Raquel Cascales*

Interpreting AI-Generated Art: Arthur Danto's Perspective on Intention, Authorship, and Creative Traditions in the Age of Artificial Intelligence

Abstract

Arthur C. Danto did not live to witness the proliferation of AI in artistic creation. However, his philosophy of art offers key ideas about art that can provide an interesting perspective on artwork generated by artificial intelligence (AI). In this article, I analyze how his ideas about contemporary art, intention, interpretation, and authorship could be applied to the ongoing debate about AI and artistic creation. At the same time, it is also interesting to consider whether the incorporation of AI into artistic creation marks a new chapter in the narrative, which seems to have reached its end, or if it represents a significant rupture with past artistic traditions.

Artificial intelligence (AI) has grown enormously in the last few years. The world is surprised by the application and the extraordinary results that AI has produced in the artistic field. Indeed, this development has pushed substantial debates about whether it is possible to call the productions made by AI "art."

---

* University of Navarra, Pamplona, Spain
Email: rcascales@unav.es

_____

In the theory of art, the practice of art is usually understood as something exclusively human, related to intentionality, emotions, and creativity. In the case of AI-generated art, is it possible to find intentionality, expression of feelings, or originality in a creation? It seems easier to be affirmative when discussing humans using such programs. However, why does it appear problematic to distinguish between artworks created by humans and those by AI? Because we still think of art as something primarily visual. AI and human artists' creations may appear indistinguishable. Nevertheless, the question remains there: are they the same?

The question is not entirely new, as the philosopher Arthur C. Danto faced the same problem in the last century. In his article "The Artworld" (1964), the concern regarding indiscernible objects is already evident. Although his subsequent art paper was published almost twenty years later, during an examination on the Archives of Arthur Danto at Columbia University, I observed that his reflection on this topic is also present in a manuscript from 1974,[1] which would later form the core of *Transfiguration of the Commonplace* (1981).

In this 1981 work there are many examples of indiscernible objects. As a matter of fact, Danto opens the book explaining nine red squares with the same appearance (Goehr 2022). However, the most iconic example in the book are Warhol's *Brillo Boxes*. This piece challenged the art world by presenting a perfect replica of a real object, emphasizing that external resemblance alone does not define art. This led Danto to define the necessary conditions for something to be considered an artwork. He established a definition of art that could significantly contribute to the ongoing debate on whether artificial intelligence can create art. This article will examine Danto's theory of art and use it to clarify some crucial issues of the present debate, as follows: first, it will present his definition of art; second, it will explore the question of intentionality following a discussion on creativity and the possibility that AI might develop a style. Third, it will examine the problem of how to interpret works of art. Finally, it will discuss whether AI productions can be called "art."

_____

[1] "Proto Theory of Art." Manuscript located in the "Arthur Coleman Danto manuscripts, 1958-2011," University of Columbia Archives. I thank the Librarians of Columbia University Archives for their work and nicety when I worked there.

_____

1. Appearance and the Definition of Art

In studying the *Brillo Boxes*, Danto considered that Andy Warhol invalidated the theory of mere perception since he displayed packages indiscernible from the everyday objects they imitated. This piece, which he first saw in 1964 at an exhibition at the Stable Gallery on East 74th Street in New York, strongly affected him. Indeed, it catalyzed his first theoretical foray into the artworld (Danto 2001, 378). Danto considered the problem of indiscernibility a philosophical touchstone from which many different issues could be addressed.

In the same way, Danto believed that Warhol's work manifests the essence of art because it sets us in the position to distinguish it from reality. Danto considered the difference between art and reality the essence of art. For this reason, the definition of art also needed to account for this distinction. After that, the question no longer consists of what art is but instead of why, of these two indiscernibly different objects, one is a work of art and the other is not. Although Danto fought the approach of "visual theory" in his first article in 1964, he did not offer a genuine alternative until his book *The Transfiguration of the Commonplace*, where he defined art.

Danto's definition of art contains two necessary (but not sufficient) conditions: art has to have meaning, and this meaning has to be embodied. The first condition for something to be art is "to be about something." Aboutness refers to having a theme or a meaning. With this first condition, Danto highlights the semantic nature of art (Cascales 2022, 126-128). Ordinary objects or elements in nature exist, and we do not wonder what they mean, while for works of art, it is essential to formulate what they mean. This significant condition of art is not an accessory part of the definition but original since, as the author says, "a work of art's being is its meaning" (Danto 2001, x).

