimed to assess whether participants perceived the intended manipulations of the artworks. When participants correctly answered the question about the arm, it indicated that they noticed the arm element and processed it within the context of the artwork. This ensured that their emotional responses were based on the observed manipulation. Similarly, when participants correctly answered the label question, it confirmed that they actively perceived the label, which could influence their emotional response. Therefore, the correct responses to these checks enhance the internal validity of the study by ensuring that the participant's emotional responses were influenced by the intended manipulations.

Materials

Stimuli

For the study, a total of two stimuli were used, consisting of one human-made artwork and one AI-generated artwork. These two artworks were presented in each condition. In one condition, the two artworks were presented with embodiment (either human or robot), and in the other condition, the two artworks were presented without embodiment. In the condition without embodiment, the artworks were labeled as either “Created by AI” or “Created by a human artist,” with labels randomly assigned regardless of the actual creator. Additionally, the stimuli with embodiment included labels corresponding to their embodiment. For example, if the stimulus featured a human embodiment, the label indicated “Created by a human artist.” Each participant was randomly assigned to one of the conditions and viewed one artwork during the study. Stimuli were shown in random order, and the author label was randomized, as randomization

may help minimize biases in participants' responses to the questionnaire (Loiacono & Wilson, 2020).

A representational style of art was employed to create the artworks. Representational art can be defined as paintings that contain recognizable objects and scenes (Markovic, 2010). A study by Leder et al. (2005) found that viewers better understood and related to representation art. This style features detailed and regular forms, allowing for associations with objects from the physical world (Markovic, 2010). It was found that representational art tends to elicit more emotions in viewers compared to abstract art since representational art has familiar objects (Simolaa et al., 2012). Additionally, research has demonstrated that representational art tends to evoke more positive emotions compared to abstract art; this may be attributed to the perception that representational art is found to have more "meaning" (Pihko et al., 2011; Schepman et al., 2015). In this study, the artworks were evaluated based on their recognizability of the objects and events depicted. Thus, artworks featuring distorted objects were excluded. Ultimately, the selected artworks included landscapes, animals, vehicles, or buildings.

Artworks

The two artworks were divided into one made by AI and one made by humans. The human-made artwork was selected from JSTOR (https://www.jstor.org/), a digital library with a diverse selection of artists and styles. Based on the representational art style, the artwork was searched based on how recognizable the objects and events were. There was no specific artist or year chosen. The other artwork was generated through ChatGPT's Dall-E. To generate a similar artwork to the chosen human-made artwork, AI was given a prompt based on the description, year, and style of painting of the human-made artwork. The chosen artwork by an unknown American artist had a description of a "wintry mountain & whaling boats." Based on that, the

prompt given to the AI was “create a simple realistic oil-style painting from the 1900s with whaling boats and wintry mountains.” See Figure 1.

All artworks are presented in video format. The artworks without embodiment were presented in a loop of 15 seconds, and the artworks with embodiment showed the embodiment for 15 seconds. To determine the video length, the study by Verhavert et al. (2017) found that viewers need 100 ms to extract information from artwork and create meaning from the artwork. Consequently, each video in this study had a duration of 15 seconds. Participants were required to watch for at least 10 seconds before having the option to press a “next” button to proceed.

Figure 1

AI artwork

Note. Image generated using the prompt "Simple realistic oil-style painting from the 1900s with whaling boats and wintry mountains," by ChatGPT, DALL-E, 2024 (https://chatgpt.com/)

Embodiment

In this study, the stimuli with embodiment were presented in a video format of 15 seconds. For the human embodiment, a human hand with a paintbrush was filmed simulating the act of painting. This human embodiment video was overlaid on the two selected artworks using Canva, simulating the illusion that the artwork was actively being painted (see Figure 2). For the robot embodiment, an animation of a robot hand painting with a paintbrush was generated through AItubo, an AI image and video generator (https://aitubo.ai/). This animation was overlaid on the

two artworks using Canva, simulating the action of the AI robot hand actively painting the artwork. The other stimuli were shown as a video without embodiment and only a label; for all the artworks, see Appendix B.

Figure 2

Example of the artwork with human embodiment

Note. In this image, the hand does not move. See Appendix C for the videos with the moving embodiment.

