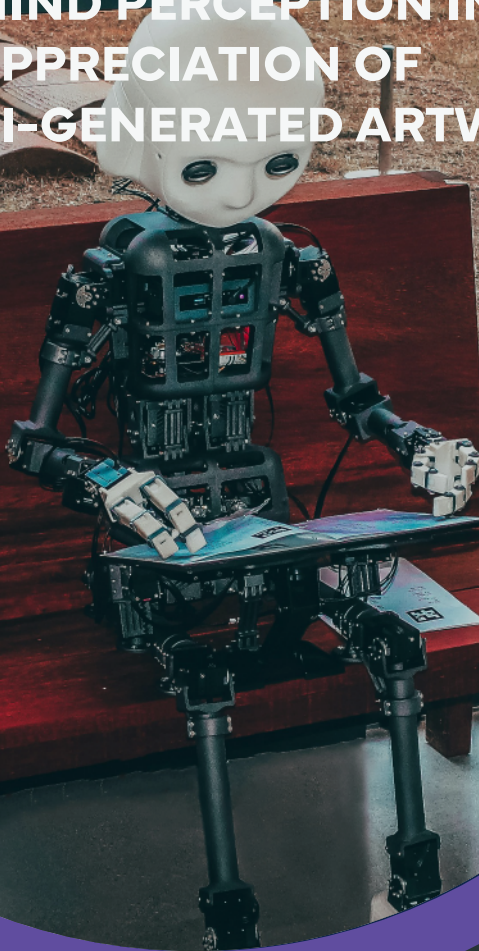


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MIND PERCEPTION IN THE APPRECIATION OF AI-GENERATED ARTWORKS



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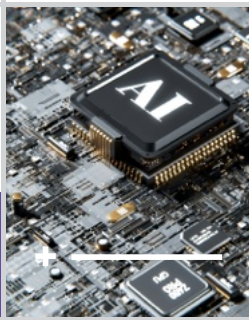
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The background of the page is a painting of a castle on a hill under a sunset sky. The sky is a mix of orange, yellow, and blue, with soft clouds. The castle is a large, multi-towered structure with a flag on top, situated on a rocky outcrop. The foreground is a hazy, light-colored landscape.

Art is an omnipresent element of human life—most of the time, beyond our consciousness. At the same time, the vast proliferation of technology, specifically in the development of Artificial Intelligence (AI), is beginning to become an accessible instrument of daily assistance. Time and time again, these artifacts are present separately as a subject of public contention, otherwise altogether under AI-generated arts.

In 2018, an AI-generated painting of "*The Portrait of Edmond de Belamy*," created by an artistic group, monikered Obvious, was auctioned at a staggering price of \$432,500 in New York City (Demmer et al., 2023). While the price is deemed standard for artworks, the creation process of the painting sent bewilderment in the artistic field, typically a negative one (Demmer et al., 2023). While the AI-human relationship is positively embraced in certain areas, the partisanship of AI and Art is still contentious (Chiarella et al. (2022). This research, thus, seeks to explore the laypersons' views and appreciation of AI-generated artworks, dubbed 'AI-Art.' Laypersons, in this context, refer to individuals without a distinct professional background in art, which are narrowed down to Indonesian students of higher education. Relative to AI's novelty, we believe there will be a greater tendency to reject the notion because AI is an unsuitable tool for art production. This hypothesis is supported by Messingschlanger and Appel's (2023) study on mind perception toward AI-Art, which concentrates on an individual's ascription of values in shaping their appreciation of art and thus acceptance of the AI-Art notion.

This research will be organized into four main sections. The first section serves as an introduction, consisting of contextual background and object of inquiry. The second section provides an overview of integrating AI into art production, offering the necessary contextual framework to understand the overarching subject of investigation and the research variables. The third section delves deeper into exploring the concept of perception, specifically its role in shaping acceptance and appreciation of AI-generated art. This section bridges the contextual groundwork laid in the previous section to address the research question by incorporating a literature review of expert perspectives on AI-Art, including those of artists, practitioners, connoisseurs, and critics. The fourth section presents the data obtained from the online monitored survey concerning the perspectives of higher education students on AI-generated art, followed by a comprehensive discussion intended to analyze and interpret the data.