Art involves the embodiment of meaning. The incarnation of meaning is the second necessary condition. It reveals that referentiality is not a mere description or allusion to something else but rather a particular way of talking about something. This meaning is usually embodied in a work of art's materiality and typically projects a point of view. With this, it is essential to emphasize that meaning is not captured once the work has been "explained" (or the explanatory text at an exhibition read) but is embodied in the work itself.

What is the artwork's content like, and how can the viewer capture it? Danto develops this question by analyzing the metaphorical structure of artworks, which he sees as symbols or vehicles of ideas that we always en-

_____

counter sensibly configured with a particular form. Put in Dantian terminology, they are embodied symbols. Works of art are not just characterized by having meaning, since objects that are not works of art also possess this characteristic. Art is the embodiment of that meaning. Embodied meaning is, therefore, the result of unity between the object and its context. They are not just related in that one came after the other; instead, embodiment is essential for meaning.

The human mind intervenes in creating meaning and choosing how to embody and shape this meaning. Embodiment is essential and can change the interpretation completely. At the same time, embodying the meaning enables the spectator's interpretation.

In creations generated by artificial intelligence, one must wonder whether the algorithm or the person setting the program introduces the meaning. In this sense, we can compare it to photography. At the beginning of photography, people thought that art died because machines could make perfect reality recreations. However, currently, we understand that a photographer is necessary if we were to have a piece of art. Many cameras record and take pictures all the time (surveillance cameras in public, satellites, etc.); however, we do not consider those recordings as art. This comparison brings us to a new point: the question of the intention. To be art, is it necessary for a piece to be created with intention?

2. The Question of Intention

Danto tried to offer a theory to distinguish artworks from mere things. The stablished theory in philosophy of Art, then supported by Neowittgenstenian philosophers, assumed that it was enough just looking to determine what art is. However, Danto thought the definition had to lie elsewhere as according to that theory, it was impossible to distinguish between Andy Warhol's *Brillo Box* and the authentic Brillo Box.

What do we have to consider to understand something as art? It is not easy to know the intention of the artist, mainly because we engage with the artwork itself rather than the artist. Also, some authors argue it is difficult to discern anyone's intention, which shows that they understand "intention" solely as a psychological aspect.

This thesis was proposed by Monroe Beardsley and called the "intentional fallacy" (1992). Beardsley argues that reference to the artist's intentions is irrelevant to interpreting a work of art (Lyas and Stecker 2009, 369) because a work is a public object open to objective examination, while an intention

_____

remains a private matter within the artist's mind. Therefore, the intention, besides being impossible to know, is irrelevant because the work is an independent object. As a result, interpretation, regarded as the identification of meaning, becomes a public matter limited by the use of linguistic rules and public data about the author.

These assumptions can be answered. Firstly, if the intention is a private mental matter, we cannot know the object of any mind. However, we often infer the mental states of others through their manifestations in actions and their products. To the extent that a work results from the artist's intentions, it is possible to identify it as the result of his action (Danto 1981).

In that same vein, Danto asserted in the opening of *The Transfiguration of the Commonplace*, "the difference between a basic action and a mere bodily movement is paralleled in many ways by the differences between an artwork and mere thing" (1981, 5). Although Danto supported the "basic actions" theory, he cited Wittgenstein and Anscombe, particularly her renowned essay "Intention." In this book, Anscombe explained how actions are configured by intention. Essentially, our bodily movements are often purposeful, each individual capable of explaining the underlying reasons. We cannot say: "I didn't shoot; it was just that my fingers moved." There exist movements devoid of intentions, such as tics or spasms, but in these cases, we do not call them "actions," and we usually do not judge them morally.

Also, people know how to interpret movements in different situations. In this sense, Anscombe argues that intention is not only psychologically private but something we can suppose through people's external actions. Wittgenstein prefers to talk about how actions fall under rules that allow observers to understand.

Therefore, if all this holds true, artists indeed have intentions when creating artworks. They harbor a content, a meaning, a sentiment they aim to express, to channel through their art: "An action and an artwork then would be differentiated by their respective orders of mental causes and by the further differences between conforming to an intention and expressing a feeling" (Danto 1981, 6).

