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Human-AI system co-creativity for building narrative worlds

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This paper explores the human-AI system co-creativity for building narrative worlds (NWs) through active human-machine collaboration. The contribution provided in this paper is of a theoretical nature, wherein a hypothesis is proposed for structuring a narrative world for the AI system, addressing the gap between the main disciplines of Design Studies and Human-Computer Interaction (HCI). Through the lens of the creative collaboration between humans and AI, this paper finds the emerging field of Interactive Digital Narrative (IDN) that stands in the abovementioned gap. Creativity has long been considered unique to humans, but in this contribution, creativity is considered in collaboration with an AI entity. The AI system becomes a tool for designers, in this case, a collaboration tool, to find novel ideas to write stories, accelerating the storytelling process. This contribution proposes a method to explore the influences of AI systems on human creativity within the design process of creating stories. The study begins with a review of the literature on the meaning of creativity as perceived through the collaborative activity of human and AI systems. The topic of interest is related to the process of story construction, the phase of crafting narrativity, through which it is possible to find creative ideas for narrative world-building. The aim is to explore the AI system's computational creativity potential as a supporting tool for the designer in world-building.

Keywords: human-AI co-creation; creativity; design process; interactive digital narratives

1 Introduction

Designing narrative worlds containing characters and objects in a fictional space is a complex process usually performed by skilled storytellers. An essential part of this work is channeling personal creativity to establish either a new narrative world or to find iterations of established narratives that provide new insights for the perceiver. Narration emerges as the primordial matrix of the models that regulate human relationships, culture, practices, and learning (Pinardi, 2010). Telling stories is a cognitive process that happens in the form of brain maps: a process probably started relatively early in terms of the evolution and complexity of the necessary neural structures to create narratives

(Bruner & Bruner, 1990; Damasio, 1999). It manifests itself in human narrative intelligence, i.e., the ability to create, tell, understand, and respond to stories (Riedl, 2016). Narrative intelligence is a topic of interest in the HCI field through generative AI tools that allow the automatic building of stories such as Scheherazade (Li & Riedl, 2015) or that help the designers to create stories such as Paper Dreams (Bernal, Zhou, Yuen, & Maes, 2019) or Shelley (Yanardag, Cebrian, & Rahwan, 2021). The role of the human who interacts with these systems is represented by the author's figure, who collaborates with the AI system to generate stories. In this study, the designer is supported by an AI system during various storytelling phases, i.e., building the imaginary world (Wolf, 2014). Given these premises, storytelling can be seen as a process (Crawford, 2013) that bi-directionally connects humans and AI systems, allowing humans' and AIs' knowledge to be shaped by elements of the story.

Considering the compelling emergence of transition transformative communication (Escobar, 2018), fueled by digitization, datafication, and virtualization, there is an urgent need to shift attention towards new hybrid disciplines straddling the humanities and scientific studies. There is a growing context of human-AI system interaction, which in the last decade has been involving and redefining the creative design process (Gu, & Amini Behbahani, 2021). Therefore, there is a latent need to address human-AI system collaboration and human-AI system co-creation to disclose the benefits, potentialities, and shortcomings of a human-AI systems relation. This paper addresses computational creativity as an automated variant of human creativity (Gu, & Amini Behbahani, 2021) and the AI system as a tool for designers to collaborate to find novel ideas to write stories, accelerating the storytelling process. A general and consensual definition of creativity among academics is the ability to produce novel and valuable ideas starting from precedent ones (Boden, 1994). In this context, creativity is attributed to the individual human who generates a new idea for themselves or humankind in general. In recent decades, creativity has begun to be seen no longer as something linked exclusively to the person. Still, it can also emerge from the exchange between several people or interaction between an environment and an individual/group (Plucker, Beghetto, & Dow, 2004). Thus, creativity can be the result not only of a single thinking mind but of multiple minds that collaborate. Indeed, the collaboration process also has profound implications on creativity (Glăveanu, 2011), despite continuing to suffer from an anthropocentric perspective (Serbanescu, Ciancia, Piredda, & Bertolo, 2022).