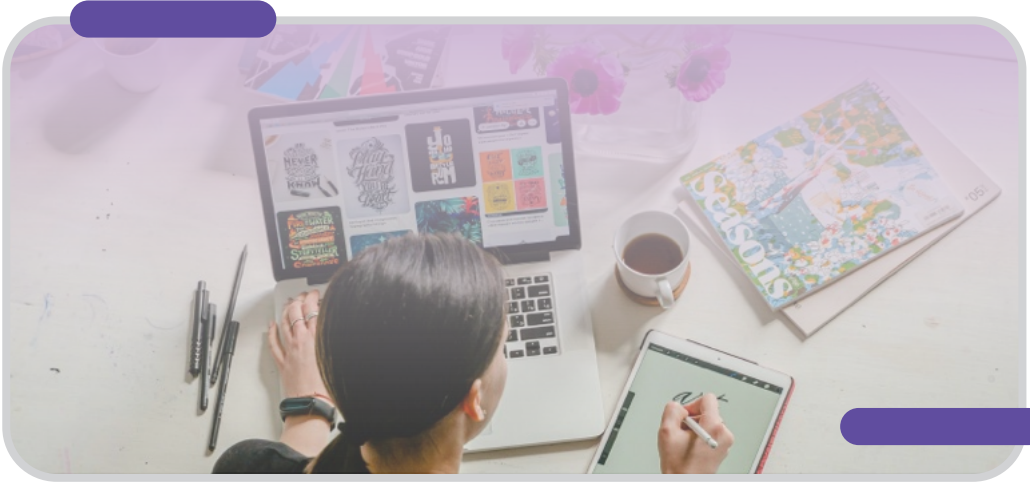


➔ THE RISE OF ARTIFICIAL INTELLIGENCE

The formal definition of Artificial Intelligence prevails as a subject of debate among varying institutions and pertinent disciplines. Nevertheless, this research subscribes to the understanding of "the skills of machines and programs to simulate human mental experiences and their practice patterns," as put forward by Aggarwal et al. (2022) and "as system that accurately interprets external data to attain a specific task" by Haenlein and Kaplan (2019).



Apart from the notable absence of a formal definition, AI is deciphered as a vast area that entails the classification of *strong* AI and *weak* (narrow) AI discerned based on its capabilities and scope. This research will focus on and further develop the latter category of AI as it holds greater significance to the scope of the overarching theme. It is worth noting that the use of terms "weak," "narrow," and sometimes "soft" do not refer to a lack of sophistication in the system; rather, it implies the limited scope of its functions adjacent to strong AI—which is abstracted to resemble human intelligence. Narrow AI(s) operate by modelling the human mind instead of attempting to reproduce it (Searle, 1980 in Flower, 2019). Hence, narrow AI(s) are pragmatic because they are programmed only to perform specific tasks and possess fewer functions that do not require the full spectrum of human-like intelligence and cognitive capabilities (Mohmad, 2023). The modus operandi of narrow AIs centres on the subset of machine learning (ML), an algorithmic technique of iterative learning from "problem-specific training data" to uncover "hidden insights and complex patterns" (Janiesch et al., 2021).¹ This technique proves to be valuable in model building and in the provision of algorithms for tasks requiring high dimensional data, such as predictive analysis, regressing, clustering, and classification (Janiesch et al., 2021; Oongsulee, 2017). Narrow AI, due to its pragmatic advantages, is increasingly being applied across various domains, encompassing voice recognition and virtual assistants (e.g., Apple's Siri and Amazon's Alexa), autonomous vehicles, digital mapping and GPS technology, medical imaging, weather forecasting, and even creative art generation websites.



