A User-centered Framework for Human-AI Co-creativity

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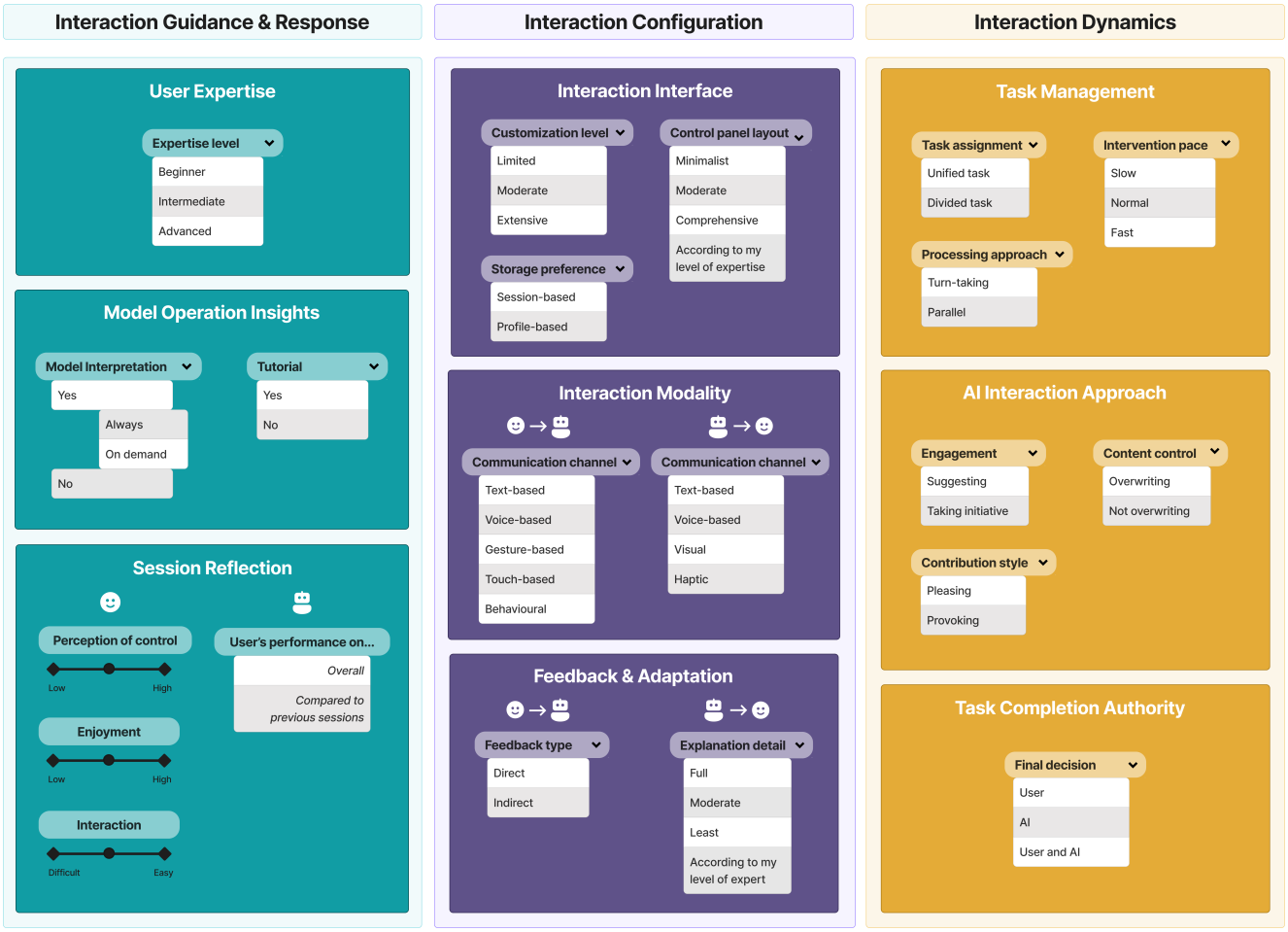

Figure 1: ***User-Centered Co-Creativity Framework.*** **The scheme presents an overview of all the dimensions and parameters contained in the UCCC framework. Dimensions are grouped under three categories: Interaction Guidance & Response, Interaction Configuration, and Interaction Dynamics.**

CHI EA '24, May 11–16, 2024, Honolulu, HI, USA

ABSTRACT

The pervasive adoption and use of Generative AI tools prompted a discourse on determining the optimal balance between automation and human agency in processes executed by users with the assistance of this technology. This paper presents a user-centered co-creativity framework that identifies key dimensions responsible for the modulation of agency and control between users and AI in

ACM ISBN 979-8-4007-0331-7/24/05
https://doi.org/10.1145/3613905.3650929

co-creative processes. It also suggests an actionable way of implementing the framework in a customization tool, in the form of a mobile application, which can be used to tailor the interaction between users and the AI system following the dimensions proposed in the framework. The paper contributes new insights within the literature on Computational Creativity and Human-Computer Interaction interested in the investigation of modalities of co-creation between humans and AI.