Figure 3

Example of the artwork with AI embodiment

Note. The robot arm is simulating paint-like movements.

Procedure

The survey was administered through Qualtrics (Qualtrics, 2024). Before beginning, participants were required to provide informed consent. After giving consent, they were asked to complete demographic information, including age, gender, educational level, and frequency of viewing art. Following this, participants received a brief introduction informing them that the questionnaire would take about 5 minutes and they would view an artwork for which they needed to provide their thoughts. The introduction asked participants to watch carefully and answer the questions thoughtfully.

Participants were then randomly assigned to one of the four conditions: AI-labeled with embodiment, AI-labeled without embodiment, human-labeled with embodiment, or

human-labeled without embodiment. Based on their assigned condition, they viewed the corresponding artwork. Participants were required to watch the video of the artwork for at least 10 seconds before they could press the “next” button, which led them to the attention check. In this check, participants had to indicate whether the artwork contained a robot or human arm, or if it was labeled as AI or human-created. After completing this check, they proceeded to the questionnaire focused on their emotional responses. All questions of the questionnaire were mandatory to answer. After completing the emotional response questions, participants were asked their thoughts on the identity of the creator of the artwork (AI or human). Finally, participants were debriefed and thanked for their participation.

Data analysis

Data analysis was conducted using Jamovi version 2.3.28 (the Jamovi project, 2024). Participants who completed the whole questionnaire were included in the analysis. Those who took more than 30 minutes or less than 2 minutes to complete the questionnaire were excluded to ensure thoughtful responses. Additionally, participants outside the age range of 18 to 35 years old or who failed to fill in the attention check correctly were excluded. A total of 20 participants were excluded for failing the attention check, and data from 9 participants were excluded for not meeting the age or time criteria, resulting in a final sample of 131 participants.

During the data collection, manipulation checks were performed to ensure that participants were paying attention to the stimuli. Participants were asked about the artists’ label shown in the artwork and about whether they saw a robot, human, or no arm in the video. However, due to a high number of incorrect responses, especially to the label question, it was decided to not exclude participants who answered these questions incorrectly, as this would have led to a large reduction in the sample size.

The statistical analysis was done through a MANOVA to examine overall the effect of artwork type and embodiment condition on emotional responses. The univariate analyses were used to examine the effect of author type and embodiment on the separate emotional categories. Additionally, independent t-tests were conducted to compare the human and AI-embodied conditions and to examine the difference between the AI with embodiment and the AI without embodiment conditions. If significant effects were found, follow-up tests were conducted.

Assumption checks for the analyses included normality tests, outliers through boxplots, and homogeneity of variance. The normality of the data was assessed using skewness and kurtosis values, and all conditions met the assumption of normality. Positive emotions showed two outliers, and aesthetic emotions showed one outlier. Homogeneity of variances was violated only for the aesthetic emotions variable. As a result, Pillai's Trace was reported, as it is more robust to violations of homogeneity (Ateş et al., 2019). For the T-tests, Welch's test was used to account for the violation. Descriptive statistics regarding the normality and homogeneity of variances can be found in Appendix D.

Results

Table 1 presents the descriptive statistics for the emotional responses (positive, negative, epistemic, and aesthetic) across the four conditions (AI-labeled with embodiment, AI-labeled without embodiment, human-labeled with embodiment, and human-labeled without embodiment).

Table 1

Descriptives of the conditions

Emotional categories	Conditions	N	Mean	Standard deviation
Positive emotions	AI-labeled with embodiment	38	3.00	1.18

	AI-labeled without embodiment	25	3.37	0.97
	Human-labeled with embodiment	46	3.46	1.08
	Human-labeled without embodiment	22	3.51	1.07
Negative emotions	AI-labeled with embodiment	38	2.80	0.86
	AI-labeled without embodiment	25	2.65	0.98
	Human-labeled with embodiment	46	2.50	0.76
	Human-labeled without embodiment	22	2.38	0.97
Epistemic emotions	AI-labeled with embodiment	38	3.38	1.23
	AI-labeled without embodiment	25	3.83	1.01
	Human-labeled with embodiment	46	3.64	1.15
	Human-labeled without embodiment	22	3.80	1.09
Aesthetic emotions	AI-labeled embodiment	38	3.10	1.41
	AI-labeled without embodiment	25	3.91	0.88
	Human-labeled with embodiment	46	3.85	1.25
	Human-labeled without embodiment	22	4.39	1.22