➔ ARTIFICIAL INTELLIGENCE IN THE PRODUCTION OF ART

In recent years, the rapid advancement of AI has impalpably woven itself into varying domains to simulate human talent, skills, and abilities in problem-solving or production. The creative industry, a domain typically identical to the emphasis on human creativity and subjectivity, does not except from the many fields intercepted by technology. The early outset of the meddling between generative technology and art production can be traced back to the late 1950s, whereby the output is more commonly termed *digital art* (Hencz, 2022). Among the notable digital art tools were AARON in 1973 and Painting Fool in 2001, specifically created for abstract art generation (Gibbs, 2023). The new milestone in the recent technological transformation has expanded the realm of AI-Art to adopt machine learning mechanisms, marked by the launch of Artbreeder –a platform designed for modifying existing images. The surge in AI's widespread appeal in 2021 welcomed the launch of new publicly accessible programs in the field. Noteworthy examples include OpenAI's DALL-E, Stable Diffusion, MidJourney, Adobe Firefly, and Google's Imagen. All of these facilitate the creation of images that exhibit statistical characteristics similar to those found in the training set (Goodfellow et al., 2014)



Notable to the overarching concept of AI-Art is *generative adversarial network* (GAN). It is a class of machine learning that embraces the purposes of generative models using deep learning methods that simultaneously discover and learn patterns from input data imperative to render an output (Brownlee, 2019). GAN operates by entailing two sub-models in a zero-sum game: the generator model, the main 'slate' to produce a new image, and the discriminator model, responsible for distinguishing data from the original data set and the artificial derivation. An interplay of these mechanisms allows AI programs to open doors for new opportunities that were once limited, such as generating original pieces in the style of late master artists, i.e., Van Gogh's characteristic brushstrokes or Paul Gauguin's experimental colour usages.

Despite their internal complexity, however, AI-Art platforms are remarkably user-friendly and readily accessible. From the users' perspective, the AI capabilities typically involve text-to-image or image-to-image prompts, a hassle-less way to visualize any image in mind.² The limit to these prompts is indefinite. Ranging from keyphrases such as "in the style of..." followed by the name of a certain artist, a selection of an aesthetic/art style, or a direct reference to a distinct timeframe (Robertson, 2022; Roose, 2022). Aimed at demonstrating the user-friendliness of an AI program, the authors generated an Image using Stable Diffusion with "a cowboy posing with a tiger," showcased in Figure (a), set in a Renaissance style, which only consumed a total of two minutes to render. Meanwhile, Figure (b) showcases Refik Anadol's AI-Art titled "Unsupervised," using DCGAN, PGAN, and StyleGAN algorithms to combine two centuries of art displayed at the Museum of Modern Art (MoMA), which goes to illustrate the capacity of creativity-manifestation is made possible by AI programs.



Figure (a) an image generated by the authors using Stable Diffusion based on a text prompt "a cowboy posing with a tiger" attuned in a Renaissance artstyle.

Figure (b) an AI-art by Refik Anadol, titled "Unsupervised," installed at MoMa. It showcases a rendition of an amalgamation of artworks displayed at the museum in the last two hundred years



It is interesting to observe that although both artworks in Figure (a) and (b) are created using AI technologies, a prominent visual difference distinctly indicates that the latter appears more artisanal. A study by Lyu et al. (2022) contends that artists and non-artist do not interact with AI-Art programs uniformly. In simultaneous use of a text-to-image AI-Art program, the creative process of a non-artist is typically oriented to the outcome; hence, it is more "simple and direct." Meanwhile, artists focus on gaining "control over tools" by employing more complex descriptions to render their artistic vision. Figure (a) represents a creative process by a non-artist utilizing an AI program explicitly designed to illustrate a 'cowboy posing with a tiger' and paying no attention to other creative intentions but

the final output. In contrast, Figure (b) demonstrates the enhanced capabilities of AI algorithms when infused with the knowledge and artistic visions of human artists. As a result, their visual presentation appears more seamless and even appealing, particularly to those who may need an extensive art background.