Consequently, co-creation emerges when the parties involved interact and result in creative ideas (Glăveanu, 2011). However, creativity is not found only in human-human collaboration as it can be supported and enhanced by human-AI system collaboration. This is characterized at least by two complementary agents, one human and the other non-human, that interact in a shared space of actions, knowledge, meanings, and values (Nack, 2003). Human-AI system collaboration is transformed into co-creation when both agents start from a potential problem setting to exchange their ability to find solutions in creative manners. To allow human-AI system co-creation, first, it is needed to have a built environment (Gu, & Amini Behbahani, 2021), a conceptual space (Boden, 2004), or a representative setting with a structure that frames that space and facilitates creative work. The built environment is more than a mere structure; it resembles an ecosystem made of contents that enrich and increase the space complexity and is regulated by rules. As creativity is here seen as a form of communication, narrative structures can provide the regulative framework. In narrative terms, the built environment is a narrative world (NW) (Ryan, 2014). The NW is a generative narrative engine that allows for infinite possibilities of stories (Venditti, Piredda, & Mattana, 2017), and a world can

exist per se without being populated by stories. Still, stories cannot exist without the world (Wolf, 2014). The study argues that as stories cannot exist without a world, similarly, creativity cannot exist without a conceptual space. This is that human-AI system co-creation can support and enhance the creative process in building what Wolf called imaginary worlds or a collectively constructed world of characters and plots (Ciancia, Piredda, Serbanescu, Ligi, 2021). The paper will focus on the construction of the characters through human-AI collaboration, each of them being a separate NW since the inner world of the character reproduces on the scale the same structure as the external world (Pinardi, & Angelis, 2006). The interpretation given to creativity is determined by the support of the AI system, which suggests proposals to the human collaborator in the construction of the NW, which is interdependent on the structure of the characters. The NW is represented in the system through a knowledge graph which facilitates the creation of relationships and connections among the characters that populate the world.

The paper should also be understood as an attempt to present the progress in building an NW in an AI system through a knowledge graph, characterized by seven essential categories (Pinardi, & Angelis, 2006) that describe characters within the world. In so doing, the contribution also faces the terminological issue of having overlapping meanings coming from the emerging discipline of interactive digital narrative (IDN) (Koenitz, 2018) as an intersection of HCI, design studies, and narratology. Therefore, it is intended to clarify some terminologies of interest in IDN straddling the disciplines mentioned above and provide an example of a set of characters that the collaborator can choose from to start creating their story.

The study starts with the literature review on the meaning of creativity seen as a result of the co-creation activity among human and AI systems. In chapter three, narratives are contextualized as the union of stories and NWs, and there are closely explored narrative elements by deepening the structure of an NW through the introduction of seven narrative categories. The fourth chapter presents the roles of the characters within a story and foresees how to build the NW according to the narrative categories. To conclude, research progress is assessed by taking a broader look at further developments.

2 The creative process and the storytelling

Creativity was seen for centuries as a mysterious human inspiration that occurs as a random epiphany, but in the current vision, it is more like an ability that anyone can learn (Isaksen, & Murdock, 1993) and develop according to personal attitudes/motivations, cognitive skills, and environmental circumstances (Bruno & Canina, 2019). Creativity is usually defined by two qualities, value and novelty, which are considered as the output of activity but do not refer to the type of activity itself (Gu & Amini Behbahani, 2021). The less critical term is value, which stands for appropriateness or usefulness for a particular purpose (Wong & Siu, 2012). Novelty, however, allows for various views. According to Gu & Behbahani (2021), novelty can be replaced by words such as uniqueness, originality, and authenticity, but it remains a term whose implications are difficult to analyze. Some academics (Gu & Amini Behbahani, 2021; Boden, 2004; Bruno & Canina, 2020; Shneiderman, Plaisant, Cohen, Jacobs, Elmqvist & Diakopoulos, 2016) attribute the definition of creativity that is given by the concept of surprise, unexpectedness (Warr, & O'Neill, 2005), which is often incorporated within the meaning of novelty as unprecedented and original combinations of ideas (Bernal, Zhou, Yuen & Maes, 2019). Margaret