The meanings of artworks are often not entirely transparent but are more accessible than "opaque." In this regard, deciphering the meaning implies referring to the communicative intention expressed and how the expression was made (Margolis 1979, 452). Therefore, identifying intentional properties is a matter of the meaning of the work, established through particular conditions of identification and interpretation.

_____

Furthermore, the debate with Beardsley underscores the challenge of relying on a purely psychological notion of artistic intentions to analyze these elements. It becomes imperative to adopt a semantic approach to the relationship between the work and the artist and, with it, to the intentional properties.

Danto asserts that a work of art is a meaningfully constructed entity. This notion implies that it is an entity characterized by physical properties that convey significant (intentional) properties, such as representation or expression of something. Hence, the possibility of distinguishing between a mere physical object and a work of art arises from the relationship between perception and interpretation. Only then it would make sense to adopt a semantic approach in which the meaning of the work becomes relevant when referring to works of art.

3. Can AI Have a Personal Style?

In his writings on intention, Danto often discusses style as a means to express different meanings. Danto derives his style concept from Frege's concept of *Färbung*, which refers to coloring (Danto 1981, 163). Nevertheless, as Fontaine points out, Danto used that concept relation to sense, allowing it to bring cognitive import to subjective associations (2022, 26-32). Style encompasses the artists' way of conveying intentions and expressing their uniqueness and creativity. Each artist develops a personal style reflected in their choice of techniques, colors, shapes, and themes. Thus, it is possible to see how personal creativity operates and how every point of view has something different to say. According to Danto, each artist brings a unique intention to their artwork, guiding its interpretation and relationship to the world. Each artistic viewpoint provides a different world perspective, communicating something unique through its style. This notion underscores the idea that creativity in art is a personal and subjective process in which each artist brings forth their unique vision within a specific historical moment.

In artificial intelligence, success hinges on meticulous data analysis and adherence to established rules, while creativity taps into the limitless realms of human imagination, fostering novel ideas that defy norms. AI thrives in structured, data-driven tasks. However, creativity's enigmatic terrain, shaped by diverse experiences, propels us to break free from convention and ask audacious "what if" questions—a uniquely human domain. As Anantrasirichai and Bull have shown, while "AI accomplishments rely heavily on data conformity, creativity often exploits the human imagination to drive original ideas that may not follow general rules" (2022, 590).

_____

In this connection, in the chapter "Narrative and Style" in *Beyond the Brillo Box*, art styles and practices refer to each other, generating their own world (1992). Thus, for example, Warhol's pop art style is not understood without considering the artistic context at the time when abstract expressionism triumphed. One of the most exciting ways to understand how Danto traces the system of internal relations that works of art establish among themselves, regardless of the place or time they were created, is by addressing the historical relevance of an artistic style once it has emerged as an integral part of the history of art. In effect, stylistic genres are constituted independently of the works that impelled their emergence. They can even be used to catalog an artist as belonging to a particular style without the artist knowing that this work will someday be integrated into a stylistically determined genre.

Accordingly, Danto believed that a greater variety of styles and practices results in a richer artworld: "The greater the variety of artistically relevant predicates, the more complex the individual members of the artworld become; and the more one knows of the entire population of the artworld, the richer one's experience with any of its members." (1964, 583-584). As we can see, the Dantian approach to style helps us understand that art is not just something an artist does but a complex framework of intentions and historical development.[2]

AI is proficient in performing various tasks, such as classification, object detection, similarity retrieval, and multimodal representations (Cetinic and She 2022). All these abilities allow AI to emulate requested artistic styles with precision. It can even compose previously unwritten sonatas in the likeness of deceased composers. However, it is a reduction to call these abilities creativity, and it is a mistake to call the result of this activity art, no matter how astounding the results are.

Instead, AI models, such as DALL·E 3, Stable Diffusion, or Midjourney, derive their creative abilities from extensive and diverse datasets. The effectiveness of AI systems hinges on their computational architecture, learning strategy, and the data they use for training (Russell and Norvig, 2020). These models exhibit specific combinatorial properties, with their performance typically mirroring the quantity and quality of the data on which they were trained. Consequently, AI models excel in recreating widely recognized artis-

_____

[2] Noël Carroll also comments on the topic in his chapter "Danto, Style and Intention" (2021). For him, the style is not only a question of interpreting the piece, as he said, "Often we are interested in stylistic features for purposes other than interpretation" (Carroll 2021, 30).