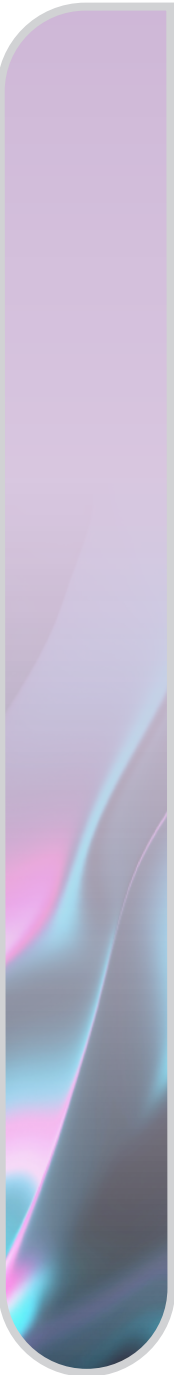


➔ MIND PERCEPTION IN SHAPING THE APPRECIATION TOWARD AI-ART

The realm of art is often perceived as a distinctly human phenomenon, characterized by rich emotions and expressions that can manifest both communally and individually. As a result, many essential elements of art are commonly regarded as inherently 'human-specific' (Chatterjee, 2014). Consequently, perceptions toward AI typically follow monochromatic views: approval and disapproval. Approval of AI resonates with the notions of acknowledgement and recognition that AI commands the ability to generate legitimate art, followed by an acceptance that AI is a valid tool to create art as compared to paintbrushes or canvases (Demmer et al., 2023); disapproval of AI can be inferred as a direct negation of its counterpole elaborated herein.



The existence of a work of art is intrinsically linked to how members of society assess and appraise it, with particular attention given to the unique aspects that come under societal scrutiny. For example, Harry Woodgate, winner of the 2022 picture book prize and illustrator of *Grandad's Camper*, demonstrated disapproval toward AI-Art, stating, "These programs rely entirely on the pirated intellectual property of countless working artists, photographers, illustrators and other rights holders" (Shaffi, 2023). A similar viewpoint is reiterated by Hayao Miyazaki, the Japanese animator, filmmaker, and founder of Ghibli Studio, who expresses deep disapproval, labelling the technology as "an insult to life itself," followed by a concluding sentiment, "I sense that we are approaching a critical juncture. Humanity seems to be losing confidence in itself" (Leatham, 2023). On the contrary, British media artist Jake Elwest posits this is "a fascinating time. Saying 'this is a new medium' or 'art movement' or 'genre'—as some people are saying—seems very grandiose, but it is also really exciting. The rulebook has not been written yet, and that is such an exciting place to be. We do not have the answers to these things. We are constantly repositioning ourselves and working out our views" (Ploin et al., 2022). A similar view is echoed by Anna Ridler, a researcher and fine arts artist. She states that "when people are working with technology from a different angle, it becomes less about the technical things that can or cannot be done and more about how it is being used and explored from a very strong critical standpoint. I am more drawn to those types of projects," pointing out that the less-explored field of AI is a wonderful realm for new opportunities and endless possibilities.

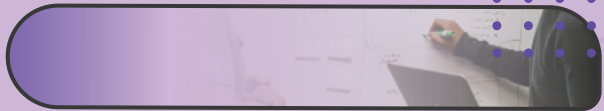


According to Messingschlager and Appel (2023), the evaluation of art hinges on the audience's mind perception, which is the capacity to attribute mental states, such as beliefs, intentions, desires, and emotions, to oneself and others. Mind perception involves two dimensions: agency and experience. Let's unpack these concepts. Mind perception refers to the capacity to attribute mental states, such as beliefs, intentions, desires, and emotions, to oneself and others. In this context, agency pertains to cognitive awareness, constituting qualities of moral discernment, emotional cognizance, and capacity for strategic planning. Experience, on the other hand, involves the ability to undergo various emotions, to possess distinct characteristics, and consciousness.

Messingschlager and Appel (2023) assert that an artwork's evaluation covers "more aspects than just the assessment of quality or perceived values" and the authorship information. A viewer's knowledge of the artists shapes their experience and evaluation of art, which is linked to their appreciation of the artwork (Fingerhut and Prinz, 2018, as cited in Messingschlager and Appel, 2023). Appreciation occurs when a piece of art is seen as beautiful, evocative, and visually pleasing; an artwork that is appreciated is, therefore, seen as meaningful (Hager et al., 2012; Schindler et al., 2017). However, multiple studies showed that the information that an artwork is created using an AI program could reduce viewers' experiential responses—thus, appreciation. These experiential responses generally differ from one study to the other; nevertheless, they range from artistic values, beauty, authenticity, and narrative interpretation of the visual presentation (Wu et al., 2020; Ragot et al., 2020; Messingschlager & Appel, 2022). The negative inclination towards AI authorship arises from the perception that AI lacks agency and experience. This perspective is rooted in the traditional belief that human input is essential in art production, considering technology primarily as a tool for logical problem-solving rather than emotional expression (Cetinic and She, 2022; Messingschlager and Appel, 2023).