Boden, research professor of cognitive science at Sussex University, identified two distinguished types of creativity (Boden, 1994): P-creativity and H-creativity. P-creativity stands for psychological creativity or personal creativity that relates to new findings, concepts, ideas that a person has not been aware of before and which can bring novelty to the way he/she sees things. P-creativity brings novelty as a new finding for the person itself, not as a discovery that applies to everyone. P-creativity is a common type of creativity since it concerns the knowledge of a single individual. This knowledge is limited to the person's interests and limited in time. H-creativity refers to Historic creativity, related to findings unpublished in the history of humanity, or as Boden put it: "A valuable idea is H-creative if it is P-creative and no one else, in all human history has ever had it before." (Boden, 1994, p.76).
Yet, there are more ways of interpreting and approaching the concept of creativity than looking at the individual designer. Warr and O'Neil divide creativity into a creative person, product, and process (Warr & O'Neill, 2005). Glăveanu (2011) approaches the subject by claiming that creativity is the result of an interaction between people divided into social creativity, group creativity, and collaborative creativity. This contribution explores creativity as a design process in the human-AI relationship based on P-Creativity. Here creativity is addressed in the context of a single individual who is supported in their storytelling activities by the AI system.

2.1 Storytelling as a process

Building narratives engage the designer's imagination in a sort of play to find original ways to transmit a message (Decortis & Rizzo, 2002). Christopher Crawford, a game designer and developer, defines storytelling as a dynamic process that envisions the potential perception of the user while developing the narrative (Crawford, 2013). The process is not only dynamic, but it is also iterative; that is, it is composed of phases that can be repeated cyclically during the development stages. In support of this affirmation, Venditti (2017) identifies a framework consisting of three steps of the storytelling process: a) collecting fragments, b) crafting narrativity, and c) reframing fragments. This framework is based on previous work by the ImagisLab research group (Departmen of Design, Politecnico di Milano), which investigates the collaborative construction of NWs and stories (Piredda, 2018; Venditti, Piredda & Mattana, 2017), applied, for example, in ethnographic research (Ciancia et al., 2021). In the latter, the first phase of collecting fragments coincides with the collection of data by the designers, who must collect information concerning the subjects they intend to represent in the form of characters. This data collection phase usually takes place through story-listening activities (Bertolotti, Daam, Piredda & Tassinari, 2016) where the stakeholders are interviewed to discover their needs, habits, way of life, and point of view. Those fragments need to be used at later phases to establish the narratives to be described. The AI system will be used to support the designer in determining relations between fragments, characters, and roles. In other terms it plays the role of an active repository where shared memory of these interviewees is organized. The phase crafting narrativity represents the moment in which the designer and the AI system actively collaborate to create the story's characters. The system uses structured fragments to give the designer an unprecedented view of these stakeholders' relationships. Finally, the phase of reframing fragments, even if it is not taken into consideration here, is intended as a moment of the actual creation of the story. The topic of interest in this paper is related to the process of story construction, the phase of crafting narrativity, which is a specific design process through which it is possible to find creative ideas for narrative world building.

2.2 Creativity in the design process

A design project is defined as creative if at least one P-creative idea emerges from the process itself. Usually, the design process starts from a known problem that needs to be solved by at least one effective solution. The path from problem to answer is a complex process. The design process has a dynamic nature (Shneiderman, Plaisant, Cohen, Jacobs, Elmqvist & Diakopoulos, 2016) and can be nonlinear, nonhierarchical, and radically transformational due to the unpredictable shifts in direction caused by creative ideas (Sawyer, 2021). According to Sawyer, creativity occurs in several steps (Sawyer & Sawyer, 2012). These steps vary in number and name based on the author of reference; in this case, it has been referred to as Bruno's framework, called Creativity 4.0, a guide for identifying the most crucial factors of creativity (Bruno, 2020). In the Creativity 4.0 framework, the steps are as follows in sequence order: engage, clarify, define, ideate and prototype. Engage is the entry step of the creative process, in which the area of interest is identified; then in the clarify step the information is collected for the research area and then interpreted. The data is then analyzed in the step define, and a series of possible directions are identified. The ideate step is the one in which inspiration is sought, in which ideas emerge. Finally, the prototyping step is characterized by creating a prototype that allows to communicate the idea to obtain feedback. Each stage repeats itself during the design process, which can be considered iterative until the solution to the problem is found (Wong, & Siu, 2012). These iterative stages are characterized by divergent and convergent thinking. Divergent thinking is a phase of the design process in which information is collected, and hypothetical solutions to the problem are generated. Convergent thinking corresponds to a process phase that attempts to interpret the data and select the best solution. The divergent phase of the creative process is often characterized by mental blocks from the designer side, who struggle to find innovative solutions. These so-called creative blocks occur in the divergent phase of the creative process, which are due to various reasons such as fear of reputation (Bruno & Canina, 2019), absence of trust and a safe environment where to express the ideas (Glăveanu, 2011), or mental inflexibility (Bruno & Canina, 2019). Those blocks refer to human creativity in the context of problem-solving. AI systems can expand the spectrum of possible solutions by giving inputs to the designer and, in so doing, fastening the design process.

