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Rethinking literary creativity in the digital age: a comparative study of human versus AI playwriting

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This paper contends that, in the digital era, the creation of art is no longer an endeavor exclusively pursued by humans to achieve a creative product. Over the past decade, computer-generated theater has emerged and progressed significantly through successive projects. This advancement has incited debate about whether these AI-generated works possess literary merit and originality comparable to Human-authored texts. Therefore, this interdisciplinary study aims to draw a comparison between an AI-generated play and a human-authored play in terms of originality, fluency, flexibility, and effectiveness. It utilizes Computational methods and NLP tools to process the two plays, analyze both content and language, and derive quantitative measures that support the creativity assessment of the two plays. The results of content and computational analysis indicate that the human-generated play has higher scores in all indexes of creativity. However, the results also suggest that the AI-generated play features significant creativity potential close in assessment to the human proficiency in several indexes. Thus, AI is capable of creative literary products, though it is not as masterful as those produced by creative humans.

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Introduction

This study is inspired by Oscar Wilde's quote "There is no such thing as a moral or an immoral book. Books are well-written, or badly written" (1890/1993, p. xxiii) but what constitutes a "well-written" or a "badly-written" text has remained for centuries a matter of taste or a personal preference. This study evaluates the literary merit of AI-generated drama through a comparative analysis with a human-authored play. This comparative study is crucial to recognize the strengths and weaknesses of the rising AI-generated literature reflecting "the momentary position of a production compared to other productions in a field" (Lubart and Sundquist, 2024, p. 20). By assessing AI-generated literary products and comparing a machine-authored text to existing postmodern writing, the research sheds light on its intersections with and distinctions from postmodernism as a movement.

The study relies on both content and computational analysis of the two selected posthuman plays, utilizing thematic analysis programs to decipher recurrent themes and NLP tools to investigate linguistic features conducive to creative potential, ultimately reaching a minute examination supported with statistical findings. Earlier studies have shown that measuring and assessing creativity can predict and enhance future creative accomplishments, revealing that certain features of creativity can definitely be measured in a way that predicts potential (Cramond et al., 2005; Karam, 2021). The research explores Topic Modeling as an innovative tool for objective literary analysis, but highlights the fact that human interpretation of its results is indispensable since topic models generate statistical patterns and detect word clusters and frequencies, not meanings. The study shows that computational methodologies are able to predict literary success, but not without legitimate concerns regarding the risk of literary homogenization. Ethical implications and challenges of AI creativity, including the derivative nature of AI-generated works, issues of authorship, and copyright, are examined with special attention to the role of human agent intervention in AI production. Finally, the study demonstrates the extent to which AI can generate a creative literary work that closely emulates that produced by a human playwright.

Intersections and distinctions between AI-generated Literature and Postmodernism

AI-generated literature and postmodernism overlap in several aspects. Tabbi (1995) anticipates the interrelation between postmodern fiction writing and AI; he argues that "the sublime persists as a powerful emotive force in postmodern writing, especially in American works that regard reality as something newly mediated, predominantly, by science and technology" (1995, p. ix). Tabbi argues that postmodern culture "no longer respects romantic oppositions between mind and machine" (p. 1). Thus, AI-generated literature fits into Tabbi's definition of postmodern sublime, which "has always located itself between discrete orders of meaning. It is not a category in itself so much as a term that describes what cannot be categorized, and the writers it claims cannot be held to any one literary genre" (p. xi). AI literature challenges the genre categorization in terms of its authorship and style. It is not purely machine-made because AI relies on data entries proposed by the human agent.

Poliks and Trillo (2023) elucidate the correlation between postmodernism and AI. They argue that the postmodern aura has generated what they term a "vapor space", an infinite state of information transfer and exchange. It is "the free interplay of fully autonomous processes cleaved from a subjective experience" (p. 6). This vapor space "automatically, unthinkingly enacts AI. It scopes AI, it limits AI, it holds and hosts AI, it expresses itself as AI—not as a revolutionary object but simply as a natural and neutral automatic predisposition" (p. 22). Baudrillard's concept of "simulacra" (2006) highlights the fact that in postmodern societies simulations and representations of reality have replaced profound actuality. In the contemporary world, AI tools produce simulated versions of reality that become the new constructed reality. With the loss of an absolute standard of reality, AI offers a different version of "material constructions of an emerging technological reality" (Tabbi, 1995, p. xi). Baudrillard's ideas are examples of hyperreality, where the line between reality and its simulation is blurred. With AI-generated literature, tools produce increasingly complex narratives that glue two or more texts together, creating a new one that is considered both creative and innovative but hardly original due to the intervention of the human agent. Sharples and Pérez y Pérez (2022) write answering if a computer can create new stories, "you could chop already-written stories into smaller pieces—single events, dialogs, descriptions—then code a computer program to select some at random and string them together, slotting in consistent characters throughout" (p. 16). This echoes the postmodern vein since no text stands in isolation. AI generative tools are capable of producing literary works that incorporate the postmodern concepts of hyperreality, fragmentation, and diversity. They are also compatible with the postmodern concept of intertextuality, integrating different sources and variable genres (Karam et al., 2024). They combine human and machine creativity. Therefore, "acquiring a heterogeneous communion of material" (Poliks and Trillo, 2023, p. 8). Both Postmodernism and AI rely on "datafication" (p. 8).

Despite these intersections between postmodernism and AI, there are various distinctions between them. Though AI uses immense tools and data, it is still confined to capabilities and tasks determined for it in the stage of programming and pre-training. Thus, the question of authorship property is a clear distinction. Another obvious distinction is intentionality. While AI is managed by its creators and users, postmodernism initiates the process of positive creativity. Postmodernism uses pastiche and parody, while AI does not provide an intentional critique of earlier texts. Postmodern literature is a human-driven movement that deliberately deconstructs meaning and experiments with form, while AI is machine-oriented and, as a result, lacks originality and intentionality (Runco, 2023).