In a similar vein, research by Chiarella et al. (2022) and Hong (2018) showed similar inclinations toward AI. In a study by Chiarella et al. (2022), participants were presented with two visually analogous abstract paintings. The creators' identity was explicitly disclosed to the participants, with one attributed to a human artist and the other to an AI generator. The findings of this study revealed an inclination among participants to exhibit a preference for artworks attributed to human authors over those generated by AI. Consistency in results persisted in the subsequent experiment, even when the data was manipulated, and both artworks were of human origin, with their authorship undisclosed as in the prior experiment. In Hong's study (2008), participants were presented with an AI-generated painting, but authorship information varied based on their assigned groups: 'AI-Artist' and 'Human-Artist.' The outcome revealed that 26 out of 28 participants regarded the painting as art; however, both groups expressed substantial disapproval of AI as an artist (specific numbers or percentages were not provided). Reasons for dissent primarily revolve around scepticism concerning AI's capacity to create genuine art, replicate human values, and convey the necessary emotions to inspire the intention of artistic production.

→ METHODOLOGY



In this research, we employed a method of qualitative surveys (N=151) to acquire empirical data on the perception of persons toward the ever-emerging AI-Art. According to Braun et al. (2020), due to their adaptable and open-ended format, qualitative surveys allow participants to share their candid insights freely, unconstrained by the researchers' preconceived hypotheses, thus enabling a more honest expression of their thoughts and experiences.

The survey is intended for Indonesian students and higher education graduates, including Bachelor's and Master's degree holders. This categorization is based on the premise that university students exhibit a relatively higher awareness and familiarity with AI (Chan et al., 2023). Data processing will follow a typological approach as a formal data categorization based on similarities and dissimilarities (Mandara, 2003).

Respondents are grouped into Art Consumers and/or Art Creators (see Figure (c)). In this context, 'consumers' alludes to individuals who enjoy viewing artistic creations, while 'creators' pertains to those who produce art. Respondents have fluid categorization in that they may fall into one, both, or none of these categories. These typologies purposely disregard the ranges of expertise about respective degrees of agency and experience among these students. Instead, it generalizes all respondents into a class of 'laypersons.' A descriptive analysis will be applied to cohere findings with the framework and literature review upon finding patterns, relationships, and insights relevant to the research objectives.

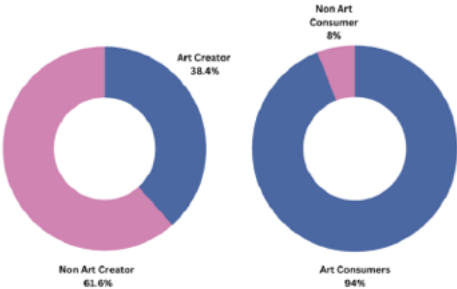
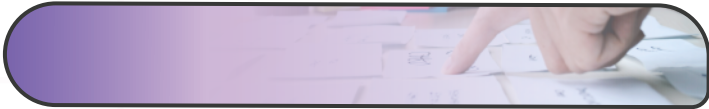


Figure (c) is a chart visualizing the arrangement of respondents (N=151) into categories of Art Creators (left) and Art Consumers (right).

→ RESULTS



As part of the qualitative survey, a fundamental question seeks to understand the respondents' views on AI-Art, specifically whether it is considered a legitimate or illegitimate form of artwork, which is separated into three categories: 'Yes,' 'No,' and 'Depends.' Yes' indicates an affirmative perspective where AI is considered an artist or a legitimate artistic tool, and AI-Art is considered valid. 'No' signifies that AI cannot be equated with human artists, and AI-Art is viewed as illegitimate, allowing subjective reasons for this judgment. 'Depends' reflects a middle ground, indicating participants are conflicted in their views. In addition, we provided our respondents with space for anecdotes regarding their opinions on their respective views.



Ultimately, as observable in Figure (d), respondents (N=151) are distributed rather evenly throughout the clusters, though with a slight predominance of a negative view toward AI-Art, with a total of 66 inputs. Meanwhile, 'Yes' and 'Depends' have 49 and 36 answers, respectively. These views are further stratified by the aforementioned typological categories—consumers and/or creators (see Table 1).