2.3 Creativity in collaboration

Creativity has been attributed to a single individual who manages to find a creative solution to a given problem. However, creativity can also be triggered by interaction and collaboration among individuals, resulting in groups of people working together to find a creative solution, the so-called collaborative creativity (Csikszentmihalyi, 1996). Collective creativity has been recognized as a social process that emphasizes the results of people's interaction in a given environment (Warr, & O'Neill, 2005. It is a way to bring individuals together to deliberately engage in the generation of novel and valuable ideas (Glăveanu, 2011). A high degree of openness, flexibility, and willingness to engage in a particular problem-solving facilitates collaborative creativity. Moreover, creativity is easier to reach if the involved collaborators have complementary skills (Candy & Edmonds, 2002). The processes that emerge during collaboration can highly contribute to the creative outcome (Glăveanu, 2011). Still, sometimes, due to an asynchronous form of interaction, collaborators may have to wait to express their opinions or feel that their ideas are less important than others (Bruno & Canina, 2019). Collaboration supported by AI systems can help defeat some creative blocks, such as emotional blocks

(Bruno & Canina, 2019). Glăveanu (2011) argues that when individuals collaborate on a project, they do not feel comfortable sharing ideas for fear of being judged. The emotional impediments that arise during human collaboration in a project leading to discomfort in expressing ideas can potentially be mitigated through the involvement of an AI system functioning as a collaborative partner in lieu of human counterparts. The inability of AI to judge from a value and moral standpoint frees the human who collaborates with the system from the burden of judgment, making it difficult for this type of hurdle to arise in collaborating with AI.

The notion of creativity is intricately linked with Computational Creativity (CC) in the context of AI support systems towards a collaboration with the human counterpart. However, it is crucial to acknowledge that the human element, encompassing social, ethnographic, and personal knowledge, remains essential for the effective realization of creativity (Lopes, Parente, Silva, Roque & Machado, 2021).

2.4 Human-AI system co-creation

Creativity can arise not only from human collaboration but also from a human-AI system collaboration, called co-creation when the system and the human act on the response of their partners in the pursuit of creativity (Lopes et al., 2021). Therefore, an AI system can be considered co-creative when collaborates with at least one human agent in a creative process. Human-AI collaboration lends itself to fulfilling this goal by having the capacity to augment creativity in various ways (Bernal, Zhou, Yuen, & Maes, 2019), such as using diversified technical skills to broaden the range of suggestions or generating multiple and unexpected options (Bruno & Canina, 2019). The research of Lopes et al. (2021) support what has been said so far that co-creation systems cannot replace human creativity but can support and increase it. During the production process, the automatism of the AI system plays a role in identifying patterns that can be used to apply creativity support methods. The AI system aims to analyze discourse information in the given context quickly and efficiently to identify instances where support is required or helpful. AI becomes a human resource for suggestion and proposal generation and hence assumes a complementary role in the design process (Urban Davis, Anderson, Stroetzel, Grossman & Fitzmaurice, 2021).

There are three ways that co-creation AI systems, seen as information systems, can influence creativity: a) exploration of scenarios from various fragments, b) a repository or the ability to store information, and c) means to communicate results (Hoffmann, 2005). In this study, the first case is the one of interest since exploring the design space triggers creativity (Gu, & Amini Behbahani, 2021). In other words, creativity results from human-AI system collaboration in conceptual spaces (Boden, 1994), also called imaginary worlds (Wolf, 2014). That means that conceptual spaces are a condition for creativity, or creativity does not exist without a conceptual space. According to Boden (2004), conceptual spaces are mental spaces in which thoughts are structured. Here, creativity is addressed as a co-creation activity between human-AI systems that needs to have a conceptual space to exist.