CCS CONCEPTS

• **Human-centered computing → HCI theory, concepts and models**; *Collaborative interaction.*

KEYWORDS

Co-creativity, Framework, Mixed-initiative, Game design, Customization tool

ACM Reference Format:
Caterina Moruzzi and Solange Margarido. 2024. A User-centered Framework for Human-AI Co-creativity. In *Extended Abstracts of the CHI Conference on Human Factors in Computing Systems (CHI EA '24), May 11–16, 2024, Honolulu, HI, USA.* ACM, New York, NY, USA, 10 pages. https://doi.org/10.1145/3613905.3650929

1 INTRODUCTION

Artificial Intelligence (AI) technology is no longer used by humans only for outsourcing large and repetitive cognitive tasks, but has rather become an interlocutor of humans [19]. Devices and applications, like voice assistants, are specifically designed to emphasize their 'humanness' and agency level, inducing users to interact with them as if they were human individuals. As a consequence, the role of machines in Human-AI (H-AI) interaction is moving away from the paradigm of 'AI as a tool' toward the direction of 'AI as an agent' and, more specifically, as a *social* agent [19, 45].

In this scenario, there is a pressing need to examine the terms of the balance between automation and agency in H-AI interaction to continue reaping the benefits of increased efficiency resulting from the automatization of repetitive and burdensome tasks, preserving at the same time the sense of **agency**, **control**, and **responsibility** of users [20]. This becomes particularly pertinent with respect to the use of AI models in creative pursuits. The relevance assigned to personal agency and freedom of expression during creative processes, coupled with the rapid advancements in **Generative AI** (GenAI) models for creative content generation, calls for in-depth investigations on the trade-off between agency and automation [15, 41].

Specifically, there is a need for a more thorough exploration of the essential dimensions of Human-AI (H-AI) interaction that should be addressed to modulate the distribution of agency and control between users and AI [6, 31, 33].

The **Computational Creativity** (CC) and **Human-Computer Interaction** (HCI) communities have been interested in the modalities of interaction and co-creation between humans and AI for a long time [3, 13, 22, 28, 34, 37]. The work presented in this paper takes inspiration from cardinal studies in this literature to draft a more comprehensive framework of H-AI creative interaction: a **user-centered co-creativity framework** (UCCC). The focus of the framework is on user agency and control, an aspect of HCI that has received increased attention since the latest developments in AI [26]. In the paper, we address the following **aims**:

1 – Providing a comprehensive list of the key dimensions in H-AI co-creativity processes that can be modulated by users to adjust the degree of control they have over the process and to match their style and creative approaches.

2 – Suggesting an actionable way to translate the dimensions of the UCCC framework into a customization tool, thereby fostering the advancement of co-creativity systems more attuned to user-centric principles.

In the next section, we introduce how the topic of agency has been addressed in HCI studies, focusing specifically on core models for co-creativity presented in the literature on the theme. We then move on to present the UCCC framework, describing each of the dimensions it includes. Lastly, we discuss future work toward an application of the framework for the development of a customization tool.

2 AGENCY IN H-AI INTERACTIONS

From its origin, the field of AI had among its main aims the development of '**agents**' [50]. Over the last year, debates around agency in AI have become more common due to the increased involvement of AI technologies in social practices, like creative processes, and to the wide demand and greater accessibility to creation allowed by GenAI models [47]. As signaled by the recent announcement by the company OpenAI, which in November 2023 started to roll out customizable versions of the large language model ChatGPT, also known as 'GPT agents' [46], technology companies are increasingly interested in developing autonomous systems that can be integrated into users' everyday tasks as assistants, rather than tools [53].