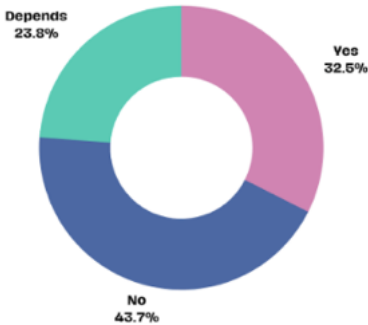


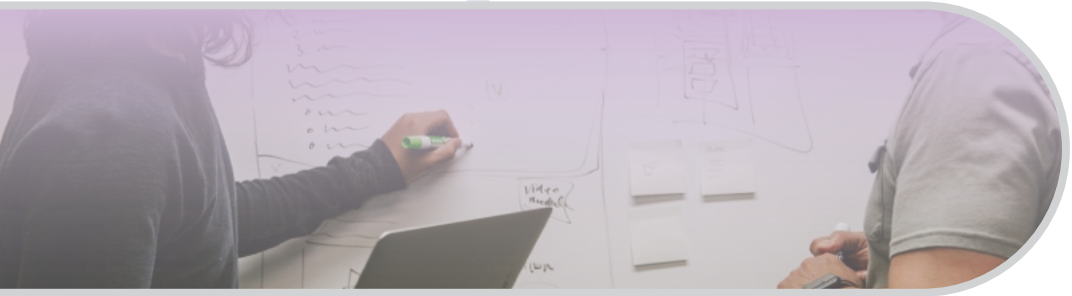
Figure (d) is a chart visualizing the distribution of respondents in accordance with their view toward AI-Art as a legitimate artwork, which is clustered into answers of "Yes," "No," and "Depends."

	CONSUMER & CREATOR (N=95)	CONSUMER & NON-CREATOR (N=86)	NON-CONSUMER & CREATOR (N=1)	NON-CONSUMER & NON-CREATOR (N=8)
YES	28,60%	32,50%	100%	50%
NO	42,80%	46,50%	0%	25%
DEPENDS	28,60%	21%	0%	25%

Upon further examination, the chosen typology grouping can be drawn into four relational sub-groups, namely

- Art Consumer and Art Creator,
- Art Consumer and Non-Art Creator,
- Non-Art Consumer and Art Creator, and
- Non-Art Consumer and Non-Art Creator.

Looking at the group (1), it can be observed that almost half of the participants chose negatively regarding the legitimacy of AI-generated artwork. The composition is similar regarding the 'yes' and 'depends' answers. Similarly, in group (2), it was found that this group tends to choose the 'no' answer to the question of the authenticity of AI art. Group (3) only had 1 participant choosing the 'yes' answer. An interesting finding is in group (4), where in terms of composition, 50% of them chose the 'yes' answer to the legitimacy of AI art. In looking at the perspective of roles above, two groups, namely (1) and (2), tend to lean towards choosing the 'No' answer regarding the legitimacy of AI art. Numerous intriguing observations, however, arise when delving deeper into the individual responses regarding the respondents' views on AI-generated art.



→ RESPONDENTS ANECDOTAL INPUT

In principle, with respect to the negative view towards AI, approximately 92% of the respondents affirmed the provided argument that AI obstructs human creativity and active participation in the art production process. Numerous interesting elaborations are present, though they generally vary in concerns. As such, a respondent expressed that his/her appreciation of art is contingent on the artist's identity. A different entry stressed the human ability to convey human emotions through artwork, a capability they believe AI lacks. S/he rejected the view of 'AI-Art defenders' who compared machine learning and the human learning system as an equivalent, asserting that human learning involves the incorporation of intangible and indescribable elements in the interpretation, which AI programs either cannot replicate or have not yet achieved. These elements encompass pride, desperation, imperfections, and disappointment.

On the contrary, a respondent from the opposing view, 'Yes,' writes that an AI program operates essentially in the same manner as human creators by allowing previous knowledge to influence the course of production. The notion of 'previous knowledge' draws a dual meaning. For an AI program, previous knowledge is the input data vested for machine learning; for humans, it is the experience of seeing other artworks and deciphering an artist's art style. However, not all affirmative respondents express an unequivocal endorsement of the AI-Art; some anecdotes are ambiguous. For example, one respondent in the category of 'Yes' iterates that AI-Art is legitimate only when generated for personal satisfaction or social media content purposes, but not commercial necessities.