Paper Dreams, which facilitates scenario envisioning through storyboard creation, is one example of an AI system belonging to the aforementioned category of exploration of scenarios from various fragments. Storyboards, on the other hand, are important visual tools that depict the progression of a narrative. Paper Dreams (Bernal et al., 2019) is an AI system created and developed by the Fluid Interface group of the MIT Media Lab, led by Guillermo Bernal, with the goal of assisting the user in their creative endeavors toward story creation. The AI support system takes a user-centered approach to design, with a user interface that facilitates communication through keywords, illustrations,

sketches, and color palettes, allowing collaborative and interactive development of personalized storyboards. In this context, the user takes on the role of story builder, collaborating with the AI and effectively functioning as a designer. A visual representation (storyboard) of actions and events is used to develop the narrative, highlighting the user's creative input.

Paper Dreams interactions involve query-based communication, in which the user can speak or write sentences within the AI interface. The system recognizes images and text using Computer Vision and Natural Language Processing methods. Paper Dreams recognizes sketches and can respond to user input with inspirational suggestions for a collaborative storyboard project. In fact, the system offers ongoing image suggestions to further enrich and develop co-creation with the user as he or she actively develops his or her idea.

Fig. 1 Screenshot from the Paper Dreams' interface (Bernal, Zhou, Yuen, & Maes, 2019).

Figure 1 shows an example of the system's interface. The system is capable of recognizing images, written language, and spoken words, translating textual input into visual representations, and making suggestions. The AI system in Paper Dreams uses the user's sketches to recommend relevant illustrations, laying the groundwork for story creation. Based on the user's input, the AI system suggests relevant sketches, facilitating inspiration and enriching the narrative world and characters. Despite the limitations of retrieving similar sketches, this collaboration stimulates the generation of new ideas, allowing creativity to flourish. Paper Dreams encourages Human-AI Co-creation by allowing for ongoing discussions and interactions during the storyboard creation process.

Shelley (Yanardag et al., 2021) is a remarkable case study of an interactive story generation tool developed by the MIT Media Lab's Scalable Cooperation group to co-create a series of horror stories with the Twitter user community. Twitter is used as a crowd-sourcing platform for collaborative story writing. The AI behind Shelley was trained on a collection of horror stories from the r/nosleep subreddit thread, emphasizing its focus on creating horror narratives. Shelley can start a story by generating an incipit, and it can collaborate with users by continuing their contributions to the narrative creation process. The collaborative process works as follows: the system randomly selects a character from the dataset and then generates ten different story options. The system evaluates and

ranks these options before selecting the best or most terrifying stories. Every hour, the system tweets a new story starter, encouraging user participation. Furthermore, as users interact with the AI-generated story starters, the system responds to the post by continuing the evolving narratives. As users interact with the system, they experience a continuous narrative journey, from reading the AI's posts to inserting their comments to further the story. The resulting digital story becomes a compilation of fragments narrated in collaboration with the AI, making the entire process a cohesive co-creative experience. Unlike traditional AI systems that operate as standalone creators, Shelley engages in collaborative co-creation with the audience. The process involves an ongoing dialogue between the AI system and the community of users on Twitter. The AI proposes a starting point for a horror story, which the community responds to with their own contributions and suggestions for continuation. The AI then selects the most thrilling storyline and tweets it as the follow-up.

Fig. 2 A screenshot of Shelley's Twitter account.

Shelley's interactivity is a remarkable example of co-creativity, where multiple parties actively collaborate to construct a narrative. Users are not passive consumers but rather play an integral role in the story's development. Their continuous involvement is enabled by an ongoing dialogue with the AI, where the system analyzes their sentences and generates appropriate follow-ups. This iterative process ensures that the narrative product emerges from a collective effort.

Overall, Shelley serves as an AI interactive story generation tool that fosters human-AI co-creation and showcases the potential of AI systems to engage users in the storytelling process. Through its innovative approach, Shelley demonstrates the transformative power of collaboration between humans and AI in crafting narratives.