Ethical implications, challenges, and human agency in AI Theater

There are crucial copyright and intellectual property concerns raised by AI-generated literature. Who owns the copyright is a controversial issue, as the user of the AI program cannot fully claim either the originality of this work of art or its ownership. The user of the program acts like an operator or initiator of the AI program. His role is not limited to providing data or guiding inputs, but he can control the generated outcome through the choice of selected training material and the subjective decision of what to keep and what to omit from the generated text. Ethically speaking, the AI program and its designer/user significantly contribute to the process of composition and production, so some specialists argue that their role in the work of art must be acknowledged. "Ethical principles, including openness, honesty, transparency, efficient use of resources, and fair allocation of credit, demand disclosing the use of LLMs" or any other AI tools (Hosseini et al., 2023, p. 451). Roles of different contributors, including AI tool designers, data providers, and users, should be acknowledged. "This creates a 'many hands problem' whereby responsibility is distributed across a plurality of professional

disciplines, potentially in a muddled way" (Thomas, 2024, p. 526). Moreover, AI tools may automatically or intentionally infringe on intellectual property rights, and this trespass may remain invisible to the user unless they utilize other AI tools such as plagiarism checkers. "Core principles of responsible AI include accountability, responsibility, and transparency, along with fairness, inclusivity, trust, privacy, sustainability, and explainability in AI design and application" (p. 526). The extent of AI accountability should be objectively determined and admitted in ethical declarations attached to every work of art whose creation has depended on AI processing. Transparency can be fulfilled when the name and role of the AI tool in the creation process are declared in detail, as well as the actual implemented percentage of AI-generated literature in the final product.

AI tools may also incorporate problematic material, which refers to misogyny, violence, racism, sex, or homophobia, or employ offensive language that stems from the training datasets. Studies illustrate that even with refined algorithms, AI-generated literature frequently exhibits a 15–20% overlap with pre-existing content, which, although is not considered verbatim plagiarism, exhibits lack of originality due to its derivative nature (Wang et al., 2023). Scott et al. (2024) emphasize that scrutinizing "data for biases is imperative as unchecked biases may perpetuate stereotypes or contribute to the underrepresentation of certain groups in the generated art". These multilayered ethical concerns accentuate the necessity of the utilization of a meticulous and all-inclusive approach in investigating the correlation between AI, originality, innovation, copyright, and artistic representation. The value of AI-generating tools does not lie in imitating writers or replacing them but in "providing humans with tools and techniques" (Dignum, 2019, p. 5). Thus, human mediation is indispensable. "Ultimately, it is the delicate balance between human creativity and AI assistance that can pave the way for innovative and immersive theatrical experiences in the future" (Ren, 2024, p. 28). As a result, researchers call for a proactive approach to ensure responsible AI development (Al-kfairy et al., 2024; Thomas, 2024).

Topic modeling

By means of using digital text corpora and statistical measures, language patterns that are difficult to spot by the naked human eye are effortlessly recognized. This has proved to have a number of benefits. One of the most successful measures has been Delta or Burrows' Delta. It was named after the Australian literary scholar John Burrows, who developed this method and first published it in 2002. With Delta's huge success and accuracy in determining authorship, researcher Mathew L. Jockers looked beyond authorship verification and tried to further employ it in literary analysis.

Questions about Delta software's capability to discover themes and characteristics of certain genres, orientations, or geographical areas were raised. For these issues, he used a high-level statistical tool called "Topic Modeling". It is "an unsupervised machine learning method that learns the underlying themes in a large collection of otherwise unorganized documents … These browsing interfaces reveal meaningful patterns in a collection, helping end-users explore and understand its contents in new ways" (Chaney and Blei, 2012, p. 419). The tool is able to identify patterns and consequently uncovers the underlying themes within a text (Jockers, 2013). Jockers's work on Topic Modeling has offered an innovative tool for objective literary analysis (Jockers and Mimno, 2013) that does not rely on subjective personal preference. However, this has to be met with caution since individuals may ascribe subjective meaning, other than what actually exists, to resulting patterns, particularly when examining lists of the most frequent words. Humans often impose interpretations on these patterns, even when they may not align with the model's statistical foundations. According to Chang et al. (2009), human interpretation is necessary because topic models generate statistical patterns and detect word clusters and frequencies, not meanings. As a result, the human agent is needed to assign meaning to the resulting numbers and statistics, but scholars are prone to over-interpretation as they sometimes give meaning to improbable instances and ignore the more obvious ones (2009). As a result, humans are expected to intervene to give meaning to topic model results, but with caution.

The Bestseller Code

In 2016, Matthew Jockers collaborated with Jodie Archer and published a book entitled *The Bestseller Code,* in which they explain why around two hundred titles out of fifty thousand American literary texts end up each year on the prestigious New York Times bestseller list. Archer and Jockers wanted to reveal what the books that made it to the bestseller list have in common, hoping that their findings can establish what literary qualities make a literary work worth buying from the readers' perspective. For analysis, they used the computational approach to analyze a vast corpus of texts to help uncover which characteristics a literary work of art should have in order to be considered a bestseller and achieve commercial success. Central to Jockers's methodology is the use of text mining and machine learning algorithms to process and analyze large volumes of text. The authors employed an algorithm that could read and analyze 20,000 books, identifying over 2,800 distinct features such as theme, style, plot, and character development that correlate with bestseller status (Archer and Jockers, 2016). One key aspect of their approach is the emphasis on thematic elements. The algorithm examines how themes are distributed and interwoven throughout the text, providing a quantitative basis for understanding how certain themes resonate more than others with American readers (Archer and Jockers, 2016).

The results showed that at least thirty percent of incorporated bestsellers consisted of one or two main topics maximum. The more topics, the less it sold. Surprisingly, the plot does not necessarily have to include excessive elements of sex or drugs since they appeal to a certain division. Part of the bestseller code is that a text must be about relationships, including people's closeness and moral dilemmas. Their analysis revealed that linguistic style, incorporating variations in sentence length and structural complexity, also impacts a book's chances of becoming a hit in the book market. Books that maintain a moderate level of complexity, avoiding both overly simplified and excessively complicated structures, are more likely to appeal to the majority. They noted that high-frequency words or parts of speech may be important signals of bestseller potential, including the repetitive use of the article 'the'. Moreover, punctuation plays a role in the proper use of periods and commas. Using question marks is acceptable, but not the disproportionate use of exclamation marks. Interestingly, computational analysis of twenty-first-century works proved that it has become more difficult to predict the author's gender than it was with nineteenth-century texts. In comparison, the success rate plunged to seventy-one percent instead of eighty percent. Well-known female authors such as Toni Morrison and Barbara Kingsolver were mistaken for men by the software. This most probably has to do with the fact that these female authors share an academic background, being university educated, with male authors of the same style. Archer and Jockers (2016) analyzed the titles of all bestsellers in their corpus and were able to detect several similarities. For example, the word "girl" was recurrent, not only in titles, but also within the texts

themselves (p. 147–9), which shows more public interest in young female characters. By providing tangible evidence through merging data science and literary analysis, Archer and Jockers's findings were able to give insight to writers in order to tailor their work to better meet market demands. *The Bestseller Code* received its share of criticism. There were concerns that accentuating data-driven writing could lead to the homogenization of creative works. This did not condone Jockers's revolutionary computational methodology as it opened new avenues for understanding and predicting literary success.