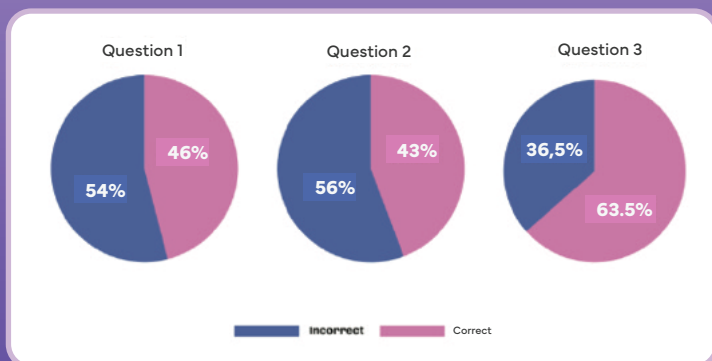
Meanwhile, an intriguing sample from the cluster of 'Depends' includes an argument that states that the 'legitimate artwork' is an abstract notion that requires a concrete coherence that is contextual to the creative industry (i.e., subjectivity, human emotion, creativity, etc.) is necessary for him/her to determine their view on AI-Art. Furthermore, there is also an opinion from participants stating that AI cannot be compared to conventional art and that AI art should have its own category. Another criticizes the provided arguments pertaining to the 'Yes' and 'No' views, asserting that the primary concern lies in the economic impact of AI in disrupting the dynamic of conventional artists in commercializing his/her artwork. The respondent suggests that if the popularization of AI does not hurt the artistic economy, there is no cause for concern.





DIFFERENTIATING HUMAN-ART AND AI-ART

The second section of the survey is a short practical test designed to assess respondents' capacity to distinguish between artworks produced by humans and AI. The goal was to determine whether these artworks exhibited substantial artistic distinctions that could convincingly support arguments related to the preservation of human values. Three question sets present pairs of paintings or illustrations, one created by a renowned human artist and the other by an AI. Respondents are then prompted to identify the image they believe was generated by an AI program. Observations are structured according to the typological categories and the diverse views on AI.



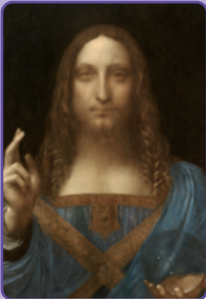
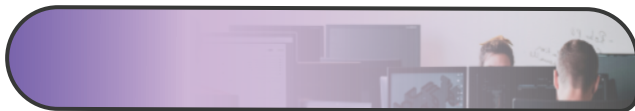
	AI-Image	Human-Image	Consumer & Creator				Views on AI-Art		
			Consumer & Creator (%)	Consumer & Non Creator (%)	Non Consumer & Creator (%)	Non Consumer & Non Creator (%)	Yes	No	Depends (%)
1	 Created using Midjourney with text prompt "James Gurney"	 A painting by James Gurney on the "Dinopedia" series.	58,9	48,8	0	75	53,1	59,1	47,2
2	 Created using Dall-e by Lawson-Tancred and Philip Booth	 An abstract painting of "Chien I" by Gary Wragg	57	53,4	100	50	53,1	62,1	50,0
3	 The infamous "The Portrait of Edmond de Belamy" created using GAN mechanism	 A painting titled "Salvator Mundi" by Leonardo da Vinci	37,5	38,3	0	0	38,8	34,8	36,1

Figure (e) illustrates the correct-to-incorrect responses ratio, further elucidated in Table 2. Fundamentally, All four groups answered the first and second in a similar manner, where a portion of each group answered correctly and vice versa. However, what is interesting is the third question, where there is a significant juncture between right and wrong answers in the role typologies, and similarly a clear drop of rate among view groups.

→ DISCUSSION



By conducting an online survey, we aimed to see the views and stance of higher education students toward AI-Arts based on their role as consumers and/or creators of art. The obtained data showed a greater inclination towards a negative view of AI-Art as a legitimate artwork. However, its proportion does not differ significantly from the other views—Yes and Depends. When further stratified into a typological category of roles, art consumers have greater tendencies toward a negative view of AI than creators. Our data showed two findings that warrant deeper analysis.