Paper Dreams and Shelley exemplify the significance of human-AI co-creativity in developing narrative artifacts. Paper Dream facilitates the generation of potential story scenarios by implementing

storyboards, employing a user-centered approach to the creative process and fostering active collaboration between the user and the AI system. In contrast, Shelley demonstrates the power of human-AI co-creation, expanding beyond a single user to engage a larger community. Shelley interacts with the Twitter community to co-create a series of terrifying stories. Both AI systems serve as active and responsive partners, assisting and inspiring users in crafting their ideas and narratives. Through dynamic and interactive engagement, the boundaries between human creativity and AI-generated content become less distinct, leading to more enriched and immersive storytelling experiences. These examples exemplify how AI systems can serve as valuable tools in supporting human creativity, opening a new era of collaborative storytelling and creative exploration.

3 The narrative elements

The conceptual space inhabited by potential ideas becomes a narrative element. We adopt the conceptual design of narrative categories by Pinardi and De Angelis (2006). The narrative comprises two main elements (see Fig. 3): the story and the world. The story is made up of a chain of events and actions involving one or more characters. Events are the facts that happen to or are experienced by the character(s), while actions are an active component, being implemented by the character. Instead, the NW is made up of the environment and the characters who inhabit it. In this study, the world within the narrative, or the so-called NW, is considered the fundamental element of a narrative since it is the space from which the stories are generated later.

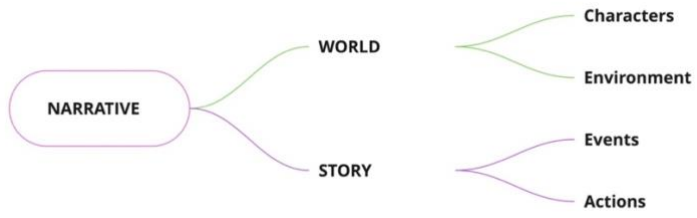

Figure 3. Mind map representing the narrative elements. Transposition and graphic translation from Pinardi, & Angelis (2006, p.19).

NWs can play a crucial role in human-AI collaboration, helping to build reciprocal dialogue and understanding (Serbanescu et.al, 2022). NWs are possible worlds constructed by the mind (Ryan, 2014). The term possible worlds is used here as a definition that encompasses the level of the realness of the NW. On the one side of the spectrum, there are fictional worlds invented by the designer's imagination, for example, the Middle-earth created by Tolkien, populated by hobbits, elves, wizards, goblins, dwarves, etc. Those worlds mirror human experiences but are accessible in the design of the natural laws and relations the characters live in. On the other side, according to the author, a NW represents a particular temporal-spatial transposition of the actual world, yet in a reinterpreted form. Examples are autobiographies and biographies that speak of people who existed in a real environment. As mentioned in the previous paragraph, the NW is the basic narrative unit that one can start on to build a story. Stories cannot exist without characters to create actions and participate in events. According to Pinardi et al., characters are NWs (Pinardi, & Angelis, 2006) since the characters' inner world reproduces on the scale the same structure that the external world has, and the outer world is

intended for the environment that characters live in. So, it can be said that a story cannot exist without a NW.

However, the NW remains an imaginary world made up of ideas during the crafting narrativity phase (see 2.1). In this phase, a solid creative component allows the construction of the story's characters, even before creating the story itself. Therefore, conceptual space and NW coincide in the phase of crafting narratives in the storytelling process. There is a strong correlation between the conceptual space that collects potential ideas and the NW that contains possible stories. In fact, the conceptual space has as its goal the production of creative ideas, while the NW has the construction of stories.

The construction of the characters constitutes the construction of the NW, and this construction is a process that involves a creative component. This means that NW narrativity and conceptual space coincide and share the same meaning in the crafting phase. These spaces at a structural and functional level can be represented through knowledge graphs or graphic notation to represent knowledge in patterns emerging from an interconnection of nodes and arcs (Sowa, 1992). Knowledge graphs lend themselves well to processing acquired information by providing both an overall sense and a specific situated one regarding the use context.