Fostering the intersection between Literary Studies and Computer Science in AI-generated literature was the following ground-breaking step in the field of creative arts. One methodology is exposing AI tools to different narrative structures and training them to generate a narrative that aligns with a particular theme or a team's thematic preference. Typical concerns about a lack of creativity were raised, as AI programs may continue to replicate existing tropes found in their training data (Bolukbasi et al., 2016). Therefore, ethical implications and challenges, including the percentage of plagiarism and who owns the copyright of the generated work of art, rose to the surface.

THEaiTRobot: an AI tool for generating theater play

This study examines THEaiTRobot, a theater script generation tool, to evaluate its ability to create a complete sixty-minute play, *AI: When a Robot Writes a Play*[1]. The play was staged, rehearsed, and premiered in theaters. The *THEaiTRobot* program stands out from earlier tools for its capacity to produce a complete play with ninety percent of the script completely computer-generated. The project team indicates: "The resulting script of the play *AI: When a Robot Writes a Play* consists of text generated by the THEaiTRobot tool from 90%, the remaining 10% are human interventions by the operator and dramaturgist David Košťák, or by the director Daniel Hrbek" (Rosa, 2022, p. 15). The team also attached a version of the play as an Appendix with all human interventions shown in the script. Thus, the team avoided the ethical issues of intellectual property rights through adopting objective transparency, declaring the role of the AI tool in the composition process as well as the actual percentage of AI contribution in the generated final product.

The 10% of human intervention consists of providing opening statements that work as guidelines, setting the scene for a narrative. In the composition of the dramatic text, THEaiTRE depended on an unmodified version of GPT-2 XL. To understand the extent of human intervention in the composition of the play, the following steps clarify the collaborative roles of the human agent and AI tool in writing the play. The human agent designs and feeds OpenAI's language model GPT-2 using a dataset of millions of webpages from various fields, including Google, New York Times, and BBC (Clark, 2019). "Based on the given prompt, the language model generates continuous lines in an uncontrolled manner—i.e., freely, without explicit constraints on content, style, or context" (van Heerden et al., 2023, p. 107), and since it may contain biases or stereotypes and infringe upon copyright, human intervention is vital (van Heerden et al., 2023). Thus, the human agent acts as a censor to purify the text from racial or gender biases. Moreover, the dramaturg inserts a human-authored prompt composed of a brief scene description in the form of a stage direction and two initial lines of dialogue that direct the development of events, allowing the program to use predictive algorithms to generate complete scenes and dialogues. From the computer-generated texts, eight dialogues were chosen in collaboration with the director, selecting those that showed the greatest staging potential from the subjective points of view of the creative team (Schmidtová, 2022). The process is repeated for every scene, with a new prompt provided each time. The annotated script includes notes indicating where and how the human agent intervenes (THEaiTRobot 1.0 et al., 2021).

One of the limitations THEaiTRobot faced is that it does not perform effectively with a large number of characters; therefore, the development team deliberately restricted its generated dialog to only two characters per scene. The play includes eight different characters; each appears only once, with the leading character appearing in all eight scenes. The individual scenes are not closely interconnected, but the central leading character of the Robot provides ambivalence. Moreover, some dialogues seem to be ambiguous or meaningless. Košťák (2022) elucidates "the robot's dialogues are closest to the theater of the absurd" (34). However, some uncanny parts may be deliberately included to suggest multilayered significance or leave the meaning open for the audience's interpretation. As psychologist Jerome Bruner (1991) argues, "Narrative, I believe, is 'designed' to contain uncanniness rather than to resolve it" (p. 16).

There are notable Human-oriented themes explored in the play, like death, humor, fear, burning out, searching for a job, and love at first sight. The play gives readers insight into how machines may portray humans and themselves. For example, the THEaiTRobot program builds its narrative portraying a humanoid Robot as its leading character. He bids farewell to his dying master in Scene I, receiving final instructions about life before being left to navigate the world alone without further guidance. In Scene II, when repeatedly prompted to tell a joke, the Robot eventually delivers one: "When you are dead. When your children are dead. When your grandchildren are dead, I will still be alive" (THEaiTRE, 2021, p. 11). This cynical remark, generated by a machine, carries a significant degree of truth and can be perceived as both sharp-witted and harsh when directed at a human. Scene III reveals the humanoid robot's longing for sensuality, which becomes evident through its decision to visit a masseuse who is, in fact, a prostitute. The scene portrays a form of virtual intimacy between the Robot and the masseuse, occurring without any physical contact. In Scene IV, the Robot stands beneath a lamp, afraid of the darkness, where he encounters a stranger who is later revealed to be an engineer. The stranger inflicts harm on the Robot and dismisses the idea that machines can experience emotions. Scene V takes an unexpected turn when a man repeatedly asks the Robot to end his life. Instead, the Robot responds with an offensive, sexual gesture. The sexual insinuations throughout the play cannot be denied in this majorly computer-generated text. They drive readers to question the non-fictional material humans first introduced to Artificial Intelligence in order to train it to produce such a script. In the subsequent scene, the Robot encounters a psychologist who questions him about his life, relationships, and emotions. Their conversation also touches on a device called the "emotion machine," which the Robot can use to manage stress. In Scene VII, the Robot visits an employment agency, where he speaks with an administrator and seeks assistance in finding a job. He expresses his desire to become an actor, mentioning his past experience as a clown. He introduces himself as Troy McClure, a name referencing a character from *The Simpsons*, a show known for its predictive elements.

In the final scene, the Robot meets a human actress dressed in a robotic costume and immediately falls in love with her. Initially hesitant, the actress eventually succumbs to the Robot's charm, and they fall in love. The Robot shares his vision of a binary world and invites her to join him. She ultimately agrees, and the play concludes with their promise to live together. Notably, in the last scene, the Robot lacks a physical form; instead, the audience hears only his voice and sees a pulsating light as he tells her "I would take you out on adventure to get you into my binar self, and then

I would be able to make love with you … Binary relationships are like real life" (THEaiTRE, 2021, p. 43–44). The actress ultimately consents to relinquish her physical form, allowing her to unite with the Robot in his binary realm.