The issue of agency is not a new problem in the HCI field [26]. **Interface agents**, for example, have been available already for quite some time (e.g., Microsoft Office assistant Clippy, released in 1997), but they struggle to achieve the right balance between unobtrusiveness and interjection [35, 36]. Considering the case of interface agents that support creative processes, they can be broadly grouped around two ends of a spectrum. On the one end, we find more traditional creativity support tools, like computer-aided design, where the agency is in the hands of the human user. At the other end, we find computational creativity, where the artificial agent generally has more control over the process in an autonomous or semi-autonomous way.

The increasingly widespread use of GenAI models is shifting the agency toward the artificial agent's side of the spectrum. It is, therefore, urgent to investigate how the modulation of agency can change users' experience and perception in creative processes that are performed together with technology [10, 16, 43].

Recently, some notable voices have been raised with respect to how investigating co-creativity between humans and AI is more important than reflecting on whether AI itself can be creative [48]. The fields of HCI and CC have the opportunity to provide an essential contribution to the understanding of the new co-creativity

interactions between users and AI technology [4, 44]. This investigation requires a reflection of which roles each participant has in the process.

The HCI and CC literature has put forward some **frameworks** in this respect to identify what influences and determines co-creativity processes between users and technology.

Almost two decades ago, Todd Lubart proposed the famous categorization of HCI, where the computer is described as either nanny, penpal, coach, or colleague [34]. Other models of the role of computational systems in co-creative interaction have since been proposed, as in the work of Guzdial et al. [18]. Some frameworks, including the work by Kantosalo and colleagues, focus on the layers of interaction between humans and computers, with the aim of providing co-creativity researchers with the tools to discuss the benefits and drawbacks of existing co-creativity interfaces [23]. Others have the goal of guiding the design of interaction modes in co-creative systems [49]. Lastly, some frameworks focus on individual aspects of the H-AI interaction, such as communication [14].

We take inspiration from these studies for deriving the UCCC framework. The latter proposes a model of the interaction between users and AI, suggesting which are the key dimensions that each user should be able to modulate in order to customize the creative experience to their own needs, style, and taste. In our framework, the choice of selecting the parameters for each dimension is left to users before commencing the co-creativity interaction and, for this reason, it is a 'user-centered' co-creativity framework (UCCC).

Mixed-initiative co-creativity is the paradigm within which the model we propose is framed, a paradigm according to which creative agency cannot be ascribed to either the human or the AI alone, but is instead a shared endeavor [12, 59]. As we will indicate below when describing the framework, some dimensions and parameters are directly inspired by debates in the HCI and CC literature. Other dimensions do not have a direct reference to the literature in the field and have been included by the authors based on their previous work on agency perceptions [14, 43] and mixed-initiative game design tools [38].

3 USER-CENTERED CO-CREATIVITY FRAMEWORK

The approach we take in drafting the UCCC framework is consistent with the idea that the ultimate aim of H-AI co-creation processes is for the AI system to assist and **empower** users instead of constraining or limiting their sense of control and creativity. Unlike the work by Lawton et al. [27], which shares a similar aim with the UCCC framework, insofar as it proposes an interface that allows the modulation of the level of control and agency between the user and the AI system in real-time synchronous drawing, the UCCC framework is modality-agnostic, i.e., it is conceived based on H-AI co-creative processes in general, without a particular field of application in mind.

For this reason, the parameters indicated under each dimension are general enough to be applied to different co-creative processes, e.g. game design, sketching, image or music generation, and so on.

The framework presents **desirable dimensions**, each containing a varied number of parameters, which users can act upon before starting a co-creative interaction with an AI system. We are aware of the technical complexity that goes into developing a tool that allows users to choose among different parameters for each of these dimensions. Thus, the model in its current form acts as a conceptual guide for developers to adapt the co-creative experience to different user profiles. We will suggest how to turn this conceptual guide into a proof of concept in section 4.

In the next section, we describe the **dimensions** included in the framework and the respective *parameters* which users can act upon before starting a co-creative interaction with an AI system.

The framework dimensions can be grouped under three **categories**: Interaction Guidance & Response, Interaction Configuration, and Interaction Dynamics (see Figure 1).

3.1 Interaction Guidance & Response

This first category of dimensions refers to the preliminary (**User Expertise** and **Model Operation Insights**) and to the final (**Session Reflection**) stages of the H-AI interaction.

Prior to initiating the co-creative process, the user has the possibility of indicating their level of expertise. The **User Expertise** dimension is a crucial tool in the users' hands to communicate to the AI their familiarity and confidence with the process they are going to perform in coordination. This dimension promotes alignment between the user and the AI to ensure effective interactions [17, 40, 57].