First, a variance of anecdotes is recorded, most pointing toward human elements and participation matters. Whether it is a 'Yes,' 'No,' or 'Depends' answer, these anecdotal accounts heavily emphasize human concerns and welfare. This finding resonates with Chatterjee's (2014) analysis, asserting that the field of art is perceived as a human phenomenon and that the employment of AI is deemed an entry into the area "belonging to humans." This trend is particularly interesting when compared with the pro AI-Art experts. As mentioned above, Elwest and Riddler in Ploin et al. (2022) mutually endorse AI employment by underscoring the novelty of the techniques and the endless opportunities it offers. Meanwhile, experts who are against AI demonstrate concerns related to humans. This comparison, however, is not to invalidate any view or anecdotes. Rather, we notice a degree of discrepancy in the object of concern, which may provide valuable insights into the further investigation regarding paradigmatic shifts in perceptions as AI technology evolves.

Second, there is a notable absence of a discernable pattern in the practical test conducted, which corroborates with the aforementioned studies by Chiarella et al. (2022), Hong (2018), and Messingschlager and Appel (2023). None of the typological groups of view and roles consistently distinguish AI from human art. As noted and mentioned in the preceding sections, much of the anecdotal evidence is pointed at human elements, such as emotions, art style, and previous knowledge. However, it can be inferred that when participants are presented with two comparable artworks without information about the creator, the artwork appears visually appealing, but identifying elements that differentiate them from

human-made art is challenging. In other words, in applying Messingschlager and Appel's (2023) hypothesis to this analysis, the lack of knowledge behind the artist of these artworks limits the room for respondents' inclination to assess the artwork based on the artists' agency and experience. Hence, the art and its values become the sole subjects of evaluation irrespective of its authorship. In this condition, a plausible assessment that one painting emits greater human elements than the other is subjective to the respondents' perception of its values. Nonetheless, this confirms previous studies' averment on how a viewer's knowledge of the artists shapes their experience and evaluation of art.

→ CONCLUSION

The interplay between machines and art production is not a novel phenomenon. However, the new milestone of AI incorporation into these systems opened up new possibilities that are highly accessible even to non-artists. On that account, this research investigates laypersons' perception toward the ever-emerging AI-generated artworks, utilizing the concept of mind perception as a determining factor in art appreciation. Through a qualitative survey, the research encompasses two typological strata, consumers and creators of art, to effectively investigate their role in art in relation to their view of AI-Art. Views are recorded based on whether AI-Art is considered a legitimate form of artwork, followed by options of 'Yes,' 'No,' and 'Depends.' The survey finds hardly any discernible patterns that link respondents' roles to their view of AI. Although negative perceptions are slightly dominant, they scantily show statistical significance to the overarching finding. Similarly, the practical test finds no significant pattern in the proficiency of certain role groups/sub-groups and views distinguishing humans from AI-generated artworks. Nonetheless, two analyses are drawn. First, respondents' anecdotal input emphasizing the vitality of human elements in arts resonates with the conception that the field of art belongs to humans; hence, the rejection or embracement of AI is intrinsically related to how it impacts humans and conventionality. Second, the lack of concrete findings in the practical test chimes the importance of authorship information for agency and experience to be ascribed. Otherwise, the art and its values become the sole subjects of evaluation.

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→ ABOUT CfDS

Center for Digital Society (CfDS) is the research center established by the Faculty of Social and Political Sciences, Universitas Gadjah Mada. The institution is created under the concern over the contemporary dynamics of socio-political condition of the world that is accentuated by the impeccable influence of information technology. The phenomenon triggers the new patterns and complexities in the society, and thus requires new approaches in managing such complexities.

CfDS pledged to delve more on the study of contemporary digital society, including related issues surrounding the topic; such as the issues of smart city and urban development. The emphasis is then put on the utilization of technology to shape the society in becoming digitalized, as well as to bring solvency to social issues.

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Solving Social Problem and Accelerating Prosperity through Indonesia Digital Society

ACTIVITIES

- Research and Development
- Dissemination and Publication
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