3.1 Narrative categories

To better understand the NW structure, Pinardi et al.'s narrative categories are now outlined to understand better the NW structure, which facilitates guidelines to identify the minimum and necessary contents for worldbuilding. The seven categories (topos, epos, ethos, telos, logos, genos, chronos) serve to generate the world and organize information relating to that world. Each of them is described in Fig 4. The seven categories perform a double function; they are applied on two levels: the inner world and the external world. The external world is everything that happens outside the character: the natural, social, cultural environment, etc. The inner world is the character himself, who is told through his physical appearance, behavior, habits, etc.

CATEGORIES	EXTERNAL WORLD	INNER WORLD
1. TOPOS	Natural and artificial environment	Physical appearance and personality of the character
2. EPOS	Historical memory related to past events	Personal memory of the character
3. ETHOS	Represents rules, values and norms that regulate behaviours within the crafted world	The values of the character
4. TELOS	The purpose of the community and society	Personal goals and purposes of the character
5. LOGOS	Various languages (official language, dialects) of the world.	Verbal and non-verbal language: forms of expression, personal terms, body language
6. GENOS	The set of relationships in the narrative world: the way the character(s) engages with others	The relationships of kinship and the relationships that a character manages to establish in the course of his existence
7. CHRONOS	The external and objective time, for example the historical period of the world	The inner and subjective time, linked to the consciousness of the character

Fig. 4. Table of the NW categories and their meaning declined between the external and internal world.

4 World-building in AI systems

This paragraph starts from the narrative categories mentioned above that are applied to the characters to propose a hypothesis of a knowledge graph for an AI system. How do these categories relate to each other? How can relationships be created between the various categories and, consequently, relationships between the characters? To answer these questions is necessary first to discover the characters' roles within a story and their relationship. The characters in this study are the archetypal characters usually present in any story: the hero, the villain, the princess/reward, and the helper (Davis & Greimas, 1984; Propp, 2010). The main character of the story is the hero, who is hindered by his counterpart: the villain. After breaking an initial equilibrium in the story, the hero embarks on an adventure to rescue a princess or achieve a prize/trophy (Campbell, 2003). During his journey, the hero encounters obstacles that undermine the success of achieving the final goal. Still, he is never alone, usually accompanied by a friend who helps him along the way, the helper.

Unfortunately, despite drawing upon cultural archetypes, these character delineation methods often manifest themselves in a constrained and overly simplified manner. Such portrayals and character descriptions, marked by predictable behaviors, are termed as flat characters, as defined by Forster (1927), contrasting them with round characters. In contrast to the former, round characters exhibit greater depth and complexity, showcasing a diverse array of qualities, emotions, and motives that more closely resemble the intricacies of real-life individuals. These rounded characters' complexity more accurately reflects human behavior and actions (Abbott, 2021).

The presence of categorizations to identify characters within preconceived roles or models, whether they be flat or round, has recently gained recognition and is being addressed. Contemporary story characters evade simple labels and stereotyping; they are multifaceted and exhibit evolution over the narrative's duration. They also possess engaging relationships, with an ensemble of characters being of equal importance, diminishing the notion of a singular main character. The risk here lies in the creation of stereotype figures that often fail to represent gender minorities and contribute to discrimination. However, delving into this topic is beyond the scope of this contribution; for a more comprehensive examination, refer to Goodman (2013), Hill & Bartow Jacobs (2020), and Dore (2022).

These four archetypal characters comprise the seven categories that form their inner world and the external world's space, creating an ecosystem of relationships between the various characters that emerge in the knowledge graph. The goal is to allow the designer to pick their hero and based on the hero characteristics; the AI system suggests the other three archetypal characters. To make this happen, the graph Fig. 5 introduced by Isbister (2006) to represent the characteristics and character aspects that identify interpersonal interaction is proposed as a starting point. The graph consists of two axes that define the spectrum of the variables of the dominance factor (vertical axis) and agreeableness (horizontal axis), which represent a spatial map of the character variables through four quadrants. The characters fit into this map which helps their positioning based on the hero's characteristics chosen by the designer. The map should not be mistaken for a spatial representation of an NW since it is a tool that supports assigning roles to the characters according to the traits that emerge from the character's seven categories. The representation of the NW is given by a knowledge graph that connects the categories of each character to the categories of the other characters and the character traits of the map, giving life to a dense relational ecosystem. The assumption is that the AI system will be able to identify from a given dataset of characters and the designer's chosen hero three

examples of archetypical characters, one for each role. Once the characters have been identified, they will be suggested to the designer, who interact with the AI system to sift through the best proposals.