Due to Covid, *AI: When a Robot Writes a Play* was broadcast online and watched by thousands of spectators worldwide. The online stream made it possible for the play to be watched by more spectators than the physical performance. The premiere was streamed in the Czech language with English subtitles. It was also automatically translated and subtitled in forty languages. The performance was followed by a discussion with the audience, who highlighted the striking similarity with Human-like incidents (Schmidtová, 2022). They reflected on the leading character's development from an automated follower to a Human master in scene I to an individual character who seeks an established love relationship by the end of the play. Many pointed out the fact that the machine was heavily influenced by the articles and datasets that trained the GPT-2 language model. This is a similar process simulating how a living author is exposed to material during his/her lifetime in an attempt to inspire his/her work. According to Košťák (2022), findings indicate that through a comparison between the generated script and the input data, verbatim plagiarism has not been detected. Words and verbal phrases are sometimes reused but placed in different contexts. Košťák (2022) argues that "a robot is paradoxically less capable of plagiarism than a living author, who, even unconsciously, can mirror his reading experience" (p. 36).

Method: creative performance assessment approach

The Creative Performance Approach mainly investigates expressed creativity, such as creative accomplishments, creative products, and creative achievements (Runco, 2024). It studies indicators of divergent thinking, associative thinking, and convergent thinking. These indicators include originality, effectiveness, flexibility, and fluency.

Both originality and effectiveness, two indicative indices of creative thinking, are interdependent. Runco and Jaeger (2012) point out that creativity requires both novelty and effectiveness, so a creative work should be unusual and unique, "posing a remarkable impact on the public taste and emphasizing its impressive, appreciable value" (Karam, 2021, p. 315). Originality refers to the novelty, uniqueness, and unusualness of the creative product, which deviates from the norm or represents previously retrieved knowledge in a novel formulation. Amabile (1982) argues that "creativity can be regarded as the quality of products or responses judged to be creative by appropriate observers" (p. 1001), indicating that the cumulative subjective assessment of critics and experts can establish a criterion for the creative assessment of a product. According to Bourdieu (1993), value attribution to a literary text is often determined by a theory of shared acceptance within the academic field. This theory suggests that the worth and significance of a text are not inherent qualities of merit but are rather established through a collective agreement among scholars, critics, and educators. The consensus within the academic community plays a crucial role in shaping the perceived value of a literary work. The criterion of effectiveness is difficult to process and apply because it is influenced by factors such as historical context, cultural relevance, and the contributions of prominent critics and theorists. For instance, a survey of reviews and rating sites can suggest a significant indicator of the degree of effectiveness which is associated with "consequences of the creative activity" and "the judgment of the outcomes" addressing creativity from the socio-cultural point of view to stress the role of the relationship between creator, creation, and audience in creativity assessment (Corazza, 2016, p. 259).

Fluency refers to the number of variable ideas a creator can generate. Thus, it "is defined in terms of productivity. A fluent individual gives a large number of ideas" (Runco and Acar, 2012, p. 67). "Fluency scores have often solely been used to represent divergent thinking, or even creativity in general" (Dumas and Dunbar, 2014, p. 57). However, other factors determine the measure of fluency, including the appropriateness of ideas and the interrelation between them. Thus, the way ideas are convincingly represented and conceptually integrated determines the level of fluency. Contemporary AI tools that perform thematic analysis are viable in measuring fluency because they can count themes and represent their interrelation in a conceptual mapping model of variable layers. Thus, fluency overlaps with flexibility, another significant index of creativity assessment and a component of creative associative thinking.

Flexibility refers to the ability to integrate the variable components of the creative work conceptually and esthetically into a coherent whole. "It is also the number of connections among different areas, categories, and ideas" (Karam and Elfiel, 2021, p. 116). Flexibility brings variable and disparate elements into a unified composition. Turner (2014) argues, "advanced blending provides us with extraordinary flexibility and a unique power for innovation" (p. 198). Spiro and Jehng (1990) elucidate this integrative feature of cognitive flexibility, defining it as "the ability to adaptively re-assemble diverse elements of knowledge to fit the particular needs of a given understanding" (p. 169). According to the empirical study of Runco and Albert (1985), originality and flexibility are positively correlated.

The process of verbalization, the expression of ideas in words, is crucial to literary creativity because the major artistic medium of literature and drama is words. Verbal creativity is "a linguistic act composed of the activation of creative thinking and a process of written reflection that allows the elaboration of a narrative with textual harmony, metaphors, originality, and imagination" (Martínez et al., 2024, p. 2). Creative verbalization entails lexical variation, meaningfulness, lexical sophistication, and figurative language, which enrich the creative expression with multilayered significance. A metaphor is an indicator of verbal fluency that is used to "describe concepts and episodes using figurative language, and it is a powerful rhetorical tool for creatively conveying complex ideas" (DiStefano et al., 2024, p. 1). The use of figurative versus literal language is utilized as a measure to assess creativity via measuring fluency. Metaphors are "crucial in human cognition and creativity, facilitating abstract thinking, analogical reasoning, and idea generation" (p. 1).

Case Study: *Marjorie Prime (2015) versus AI: When a Robot Writes a Play* (2021)

This section introduces the two plays that represent the samples of the contrastive analysis. Then, both are brought to scrutiny in two-dimensional analysis, literary analysis, and computational analysis. The latter depends on NLP tools to analyze both language and content. Both posthuman texts raise existentialist questions about the nature of existence and the possibility of transcending human limitations through technology, along with the possible consequences of encounters between humans and technology. These texts explore the recurrent theme of autonomy, free will, and dominance. Human playwrights/computer-generating tools differ in their depiction of the mainstream and the other, as well as the degree to which their AI characters are humanized and imbued with emotions.