_____

tic styles—such as the expressive works of Van Gogh—where the dataset is extensive and rich in examples. However, they face challenges when reproducing more obscure or lesser-known artistic styles. In essence, AI effectiveness depends on the quality and appropriateness of training data, as it is through these data that AI systems learn to make informed decisions and produce accurate results when deployed in real-world scenarios (Anantrasirichai and Bull 2022, 635). Besides, the consideration that AI models produce already widely acknowledged and popular styles is also interesting in itself. This production raises the question of whether these models inadvertently contribute to the perpetuation of well-established artists and styles, potentially overshadowing and hindering the dissemination of lesser-known or emerging artists.

Furthermore, AI lacks the initiative or intrinsic motivation to pioneer entirely new artistic styles. Instead, it relies on human input to combine or adapt existing styles. These dynamics highlight the symbiotic relationship between AI and human creativity, wherein AI serves as a tool to amplify and reinterpret established artistic conventions. However, the overarching question remains: can AI ever truly generate art that is original and independent of human influence, or is it fundamentally bound by the algorithms and data from which it derives its creative capabilities?

In a lucid 2010 interview, computer art pioneer Frieder Nake defended that computer art has no masterpieces because computer art is not about producing "pieces." It is about the production of system designs and the beauty and coherence of these designs. In other words, as Offert pointed out in another article, "it is the method, not the artifact, that is relevant for the aesthetic judgment of a work" (2019).

4. The Problem of Interpretation. What does it mean to interpret?

According to Danto's theory, artistic interpretation is an intellectual operation through which an object in the everyday world is elevated to the category of "artistic object". The interpretation is ontologically constitutive: "An object o is then an artwork only under an interpretation I, where I is a sort of function that transfigures o into a work: I (o) = W" (Danto 1981, 125).

In this light, if everything depends on interpretation, we can theoretically interpret something created by a machine as art. However, our interpretation is based on a concept of art (embodied meaning) and within this concept, there needs to be someone who imbued that meaning into the artwork with an intention. When there is no human agent behind the intention, as is

_____

the case with a machine, we tend to extrapolate, assumen, and project human-like intention onto the program, despite its lack of actual intentionality. Hence, the critical distinction lies in attributing human-like characteristics to AI programs: either imagining that they operate similarly to us during the "creative" process or, more problematically, presuming that human beings operate identically to AI program.[3]

Art is significant only if there are humans who can interpret it as art. Consequently, art exists only when interpreted as such. This means artworks can also be subject to misunderstanding or destruction. It is the spectator who carries out this transfiguration through interpretation, yet we should remember that such interpretation would not be possible without the artist's creation or configuration. For this reason, to understand interpretation properly, it is crucial to keep in mind the intrinsic relationship between the artist's process and the viewer's interpretation. The spectator's task is to identify the aboutness, capture the artwork's metaphor, and give life to the work. In turn, the work has a semantic dimension that must be interpreted, providing a hermeneutical dimension. In this sense, an artwork can only be considered alive when interpreted.

Thus, interpretation constitutes the work, yet, in turn, is determined by the artist's intended meaning. That is why an artist's intentional manipulation of an everyday object can produce the transfiguration of the object into a work of art. This process includes a transfiguration of the object and provides an ontological coating that gives the object a new identity. As Danto notes,

> My theory of interpretation is instead constitutive, for an object is an artwork at all, only in relation to an interpretation. [...] Interpretation in my sense is transfigurative. It transforms objects into works of art and depends upon the "is" of artistic identification. [...] If interpretations are what constitute works, there are no works without them, and works are misconstituted when interpretation is wrong (1986, 44-45).

_____

[3] Recent studies have shown that aesthetic judgements of abstract artworks differ when attributed to humans or robots. Mikalonytė and Kneer (2022) demonstrated that people judge robot paintings and human paintings as art to roughly the same extent. However, people are much less willing to consider robots as artists than humans, which is partially explained by the fact that they are less disposed to attribute artistic intentions to robots. On the other hand, Di Dio, Ardizzi, Schieppati, Massaro, Gilli, Gallese, & Marchetti (2023) illustrated how human-authored paintings received higher ratings when attributed to humans, while robot-authored paintings received lower ratings on beauty when viewers knew the authorship, suggesting resistance to accepting AI in art creation and underscoring the emotional aspect of human artistry.