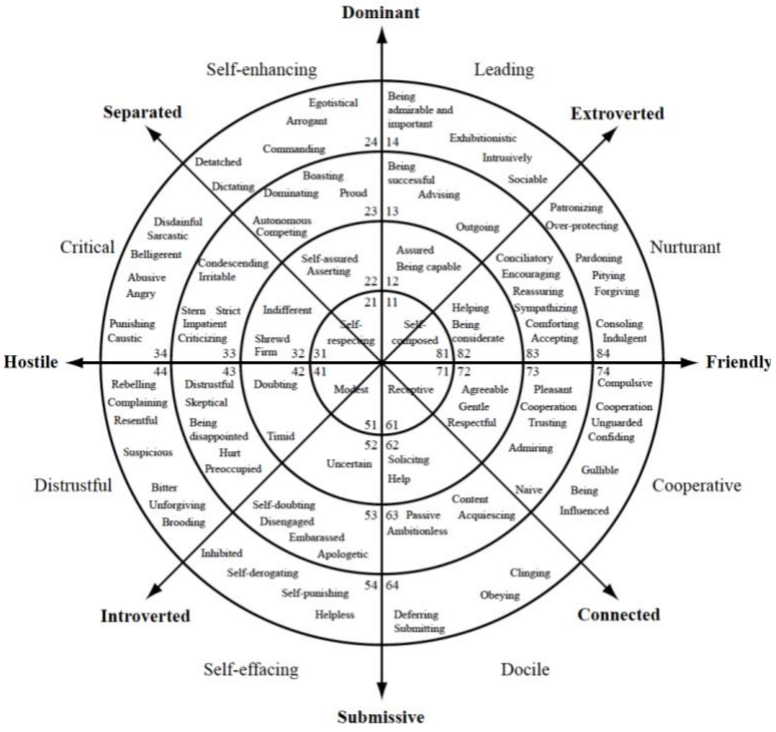

Figure 5. Graphic representation of the interpersonal circumplex (Isbister 2006, p.269).

In discussing the application of the interpersonal circumplex to an AI system, an illustrative example can be drawn from the reinterpretation of Maleficent's story (Stromberg, 2014). Maleficent represents a unique perspective on the traditional story of Sleeping Beauty, offering an unconventional portrayal of the villain as the protagonist, depicted in a positive light. This character's complexity and departure from stereotypes add layers of nuance to the narrative.

By employing a knowledge graph facilitated by the AI system, users find support in creating or selecting characters whose personalities are influenced by the variables found within the four quadrants resulting from the dominant/submissive and hostile/friendly axes. It is essential to clarify that this framework serves as a theoretical foundation for the actual AI system that generates an intricate narrative world encompassing numerous interconnected characters within a comprehensive narrative ecosystem.

5 Conclusion and further developments

This study faced the human-AI collaboration understood as co-creation, working on the gap between two narrative macro areas: design studies and HCI. In its intersection, the Interactive Digital Narrative (IDN) is a genuinely interdisciplinary field (Koenitz, 2015) that, in the case of this contribution, combines narrative studies, design studies, and AI discipline. IDN is the focus area to develop the collaboration between a human and an AI system to support and enhance creativity. While no empirical work has been conducted, the work presented here lays a conceptual and theoretical foundation for further investigation. The focus on IDN highlights its interdisciplinary nature and its

potential to foster creative interactions between humans and AI systems.

The collaborative relationship between humans and AI systems in IDN reveals an inherent creative potential, with AI offering computational creativity to support human in worldbuilding. Additionally, the conceptual space emerges as a crucial element in the creative process, providing the necessary environment for creativity to flourish. In the context of storytelling, the Narrative World (NW) represents this space from which stories are generated.

Moving forward, the study proposes the development of a comprehensive knowledge graph based on the identified assumptions. This graph aims to explore the intricate interaction between designers and AI systems when selecting characters, further enhancing the understanding of human-AI co-creation in the context of IDN. While empirical work is yet to be undertaken, this work sets the stage for future research to delve into the dynamics of creativity within the human-AI collaboration paradigm in the domain of IDN.

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