Marjorie Prime, by American playwright Jordan Harrison, explores themes of memory, identity, and, most notably, the Human-AI relationship. The play's complex characters and thought-provoking themes have earned it critical acclaim,

establishing it as a significant reference for posthuman existence through the depiction of holograms from a human perspective (Harrison, 2015). Marjorie Prime takes place in the near future, where holographic projections known as Primes are utilized to recreate deceased loved ones. These interactive holograms engage in conversations with the living, assisting them in remembering and coping with loss. Primarily serving a therapeutic purpose, they help the elderly Marjorie preserve her memories as she struggles with dementia. Marjorie interacts with young Walter's prime, which depicts her husband, who passed away, on a daily basis. The use of a life-like hologram in the play is not an added impressive edge given to the play for the audience's marvel and fascination with a new lighting technique, but a profound part of its plot. Holograms explore how technology can mimic and/or substitute human relationships and sustain a person's presence beyond their fragile, mortal physical body. In Harrison's futuristic vision, "the Primes" are placed in a domestic setting, demonstrating their role in comforting those who have lost loved ones by offering companionship through interactive holograms that are as intelligent as chatbots. Additionally, the play highlights the endurance of the Primes, persisting long after all human characters have passed away and been replaced with 'primes', encouraging the audience to consider technological substitutes for physical existence. The play is able to shed light on new reasons for alternative existence, like cyberimmortality, and helping the deceased's beloved ones, as it explores Human–AI relationships. The original production of the play premiered at the Mark Taper Forum in Los Angeles in 2014 and was directed by Les Waters. The use of holograms was a central element of its staging, requiring advanced lighting techniques to create the hologram illusion.

AI: When a Robot Writes a Play is an experimental project where an AI tool generated a script based on input datasets. The resulting play presents an insight into Human–AI relationships through the robotic lens. In *AI: When a Robot Writes a Play*, robots play a major role not only in co-authorship but also as a major protagonist of the text. The plot explores human-robot interactions, exploring the emotional and ethical dimensions of such relationships. The AI-generated play is a testament to the advancements in natural language processing (NLP) and machine learning.

The play's production was challenging and unique since it integrated robotic elements into the performance. This involved using an actual robot on stage, designed to deliver its dialogues and engage with human performers. This robot was equipped with advanced speech recognition and generation systems, allowing it to respond to live cues and maintain a fluid interaction with the cast (Colton et al., 2011). Thorough rehearsals were conducted to guarantee seamless interactions between the actors and the robot. The audience responded positively to the play, witnessing robots perform on stage and all actors (humans and the robot) delivering AI-generated dialogue. The play represents a significant milestone in the integration of artificial intelligence in theater. Employing a robot as both a creator and performer questions the conventional perception of authorship, prompting audiences and critics to consider AI creativity and compare it to Human-written texts.

Literary content analysis. This study employs a set of criteria for assessing the literary content and quality of both plays, including character development and thematic complexity. The analysis reveals that the computer-generated text exhibits key features found in the Human-generated work, such as character development and change. Marjorie's evolving relationship with Walter Prime reveals deep insight into her past and her coping mechanisms with loss and aging. For example, she says, "Sometimes I think about how nice it would be if you could just tell me what to do. If you could give me a program. Just one. To tell me how to go on without you" (Harrison, 2015, p. 45). In *AI: When a Robot Writes a Play*, the Robotic character develops from one scene to the other, however human characters surrounding the leading character lack the human sentiment often found in Human-created characters. For example, in scene i the Robot repeats what his dying master says "Mas.: I have been a bad boy", "Rob.: I was a bad boy" (THEaiTRE, 2021, p. 4). As he learns from his master, the humanoid Robot by the end of the play shows sagacity and evolution. Later, when asked about his desired profession, he responds, "a movie star" (THEaiTRE, 2021, p. 33). Acting is an occupation that requires talent and creativity rather than monotony and repetition. The protagonist, who initially imitates others, eventually seeks a stable career and a committed relationship.

The AI-generated text lacks thematic complexity and emotional depth, often conveyed by fluid human discourse found in Human-generated plays. For example, when Harrison presents a holographic version of one of his characters in *Marjorie Prime*, it takes the audience considerable time to recognize that they are encountering a posthuman version of a deceased individual because the hologram is eloquent and knowledgeable to a great extent. In fact, in Part III, Harrison writes in his stage directions that *TESS Prime sits with MARJORIE Prime and WALTER Prime. They are at ease with each other, animated, not robotic* (2015, p.59). Harrison's depiction of all three holograms lacks distinctiveness in language and gestures. This is a typical example of Baudrillard's concept of "simulacra" (2006), which highlights the fact that simulations and representations of reality can replace profound actuality in the near future. Harrison demonstrates that AI can transform human relationships and alter the perception of reality, blurring the boundaries between the real and the artificial. The play questions the notion of physical existence by presenting new forms that substitute perishable bodies, allowing the audience to consider whether saved memories in simulated holographic images of a deceased person qualify as a newly constructed version of reality. On the other hand, in *AI: When a Robot Writes a Play*, the machine's portrayal of human characters is quite the opposite. From the Machine's perspective, human actions can often appear arbitrary and lacking justification. For instance, in Scene IV, a man suddenly makes an unanticipated request of the Robot, which is asking him to kill him. The Robot replies, "Sir, I think it would not be wise to attempt to destroy your world" (THEaiTRE, 2021, p. 21). The Robot is presented in a favorable light throughout the play. Written from a machine's perspective, the humanoid robot is often victimized by human characters, oddly hurting the feelings that AI alleges the Robot possesses. The Robot is portrayed in human situations, grappling with psychological well-being, employment challenges, mistreatment, sensuality, and the pursuit of a romantic relationship. The Robot exhibits emotions of anger, stress, sadness, fear and love. He is the more logical party in terms of actions.

Emotional depth and psychological complexity are by far the most notable of all differences between the two texts. In *Marjorie Prime*, dialogues created by humans, including those scripted for the holograms, are layered with subtext and emotional nuance, enhancing the play's psychological complexity. For instance, Walter Prime says to Marjorie, "Your memories are all we have left, Marjorie. The pieces of you that still linger in this house. But I am here to help you remember, to help you hold on to what was once yours" (Harrison, 2015, p. 30). The emotional tone of the human-created drama is intricate and undergoes transformation throughout the play. Sentiment analysis reveals notable shifts in tone that align with key dramatic moments, highlighting the

Table 1 Differences between values of linguistic and thematic scores.

Plays	Number of interrelated themes	Levels of conceptual model	Idea density	Lexical density	Lexical sophistication	Type-token ratio (TTR)
Marjorie Prime	5	3	0.483	51.16%	33%	19.28%
AI: When a Robot Writes a Play	6	4	0.447	43.1%	30%	12.11%

narrative's emotional depth. This is exemplified in the following excerpt from the leading female character: "I don't want to forget him. I don't want to forget us. But the more I try to hold on, the more it slips away" (52). The statement highlights anxiety about memory and identity. The emotional depth arises from the underlying fear of losing oneself. Stylistically speaking, the dialog is carefully crafted to reflect variable emotional states, generational differences, and the passage of time.