H1: effect of author type

The MANOVA was conducted to examine the effect of author type (AI vs human) on emotional responses across the four emotional categories. As one of the emotions violated the assumption of homogeneity of variances, Pillai's Trace was reported, as it is more robust to violations of homogeneity (Ateş et al., 2019). The multivariate test revealed no significant effect of author type, $F(4, 124) = 0.56$, $p = 0.62$, Pillai's Trace = 0.02, $\eta p^2 = 0.02$.

The univariate analysis showed no significant effect for positive emotions, $F(1, 127) = 0.08$, $p = 0.77$, $\eta p^2 = 0.00$, negative emotions, $F(1, 127) = 0.65$, $p = 0.41$, $\eta p^2 = 0.01$, epistemic

emotions, $F(1, 127) = 0.00$, $p = 0.95$, $\eta p^2 = 0.00$, or aesthetic emotions, $F(1, 127) = 0.56$, $p = 0.45$, $\eta p^2 = 0.00$.

The MANOVA did not provide an explicit test for the violation of homogeneity of variances. However, because the univariate test violated this assumption, a Mann-Whitney U test was conducted for the aesthetic emotions, which is more robust against violations of assumptions. The results also showed no significant effect $U = 2023.00$, $p = 0.57$, $r = 0.05$. Therefore, the findings showed no support for H1.

H2: effect of embodiment

The MANOVA was conducted to examine the effect of embodiment on emotional responses across the four emotional categories. The multivariate test revealed a significant effect of embodiment $F(4, 124) = 2.60$, $p = 0.03$, Pillai's Trace = 0.07, $\eta p^2 = 0.07$. Suggesting a small effect of embodiment on the emotional responses.

The univariate analysis showed no significant effect for positive emotions $F(1, 127) = 0.82$, $p = 0.36$, $\eta p^2 = 0.00$, for negative emotions $F(1, 127) = 0.46$, $p = 0.49$, $\eta p^2 = 0.00$, or for epistemic emotions $F(1, 127) = 1.95$, $p = 0.16$, $\eta p^2 = 0.02$. However, the univariate analysis only found a significant effect of aesthetic emotions on embodiment $F(1, 127) = 7.19$, $p = 0.008$, $\eta p^2 = 0.05$.

As the univariate test violated the assumption of homogeneity, an additional Mann-Whitney U test was conducted for aesthetic emotions. The results also showed a significant effect for embodiment on aesthetic emotions $U = 1385.00$, $p = 0.005$, $r = 0.29$. These results provide partial support for H2.

H3: effect of AI conditions

An independent t-test was conducted to compare AI-labeled artworks with embodiment to those without embodiment. For positive emotions, no significant difference was found between the two groups, $t(64) = 0.14$, $p = 0.88$, Cohen's $d = 0.03$. Similarly, for negative emotions, no significant difference was found, $t(64) = -0.02$, $p = 0.98$, Cohen's $d = -0.01$. For epistemic emotions, the results showed no significant difference, $t(64) = 1.08$, $p = 0.28$, Cohen's $d = 0.27$.

For aesthetic emotions, a Welch's test was conducted as homogeneity of variance was violated. The analysis revealed no significant difference between AI-labeled artworks with embodiment ($M = 3.51$, $SD = 1.38$) and AI-labeled artworks without embodiment ($M = 3.91$, $SD = 0.88$), $t(63.81) = 1.42$, $p = 0.15$, Cohen's $d = 0.34$. These results provide no support for H3.

H4: Effect of embodiment conditions

To examine whether human-labeled artworks with embodiment evoke stronger emotional responses than AI-labeled artworks with embodiment, an independent T-test was conducted. The results for positive emotions found no significant difference between the two groups, $t(82) = 0.64$, $p = 0.52$, Cohen's $d = 0.14$. Similarly, for negative emotions, no significant difference was found, $t(82) = 0.24$, $p = 0.80$, Cohen's $d = 0.05$. The results of the epistemic emotions showed no significant difference $t(82) = 0.00$, $p = 0.99$, Cohen's $d = 0.00$.