_____

Of course, these words do not imply that an artwork can only have a single interpretation. While multiple interpretations are conceivable, not all are valid. Both the artwork and its interpretation are inscribed in the artworld. Our historical awareness and knowledge of art history influence how we interpret art, whether it is actual or ancient. Therefore, not all possible interpretations hold true in the context of art.

Danto assigns a role to interpretation that places the weight of art's constitution on the spectator. This idea is one of contemporary art's essential characteristics, which Danto's philosophy of art insightfully includes, explains, and defends. Since, as mentioned, the meaning of a work of art is not transparent to human perception, the viewer must set in motion an intellectual process to identify the work as such. Along the way, the artworld has developed certain conventions that permit distancing art from reality, making it easier for the viewer to consider what is in front of him as a piece of art. As Danto himself perceives, these conventions have been developed in all the arts: a frame delimits the borders of the painting, the pedestal delimits a sculpture, and the stage and backdrop constitute a theater.

However, since contemporary art has broken these conventions, distinguishing art from reality is now more challenging. For this reason, Danto warns us that identifying artwork means seeing the artistic object (which will sometimes be an unmodified, real object) endowed with a meaning that other objects lack. Everyday objects are produced for something, but they are not about anything. In contrast, a work of art has a built-in meaning that gives it a different ontological status. As he says, to see something as a work of art is to go from mere things to the realm of meaning.

This question does not involve everyone assigning the artwork a meaning or that meaning is made up. It is, instead, about trying to discover its meaning: "You can call a painting anything you choose, but you cannot interpret it any way you choose, not if the argument holds that the limits of knowledge are the limits of interpretation" (Danto 1981, 131). Indeed, correct interpretation coincides with the artist's intention. Although I think that, at this point, Danto intends to argue that not all interpretations are valid and that correct ones consider the artist's intention, it is also true that the historical perspective highlights nuances that the artist could not have foreseen.

Margolis rightly questions the implication that artwork does not exist if the artist's intention remains unknown (Margolis 2008, 85-86) and how we can know that intention. This discussion about intentionalism and psychologism was already brewing when Carroll criticized it in a previous article. Intentionalism is an approach that gives great weight to the artist's psycho-

_____

logical intentions and holds that, in some way, the artist's "intention" is externally stamped on the artwork. This view involves understanding the artwork as a substance to which external elements are added, making it a work of art. However, the artwork is not constituted as such; the artistic intention is constitutive and imprinted throughout the creative process.

Externalist considerations problematize the question of interpretation. From the externalist and mentalist perspectives, explaining artistic intentionality is impossible. Faced with this consideration, the concept of intentionality is worth clarifying. We certainly cannot know the artist's mental reflections, but intentions that manifest themselves both publicly and in the work itself guide interpretation. Intentional elements have to be inferred from intentional structures and attributes within works of art, which are now seen as public objects, to escape from solipsism in art philosophy. Thus, the problem of knowing the artist's intention is solved when we rid ourselves of psychological determinations and consider that it is possible to know, at least to a certain extent, the artist's intentions.

In conclusion, AI is not creating art. When we perceive the machines as creating "art" we ascribe to them interiority, intention, and creativity to embody meanings in the same way we assume that people in films live authentically. Although AI has demonstrated remarkable capabilities traditionally considered artistic, defining creativity involves producing original and imaginative ideas, often requiring human intuition, experience, and an audience's understanding.

Concluding remarks

Looking to the future, AI's role in creative endeavors will continue to evolve. While AI can replicate existing styles and generate content based on predefined patterns, achieving true artistic innovation remains a significant challenge. This article illustrates how Arthur C. Danto's philosophy of art, while conceived before the proliferation of artificial intelligence (AI) in artistic creation, offers valuable insights for interpreting AI-generated productions.

Danto's emphasis on the role of context in understanding art gains renewed relevance in the context of AI-generated art. AI produced artworks are shaped by data and algorithms, raising questions about intention. As AI lacks intentionality, spectators often anthropomorphize the program, attributing human-like intentions to it. This tendency raises significant issues in discussions about AI-generated art.