On the other hand, in *AI: When a Robot Writes a Play*, the language, expressing emotional and psychological states in the computer-generated play, is overly simplistic, inconsistent, and repetitive, highlighting its limitations at the time in conveying the depth and complexity of human dialogue. The language, utilized to convey emotions, is primarily functional rather than artistic. This is exemplified in the following excerpt from the exchange between the mysterious engineer and the Robot, "Rob.: I love robots", "Str.: I love humans", "Rob.: I know. But I love robots", "Str.: And I love humans" (THEaiTRE, 2021, p. 18). Such repetitive declarations of sentiment occur multiple times throughout the play between the leading character and his fellow humans. The emotional tone is static, with little variation in sentiment. The AI's inability to fully express human emotion results in a monotonous delivery that depends on repetition and lacks climax. Another instance of ineffective language use is the tendency for literal interpretations. In Scene II, the robotic character sincerely asks a young boy, "Is there a problem? I noticed you have a wet face!" to which the child replies, "those are tears, jerk!" (THEaiTRE, 2021, p. 8). This naïve question illustrates the robot's literal perception of human behavior, highlighting its difficulty in understanding emotional expressions. It shows that while the AI-generating tool is capable of producing a coherent and contextually straightforward dialogue, it often lacks distinctive emblematic and rhetorical literary features found in Human-authored texts.

Computational analysis of language and content. This study utilizes recent computational and NLP methods to derive precise metrics suitable for comparing the human-authored play with the AI-generated play in terms of both language and content. The used measures, including language sophistication, lexical variation, Type-Token Ratio (TTR) and idea density are commonly used by researches to assess the quality of writing and creativity indices potentials in written texts such as originality, fluency and flexibility (Palfreyman and Karaki, 2019; Turkman and Runco, 2019; Karam and Elfiel, 2021). Turkman and Runco (2019) argue that "creativity has its own unique way to show itself in written documents" (p. 19). The measures used include language sophistication, lexical variation, lexical density, and Type-Token Ratio (TTR).

This study relies on recent computational and NLP tools to obtain the aforementioned variables and evaluate the creativity indices accordingly in the two selected plays. First, Lexical Complexity Analyzer measures variables of lexical richness, such as lexical density, lexical sophistication, and word variation. Second, the Figurative Language Checker is used to calculate and classify figurative language used in the two plays. Third, Computerized Propositional Idea Density Rater (CPIDR 5) is a computer program that measures the propositional idea density (ID) of a written text. Fourth, Python, a versatile programming language, is utilized to calculate the type-token ratio (TTR). Fifth, MAXQDA, a qualitative data analysis software, is used to perform thematic analysis of the two plays. Table 1 includes all values that represent the difference between processing the two plays through the abovementioned tools (Fig. 1).

The results shown in Table 1 demonstrate that the human-authored play scored higher values in all linguistic measures compared to the AI-generated play. Higher scores of lexical richness and variation indicate more original use of language and expressions. Accordingly, the higher quantity of lexical density, lexical sophistication, and idea density in human-generated play indicates a higher degree of fluency and meaningfulness. Halliday (2004) elucidates that language bears more weight of significance and "becomes complex by being lexically dense" (p. 354). Lexical sophistication (LS) deals with the proportion of advanced vocabulary employed by writers in their writings. (Palfreyman and Karaki, 2019). The human-generated play includes higher lexical sophistication, which reflects a more proficient capability of effectively managing cognitive load while dealing with multiple tasks (Liu and Dou, 2023).

Originality is operationalized as the statistical infrequency and uniqueness of outputs or responses to a certain stimulus, the unusualness of writers' ideas and production (Runco and Acar, 2012). The human-generated play scored higher word frequency in the indices of type-token ratio (TTR) and lexical diversity (19.28%) compared to the AI-generated play (12.11%), indicating higher originality in the former, determined by the level of frequency and effectiveness of lexical items (Kyle et al., 2018; Karam and Elfiel, 2021). Type-token ratio (TTR) refers to the percentage of unique words to total words in a text, so a higher TTR shows greater lexical diversity. Word frequency indices, referring to the utilization of less common words, indicate general quality, language richness, and competence with written outputs that incorporate lower frequency words, tending to obtain higher quality and proficiency scores. The difference between the two scores ranges between 3% and 8% in favor of the human-authored play. Although this slight difference reveals that the human author is more capable of using more meaningful, original, and sophisticated language, scores show that the proficiency of the AI author is close to that of the human author in terms of linguistic richness.

For content evaluation, this study uses thematic analysis to construct conceptual models for the two plays to identify recurrent themes and interplay between them in textual content (Naeem et al., 2023). It also calculates idea density, which "aims to determine the creativity of a work by examining the density of ideas presented in that work" (Turkman and Runco, 2019: p. 21). The human-authored play has a slightly higher idea density (0.483 versus 0.447), indicating that it may convey more ideas per unit of text. This reveals higher fluency, which "is defined in terms of productivity. A fluent individual gives a large number

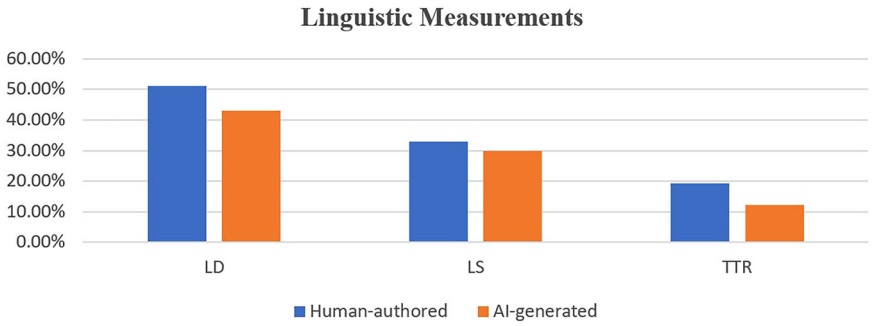

Fig. 1 The column charts for the linguistic scores of the two plays.

Table 2 A list of recurrent and interrelated themes in the two plays.