For aesthetic emotions, a Welch's test was conducted due to a violation of homogeneity of variance. The results showed no significant difference between human-labeled artworks with embodiment ($M = 3.51$, $SD = 1.37$) and AI-labeled artworks with embodiment ($M = 3.52$, $SD = 1.38$), $t(81.75) = 0.01$, $p = 0.98$, Cohen's $d = 0.00$. Therefore, the results show no support for H4.

Discussion

The aim of this study was to explore the effect of embodiment on emotional responses to AI-generated versus human-made artworks. H1 proposed that human-labeled artworks evoke

stronger emotional responses than AI-labeled artworks. However, the findings revealed no significant effect of author type (AI vs human) on the positive, negative, epistemic, or aesthetic emotional responses. This suggests that labeling an artwork as human-made or AI-generated did not significantly impact emotional responses, contradicting prior research suggesting a bias against AI-generated art (Millet et al., 2023; Park et al., 2023; Ragot et al., 2020; Bellaiche et al., 2023; Chamberlain et al., 2018). Notably, most earlier studies focused on aesthetic aspects, such as liking, beauty, or creativity, rather than the emotional responses (Millet et al., 2023; Park et al., 2023; Ragot et al., 2020; Bellaiche et al., 2023; Chamberlain et al., 2018). In contrast, the findings showed no significant effect of author type on aesthetic emotions, indicating that there was no bias toward AI labeling in the emotional aspect.

One possible explanation could be that when participants are reflecting on their emotional responses, they may be less influenced by biases toward AI-labeled art compared to when evaluating aesthetic aspects, such as liking or beauty. When asked to focus on their emotional responses, participants may have focused on their internal reactions to the artwork. Emotional responses are shaped by aesthetic aspects of an artwork, such as color, texture, and composition (Chatterjee & Vartanian, 2014). These visual elements are known to evoke specific emotions, such as happiness or anger, aside from the artist's identity (Lin et al., 2018; Manippa & Tommasi, 2021; Van Paasschen et al.). Since emotional responses play a role in how viewers evaluate art, including judgements of liking or beauty (Eskine et al., 2012). Participants may have focused more on the visual elements than the contextual information over the artists, AI or human labeling. This could have reduced the bias toward the artists' identity, thereby reducing the effect of AI or human labeling on emotional responses.

H2 suggested that the artworks with embodiment will evoke stronger responses compared to artworks without embodiment. The findings partially support H2, as a small significant effect was observed for aesthetic emotions such as liking, fascination, being moved, and awe. This indicates that embodiment enhances aesthetic emotions, even though it did not significantly influence the other emotional categories, including positive, negative, or epistemic emotions. These results partially align with the embodiment simulation theory, which suggests that the use of a moving hand, whether human or robotic, can enhance emotional engagement with the artwork (Gallese, 2017). Previous research studies have similarly found that actively perceiving artistic gestures can increase the liking of artworks, providing further validation for the observed enhancement of the aesthetic emotions (Tinici et al., 2014).

However, the lack of significant effect on the other emotional categories suggests that embodiment may not enhance these types of emotional responses. One explanation could be that the stimuli did not elicit these types of emotions. For instance, epistemic emotions such as curiosity and surprise arise from engagement with the artwork or a deeper understanding of its elements (Schindler et al., 2017). Similarly, positive emotions or negative emotions are often evoked by specific objects or scenes in the artwork. Indicating that the artwork may not have incorporated scenes or objects that evoke these specific emotions, thereby not activating the emotional responses. Additionally, emotions like happiness or anger can occur by color choices, as yellow is associated with happiness and red with anger (Lin et al., 2018). These cues might not have been present enough in the artwork, it could explain the lack of significant effects of the other emotional categories.