_____

The central issue here isn't whether AI creations can be termed 'art,' but rather, who should be considered the true 'author' of an AI-generated artwork—the human programmer, the AI model, or both? We do not have any problem understanding that photographs are taken by humans, not by cameras. This controversy reflects a similar dilemma that will be resolved with a deeper understanding of AI's functioning.

In summary, Arthur C. Danto's philosophical framework provides a valuable perspective for examining AI-generated art. As AI continues to shape the artistic landscape, Danto's ideas serve as a thought-provoking foundation for understanding and critiquing the intersection of human and machine creativity. Whether AI represents a continuation or disruption of artistic traditions remains a topic ripe for exploration and debate in the evolving art world.

Bibliography

1. Anantrasirichai Nantheera, Bull David (2022), "Artificial Intelligence in the Creative Industries: A Review", *Artificial Intelligence Review*, pp. 55, 589-656, https://doi.org/10.1007/s10462-021-10039-7.
2. Beardsley Monroe C. (1992), "The Authority of the Text", [in:] *Intention and Interpretation*, ed. Gary Iseminger, Philadelphia: Temple University Press, pp. 24-40.
3. Cascales Raquel (2022), "Vindicating the Historical Condition of Art and its Consequences: Hegel's Influence on Danto's Philosophical System", *Rivista di estetica*, 79 (1), pp. 121-136.
4. Carroll Noël (2021), "Danto, Style and Intention", [in:] *Arthur Danto's Philosophy of Art*, Leiden: Brill, pp. 25-35.
5. Cetinic Eva, She James (2022), "Understanding and Creating Art with AI: Review and Outlook", *ACM Transactions on Multimedia Computing, Communications, and Applications*, 18, 2: 66, pp. 1–22, https://doi.org/10.1145/3475799
6. Danto Arthur C. (1981), *The Transfiguration of the Commonplace*, Cambridge: Harvard University Press.
7. Danto Arthur C. (1992), *Beyond the Brillo Box. The Visual Arts in Post-historical Perspective*, Berkeley: University of California Press.
8. Danto Arthur C. (2001), *The Madonna of the Future: Essays in a Pluralistic Art World*, Berkeley: University of California Press.
9. Di Dio Cinzia, Ardizzi Martina, Schieppati Sara Valentina, Massaro Davide, Gilli Gabriela, Gallese Vittorio, Marchetti Antonella (2023), "Art Made by Artificial Intelligence: The Effect of Authorship on Aesthetic Judgments", *Psychology of Aesthetics, Creativity, and the Arts*, https://doi.org/10.1037/aca0000602
10. Fontaine Arturo (2022), "Writing with Style", [in:] *A Companion to Arthur C. Danto*, eds Jonathan Gilmore and Lydia Goehr, Hoboken: John Wiley & Sons, https://doi.org/10.1002/9781119154242.ch3.

_____

11. Goehr Lydia (2022), *Red Sea, Red Square, Red Thread. A Philosophical Detective Story*, Oxford: Oxford University Press.

12. Lyas Collin, Stecker Robert (2009), "Intentional Fallacy", [in:] *A Companion to Aesthetics*, eds. Stephen Davies, Kathleen Marie Higgins, Robert Hopkins, Robert Stecker, David E. Cooper, Malden: Wiley-Blackwell, pp. 369-371.

13. Margolis Joseph (1979), "A Strategy for a Philosophy of Art", *The Journal of Aesthetics and Art Criticism*, 37, 4 (Summer), pp. 445-454.

14. Margolis Joseph (2008), *The Arts and the Definition of the Human: Toward a Philosophical Anthropology*, Stanford: Stanford University Press.

15. Mikalonytė Elzė Sigutė, Kneer Markus (2022), "Can Artificial Intelligence Make Art? Folk Intuitions as to whether AI-driven Robots Can Be Viewed as Artists and Produce Art", *ACM Transactions on Human-Robot Interaction*, http://dx.doi.org/10.2139/ssrn.3827314.

16. Nake Frieder (2010), "An interview with Frieder Nake", *Right Click Subscribe*, [online] https://www.rightclicksave.com/article/an-interview-with-frieder-nake.

17. Offert Fabian (2019), "The Past, Present, and Future of AI Art", *The Gradient*, [online] https://thegradient.pub/the-past-present-and-future-of-ai-art/.

18. Russell Stuart, Norvig Peter (2020), *Artificial Intelligence: A Modern Approach*, Harlow: Pearson.