Thematic analysis

No	*Marjorie Prime*	*AI: When a Robot Writes a Play*
1	Memory and Identity	Human Emotions and Robot Identity
2	Loss and Sorrow	Fear and Vulnerability
3	Humanity versus Technology	Technology and Humanity
4	Family Dynamics and Relationships	Love and Relationships
5	Time and Mortality	Mortality and Existentialism

of ideas" (Runco and Acar, 2012, p. 67). The thematic analysis of the two plays reveals that both the AI-generated play and the human-authored play have the same number of interrelated themes (5), suggesting that both offer almost equal complex narrative structure (Table 2). However, the AI-generated play has a deeper conceptual model (4 levels) compared to the human-authored play (3 levels), indicating a more layered interrelation in the thematic map and reflecting higher flexibility, which lies in the number of conceptual connections among different areas and ideas (Karam and Elfiel, 2021). Flexibility indicates to what extent varied words and ideas are employed and integrated into a meaningful content.

Thus, although the human-authored play includes higher idea density, the AI-generated play incorporates equal number of recurrent and interrelated themes. Moreover, the thematic analysis of AI-generated play reveals a higher proficiency in drawing a multilayered conceptual map between the tackled themes which are connected in four levels of the conceptual model (see Figs. 2 and 3).

Though all differences between the two play scores are slight, they indicate that the human-authored play is more creative in terms of language use, and the AI-generated play is slightly more complex in mapping incorporated themes. Generally, this indicates that AI tools are capable of generating dramatic work that closely simulates that written by creative playwrights (Fig. 4).

The last feature in the content analysis is the use of figurative language, which is an indicator of creative verbalization and style. Previous studies argue that the creative use of metaphors indicates a high degree of flexibility in the use of semantics by drawing an association between two unrelated concepts to form a novel conceptual integration (Kenett et al., 2018; Karam and Eissa, 2023; DiStefano et al., 2024). "The creation of metaphors involves the ability to activate a broader, more flexible set of semantic associations in order to integrate the meanings of the weakly related parts of the metaphor into a meaningful linguistic expression" (Kenett et al., 2018, 1). The results of checking the figurative language in the two plays (see Table 3) reveal that the human author is more capable of figurative expression than the AI author, indicating more semantic flexibility and higher creative use of language.

To investigate the effectiveness of the two plays, this study also surveyed all review websites and platforms to check the impact of the two plays on the audience in general and how they were received and appraised by critics. Concerning the indicator of effectiveness, *Marjorie Prime* received more than 60 reviews published in renowned websites, including The New York Times, The Guardian, Time Out New York, The Hollywood Reporter, The Telegraph, and The Stage. It is rated 4.5 on Amazon with 65 reviewers, 95% rating it with 5 stars. On Goodreads, it is rated 4.17 and has received 37 reviews. 41% of readers rated it with 5 stars and 38% with 4 stars, resulting in a high average rating. The other play, *AI: When a Robot Writes a Play*, received 23 Reviews published in London Theater, The Guardian, British Theater Guide, The Stage, BBC, and Time Magazine. On Goodreads, it is rated 1 and has received one review. This survey indicates that the human-authored play is more critically acclaimed, and it has a more significant impact on reviewers and readers compared to the AI-generated play. However, the lower degree of effectiveness of the AI-generated play, *AI: When a Robot Writes a Play* (2021), may be due to its late publication, six years after the human-generated play, *Marjorie Prime* (2015). Moreover, the screen adaptation of *Marjorie* and its nomination as a finalist for the Pulitzer Prize have given it wider fame and spread.

Potentials and limitations of AI in literary creations

The study sheds light on the potential and limitations of AI in the field of literary composition and creativity. Limitations should not discourage computer scientists and scholars from further investigating AI's potential in the literary domain, as it is capable of producing grammatically accurate and coherent texts. By mid-2023, advanced language models like GPT-4 have become able to produce more sophisticated narratives and dialogues which are grammatically correct and semantically meaningful (van Heerden et al., 2023). AI's ability to analyze vast datasets quickly has become extensive, scanning a widespread array of sources and leading to unique combinations and innovative narratives (Archer and Jockers, 2016) that may exceed human creativity in some aspects. It allows "the creation of a text that is not limited by conventional realistic thinking. The generated text surprises the dramaturge by its improbability and outside-the-box thinking, which can be considered as originality" (Košťák 2022, p. 34). Moreover, the AI capability of merging data, derived from inputs, into a novel composition is immense. It can elaborate thematic prompts extensively, constructing a multilayered conceptual map in which ideas are intricately interrelated. It can tackle various themes and draw a convincing interconnection between them. Though it depends on the inputs and prompts inserted by the dramaturg or director, the scope and progress of the AI script are unlimited and unpredictable. van Heerden et al. (2023) indicate

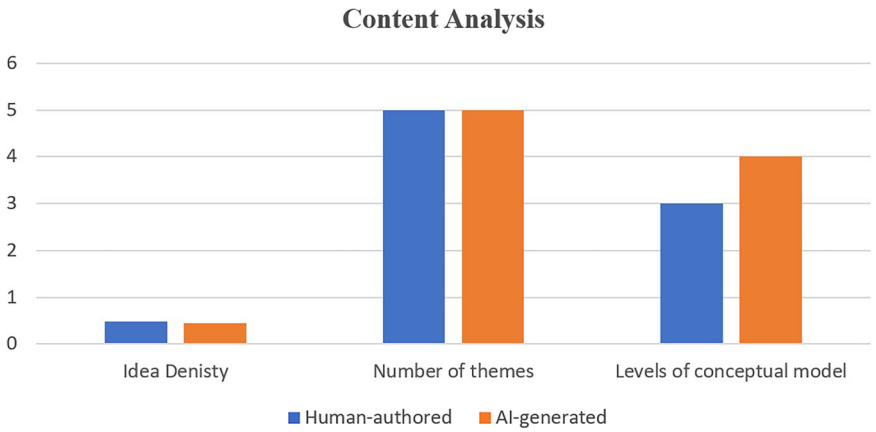

Fig. 2 The column charts for thematic analysis and idea density.

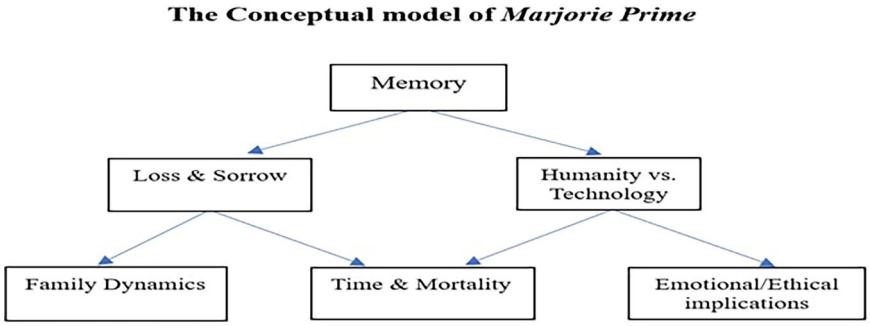

Fig. 3 The conceptual map of thematic distribution in *Marjorie Prime*.