For implications, as this study found partial support for the embodiment simulation theory in relation to the aesthetic emotions. The findings demonstrate that embodiment, even in

the form of robotic arm movements, can enhance aesthetic emotional responses. This suggests that the embodiment simulation theory is not limited to human gestures but also applies to robotic movements, broadening its theory. These results have implications for mitigating biases toward AI in the creative field. As previous research found that AI art is evaluated negatively in terms of liking, beauty, and creativity (Millet et al., 2023; Park et al., 2023; Ragot et al., 2020; Bellaiche et al., 2023; Chamberlain et al., 2018). By incorporating an embodiment of, for example, a robot arm simulating paint-like movement, the AI creators may enhance the connection and aesthetic evaluation, helping to lower the biases toward AI. Since, Chamberlain et al. (2018) found that participants showed positive aesthetic responses when they viewed robot artists involved in the creation process. Suggesting that artists using AI to create artworks, including embodiment, may not only improve the aesthetic responses but also might reduce biases toward AI in the creation process.

H3 suggested that AI-labeled artwork with embodiment will evoke stronger emotional responses than AI-labeled artwork without embodiment. The findings revealed no significant difference between the two conditions for any of the emotional categories. Indicating that the participants' emotional engagement with AI-labeled artworks is not influenced by the presence or absence of embodiment. Although previous research suggested that embodiment, particular AI could enhance aesthetic emotions (Chamberlain et al., 2018). Where Heider & Simmel (1944) found that viewers can perceive intention in non-humans, thereby enhancing emotional responses, these effects were not observed in the present study. Suggesting that embodiment may play a role in certain contexts but does not influence emotional responses on AI-labeled artworks in this context. One explanation for these findings could be that the connection between embodiment and emotional responses evoked by AI-labeled artworks are more complex. While

the embodiment simulation theory suggests that observing physical gestures or simulated actions, such as those performed by the robot arm, should enhance emotional engagement, as viewers see the intention and the creation process behind the artwork (Gallese, 2017; Freedberg & Gallese, 2007). For AI-labeled artworks, the lack of a fully visible artist may have reduced the emotional responses. Only using the robotic arm might lack the feeling of a physical artist creating and thereby feeling the intentionality of the AI artists. The knowledge-meaning system suggests that prior biases or knowledge may influence the judgements of art (Chatterjee & Vartanian, 2014).

H4 hypothesized that human-labeled artworks with embodiment would evoke stronger emotional responses than AI-labeled artworks with embodiment. However, the results showed no significant difference between these two conditions in terms of positive, negative, epistemic, or aesthetic emotions. This finding contrasts with previous research suggesting that human-created art typically evokes stronger positive emotions and awe (Xu & Hsu, 2020; Millet et al., 2023). These studies suggest that human artists are perceived as intentional artists capable of connecting with the viewers. While AI is often considered a tool lacking intentionality and the ability to connect with the viewer, not creating an emotional engagement with the viewer (Mikalonytė & Kneer, 2022; Neef et al., 2024; Demmer et al., 2023; Oudgenoeg, 2024). Chamberlain et al. (2018) suggested that the embodiment of AI artists enhances the aesthetic appreciation of the artwork made by AI. However, in the comparison between the two conditions, embodiment did not enhance aesthetic emotions, regardless of whether the artwork was labeled AI or human or was embodied. Similarly, prior research indicated labeling artworks as AI-generated could negatively influence aesthetic evaluations, but these did not directly influence the other emotional responses (Bellaiche et al., 2023; Park et al., 2023). The aesthetic triad may provide an explanation for these results. Emotional responses to art can come from sensory-motor,

emotion-valuation, and knowledge-meaning systems. Labeling and background information about the artist might influence the knowledge-meaning system and, consequently, the emotional responses. The emotion-valuation system is more likely to be influenced by visual features, such as color or composition (Chatterjee & Vartanian, 2014). This suggests that since participants were asked to focus on their emotional responses, they might have focused more on the visual features rather than the labels or creator seen in the video.

As implication, the results of this study add to the growing interest in using AI for creative outputs and if there is a bias toward AI on emotional aspects. As previous research showed a negative evaluation of AI-labeled art on aesthetic aspects (Millet et al., 2023; Park et al., 2023; Ragot et al., 2020; Bellaiche et al., 2023; Chamberlain et al., 2018). The findings found no significant effect on positive or negative emotions based on whether the artwork is labeled AI or human-made, suggesting that emotional responses to art may be less connected to the artist's identity than aesthetic evaluations.