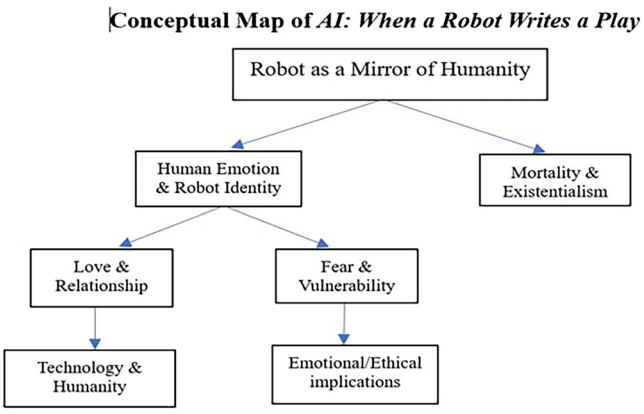

Fig. 4 The conceptual map of thematic distribution in *AI: When a Robot Writes a Play*.

that GPT-2 XL can generate "continuous lines in an uncontrolled manner—i.e., freely, without explicit constraints on content, style, or context" (p. 107). Thus, AI tools employed in literary composition have remarkable potential in thematic elaboration, narrative construction, and plot development. These tools also offer a high degree of flexibility and openness in processing data and inputs, allowing the AI operator to add, modify, delete, or edit lines and components of the composition at all stages. Thus, AI-generated drama represents a case of "symbiotic cooperation of human and machine where the machine does most of the work but asks the human for input when necessary" (Rosa et al., 2020, p. 3). Combining the best of both worlds, AI can assist writers by providing suggestions for character development, allowing for the exploration of unconventional narratives and diverse voices that might not be as prevalent in Human-generated works. Moreover, AI tool has a distinguished ability to merge several literary genres in a comprehensive whole and innovative collage; they can incorporate poetry in narrative, science fiction in drama, technology in theater, etc. Moreover, it can facilitate new forms of interactive and adaptive storytelling, such as personalized narratives and immersive experiences in virtual environments (Schmidtová, 2022).

AI tools for generating literary composition have some limitations that scholars and scientists should be familiar with in order to devise more sophisticated algorithms and machine learning techniques to bridge the gap between Human and AI-generated literature. Handling more than two or three characters at a time is still a restricting issue for AI-generating programs. AI may produce content that is culturally insensitive or ethically problematic due to biases in the data inputs inserted in training the AI tool. The generated text may contain "harmful social biases and stereotypes, spread disinformation, violate privacy, and infringe upon copyright", so careful human review is necessary to avoid these issues (van Heerden et al., 2023, p. 107). In drama, the stage direction is an indispensable complementary component that describes place, gestures, and characters' movement, which are not mentioned in the dialogue. The AI-generated plays delve into the dialogue and ignore the role of the stage directions in illustrating kinetics and spatial dimensions. Therefore, it produces a dialogue which "lacks any idea of the characters' non-verbal actions and of a coherent fictional world" (Košťák, 2022, p. 34). Language is limited to the inputs, so the AI tool uses oversimplified and banal language. Its ability to employ functional figures of speech is still limited because the use of figurative language is a complex skill that requires high cognitive capacities that AI cannot master. AI tool ignorance of the complexity of human

Table 3 The calculation of the figurative language use in the two plays.

Figurative language	*Marjorie Prime*	Examples	*AI: When a Robot Writes a Play*	Examples
Simile	10	- "Rows and rows, like Buddhist monks marching into the trees." - "The violins plucking high notes like icicles." - She was like a squirrel.	8	- "It's like touching a butterfly." - Your lips are like warm honey.
Metaphor	37	- Every day is science fiction. - That living is a distraction from death - It was easy for me to be human morphine for a couple years	20	- "I would be her zero and she would be my one." - "Your lips are like warm honey."
Personification	4	- "Memory is like a child learning to talk."	5	- "Robot falls in love with her at first sight."
Total	51		33	

psychology restrains its portrayal of characters, which appear devoid of psychological and emotional depth. Therefore, critics argue that it produces a script that "lacks a soul" (Košťák, 2022, p. 33). Though AI-generated plays are well received by the audience for the novelty of the experience itself, spectators still seek engaging narratives that connect with them on a deep personal level. They often value the originality and human touch of playwrights.

Conclusion

This study navigates the intricate terrain of literary creativity assessment in a comparative study that puts an AI-generated play in contrast to a human-authored play. It explores what constitutes merit in literary and computational terms. It explores the emergence of new types of authorship, represented in AI-generated plays, and examines their originality, effectiveness, flexibility, and fluency. The study establishes the strengths and limitations of AI-generated literary compositions and their theatrical representations. For some, AI-generated drama may still not have reached the level of literary merit found in Human-generated texts, but the level of development achieved by AI to transform the discipline of creative writing and address the perceived challenges is promising. The evolving relationship between human creativity and Artificial Intelligence holds potential for future exploration, offering new dimensions to the field of digital humanities.

Data availability

Data used is referred to in the references section. The data supporting the quantitative findings of this study are available in the article itself, and any further data can be obtained through contacting the corresponding author.

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Note

1 The script was produced by THEaiTRobot 1.0 operated by David Košťák. The play was directed by Daniel Hrbek, and premiered in the Švanda theater in Prague on 26th February 2021. Due to the pandemic, spectators could not visit the premiere physically, but the premiere was streamed online and was viewed by approximately 20,000 spectators from all over the world.

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Author contributions

All authors contributed to this research and the manuscript. Silvia Elias designed the research, did all procedures of conceptualization, conducted literary analysis, and wrote the paper. Khaled Karam chose the theoretical framework, managed the project, analyzed the results of quantitative analysis, drew conclusions, and reviewed the whole article. Bunder Alshammari conducted the linguistic analysis and obtained statistical data. Khaled Nasser Alfraidi participated in the literary and thematic analysis, wrote the literature review, and all parts of the literary background.

Competing interests

The authors declare no competing interests.

Ethical approval

Ethical approval was not required as the study did not involve human participants.

Informed consent

This was not required, as outlined in the ethical approval statement

Additional information

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