Moreover, this study sought to answer the question, "What is the effect of embodiment on emotional responses to AI-generated versus human-made artworks?" The study findings indicate that embodiment only has an effect on aesthetic emotions. However, it does not appear to influence other emotions that artworks may evoke, such as joy, energy, interest, or surprise. These results contribute to the growing field of AI in the art section by demonstrating that embodiment can enhance the aesthetic appreciation of AI-labeled artworks. Nonetheless, as embodiment did not enhance other emotional responses, further research is needed to explore how different aspects of embodiment could evoke a broader range of emotions.

Limitations

For limitations**,** one limitation of this study is the use of a small stimuli assortment consisting of only two artworks. A broader selection of stimuli, including various compositions, colors, and textures, could provide a more comprehensive understanding of emotional responses. As different visual elements have the potential to evoke different types of emotional responses, and by limiting the study to two stimuli, the range of emotions may have been restricted (Schindler et al., 2017; Kemp & Cupchik, 2007; Chatterjee & Vartanian, 2014). Future research should consider including a larger and more diverse set of artworks, both AI-generated and human-made. This might evoke a wider spectrum of responses and enhance the generalizability of the findings.

Another limitation of the study is the embodiment of the robot arm in the artwork. As AI lacks a physical body, the design of the robot arm is fairly subjective. In this study, the arm was designed to match the human arm embodiment, which may have led to mixed reactions from participants. As each of the participants has their own view as to how an AI arm should look, some may think it should look more human-like, while others may think it should be more mechanical or artificial. Additionally, the chosen gender for the human arm might have influenced the responses, as the study used a female arm. Using a male arm might change the view of the participants on the artwork and creator. Therefore, choosing a different gender or more human-like design could have influenced the responses to the arm. Future research could benefit from exploring which designs represent AI.

Furthermore, a limitation of the study is the effectiveness of the embodiment manipulation. Despite the embodiment simulation theory suggesting that observing active actions, such as brushstrokes, be performed could enhance emotional engagement in the viewer. The embodiment manipulation in this study might not have embodied the paint-like gestures

enough to evoke more emotional engagement in the viewer (Gallese, 2017). In specific, using only a robot arm might not be perceived as a real intentional artist painting the artwork, thereby not fostering a connection with the viewer and losing intention behind the brushstrokes.

Additionally, another limitation of the study is the handling of the manipulation check questions. Although participants were asked to identify the artist's label and whether they saw an arm in the artwork, it was decided not to exclude participants who answered incorrectly. As excluding all the incorrect answers would have reduced the sample size substantially. However, this resulted in a flawed and not as effective manipulation check. It was an assumption that participants would pay enough attention to the stimuli to answer the checks correctly. However, participants may have paid more attention to the arm in the video, the more prominent feature, than the label. The arm question was answered more correctly than the label question. Therefore, this may have influenced the overall validity of the data, as the manipulation checks were not taken into account while performing the analyses. Thereby risking using data of participants that did not pay enough attention to the stimuli.

Future research

As the study found partial support for the embodiment simulation theory in enhancing aesthetic emotions, future research should explore the broader potential of embodiment. Exploring if embodiment has the possibility to evoke a wider range of emotions, including positive and negative. For instance, it would be valuable to investigate how different forms of embodiments, such as varying types of movement, the presence of an artist versus only the arm, or the use of various types of robot arms, could influence emotional responses. These variations might help identify whether specific types of embodiment are more effective in eliciting emotional responses.

Furthermore, in this study, two manipulation checks were used to assess participants' understanding of the conditions, one to see if they paid attention to the artists through seeing the label and one to confirm whether they saw an arm and which one. However, many participants failed to fill in these two questions correctly. However, to mitigate sample size reduction, participants were not excluded for filling in the questions incorrectly. Risking using data from participants who did not pay enough attention to the stimuli. Future research should address this issue by using correct manipulation checks. One could be asking participants the arm or label questions straight after watching the video before being able to continue. Or redirecting participants who filled in the questions incorrectly to the end of the survey. Additionally, future research should implement a manipulation check and exclude participants who answer incorrectly, as this would improve the validity of the study. Addressing these issues will help ensure that participants pay attention and respond with the right information, strengthening the drawn conclusions from the data.

Conclusion

In conclusion, this study explored the effect of embodiment on emotional responses to AI-generated and human-made artworks. Finding that labeling artworks as human-made or AI-generated did not significantly impact the emotional responses, despite previous research suggesting a bias toward AI-labeled art. Partial support was found for the embodiment simulation theory, with embodiment enhancing aesthetic emotions such as liking, fascination, and awe, although it did not enhance positive, negative, or epistemic emotions. The lack of significant differences between human- and AI-labeled artworks with embodiment indicates a complex connection between embodiment and emotional engagement. Thus, future research

should explore various forms of embodiment to find their potential to impact emotional responses to artworks.

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Appendix

Appendix A

Aesthemos scale

Item	Subscale
Liked it	Feeling of beauty/liking
I found it beautiful	Feeling of beauty/liking
Was impressed	Fascination
Fascinated me	Fascination
Felt deeply moved	Being moved
Touched me	Being moved
I found it sublime	Awe
Felt awe	Awe
Felt something wonderful	Enchantment
Was enchanted	Enchantment
Made me feel nostalgic	Nostalgia
Made me feel sentimental	Nostalgia
Delighted me	Joy
Made me happy	Joy
Amused me	Humor
Was funny to me	Humor
Spurred me on	Vitality
Invigorated me	Vitality
Motivated me to act	Energy
Energized me	Energy
Calmed me	Relaxation

Relaxed me	Relaxation
Baffled me	Surprise
Surprised me	Surprise
Made me curious	Interest
Sparked my interest	Interest
Challenged me intellectually	Intellectual challenge
Was mentally engaged	Intellectual challenge
Felt a sudden insight	Insight
Sensed a deeper meaning	Insight
I found it distasteful	Feeling of ugliness
I found it ugly	Feeling of ugliness
Felt indifferent	Boredom
Bored me	Boredom
Felt confused	Confusion
Was unsettling to me	Confusion
Made me aggressive	Angry
Made me angry	Angry
Worried me	Uneasiness
Felt oppressive	Uneasiness
Made me sad	Sadness
Made me feel melancholic	Sadness

Appendix B
Figure 4

The human-made artwork used in the study

Note. Untitled (19th century). *Whaling scene* [Painting]. JSTOR. https://www.jstor.org/stable/community.15770555

AI artwork

Figure 5

The AI-generated artwork

Note. Prompt given to create this image: “Create a simple realistic oil-style painting from the 1900s with whaling boats and wintry mountains.”

Appendix C

Videos with embodiment are found within this Google drive folder.
https://drive.google.com/drive/folders/1jCFqMh4UXOmOYyK6xgwoE7CnxuhvEr_e?usp=drive_link

Appendix D
Table 1

Normality descriptives of the conditions

	Conditions	Skewness	Kurtosis
Aesthetic emotions	AI-labeled embodiment	0.33	-0.64
	AI-labeled non-embodiment	-0.10	-0.84
	Human-labeled embodiment	0.93	-0.50
	Human-labeled non-embodiment	-1.37	-0.63
Positive emotions	AI-labeled embodiment	0.33	-0.64
	AI-labeled non-embodiment	-1.26	0.32
	Human-labeled embodiment	1.74	1.19
	Human-labeled non-embodiment	0.63	-0.34
Negative emotions	AI-labeled embodiment	1.14	0.78
	AI-labeled non-embodiment	1.07	-0.10
	Human-labeled embodiment	1.89	-0.03
	Human-labeled non-embodiment	1.42	0.52
Epistemic emotions	AI-labeled embodiment	-0.53	-0.18
	AI-labeled non-embodiment	-0.68	0.12
	Human-labeled embodiment	0.32	-0.56
	Human-labeled non-embodiment	-0.38	-1.18

Table 2

Variance descriptives of the conditions

Aesthemos scale	Variance
Aesthetic emotions	2.50
Positive emotions	1.41
Negative emotions	1.30
Epistemic emotions	1.46