In some of the dimensions, the user can select the option 'According to my level of expertise', thereby entrusting the AI with the discretion to tailor the interaction based on the user's familiarity with the intended practice. The interaction between the user and the AI is not fixed at the beginning but, instead, they both adapt to each other according to the feedback received (see the **Interaction Modality** dimension below). In various mixed-initiative works in game design, this adaptation is present through, for example, the dynamic presentation of suggestions by the artificial agent, which is updated according to the choices made by the user throughout the creative process. Another common mode of interaction involves both agents taking turns contributing to the creative artifact, which requires the AI to adapt its interventions based on the user's previous actions and/or requests. The user, in turn, is influenced by the system's suggestions or contributions and adapts their subsequent interventions.

This dynamic feedback between user and AI system, covered in the CC and mixed-initiative literature [2, 7, 11, 18, 25, 29, 52], is a key desirable aspect of H-AI interaction in co-creative processes which the UCCC framework aims to capture.

Through the **Model Operation Insights** dimension, which is in line with the principle of "exposing the creative process" outlined in the work of Llano et al. [32], users have the option of choosing whether they want to have access to the model operation, e.g., through visualization techniques like clustering or dimensionality reduction [8]. If they select the option 'Yes', they can further decide whether they want the system to always display this information (for example, on a dedicated portion of the interface) or only when prompted. The possibility to access the **Model Operation Insights** allows the user to be more aware of the distribution of agency and, consequently, limit the risk associated with wrong attributions of responsibility [21, 42]. Explanations "serve to build understanding

and possibly trust between the AI and the user or beneficiary of the AI" [60], and research has found that receiving feedback on the outcome produced by the AI may lead to increased levels of trust in users [1, 51].

Although it might be argued that users will always benefit from choosing 'Yes', there are at least a couple of cases in which not having this option selected might be beneficial. First, if the user is not interested in accessing the model operation explanations, selecting the option 'No' can have the advantage of saving computational resources, thereby reducing the environmental footprint. Secondly, the option 'No' might automatically be selected – through the customization device that we will present in section 4 – in the case in which the user opts for a minimalist *Control panel layout* to have a cleaner interface (see section 3.2).

The **Session Reflection** dimension refers to the post-interaction stage, when the user reflects on the co-creativity session just terminated and the AI provides them with some feedback. The user can indicate on a discrete scale the level of control experienced during the interaction, how much they enjoyed the latter, and how difficult the interaction with the AI has been. Engaging in this reflection exercise is beneficial for the adaptation of the AI system behavior in future interactions, according to the answers provided by the user. Concurrently, the AI can provide feedback to the user on different aspects of their performance. This will vary according to the nature of the co-creative process. For example, in the context of H-AI game co-design, it may give the user a score based on the originality of the output, reflecting how novel the latter is with respect to the original training examples or the playability of the levels. The score can be related to the user's performance overall or in comparison to previous interactions with the AI.

3.2 Interaction Configuration

The second category of dimensions is Interaction Configuration, and it refers to formal aspects of the interaction between the user and the AI. It includes the dimensions **Interaction Interface**, **Interaction Modality**, and **Feedback & Adaptation**.

The **Interaction Interface** dimension contains three parameters. Through the *Customization level*, the user can decide how much control they want to have on the customization of all the other dimensions included in the Interaction Configuration and Interaction Dynamics categories. How this works will become clearer when we describe the configuration of the customization app that can be developed based on the UCCC framework in section 4.

A user might prefer a limited level of customization to avoid being overwhelmed by what they might consider to be a too high number of choices, or because they do not have enough time to reflect on them before starting the interaction. An extensive level of customization, instead, might suit a more experienced user who wants to be able to make a choice for each of the available parameters.

The *Storage preference* parameter refers to whether the user wants the settings and feedback to be saved for future interactions with the system (profile-based) or not (session-based).

Lastly, the *Control panel layout* parameter refers to how rich the user wants the design of the interface to be, for example, how many toggles, switches, and other elements are displayed and accessible. The choice of whether to have a minimalist or comprehensive layout may follow the same logic as in the case of the *Customization level* parameter.

The user can also have the option of letting the AI automatically select a layout choice according to the level of expertise indicated at the beginning. In this case, for example, an experienced user may be offered a comprehensive layout with more elements to act upon, according to the nature of the co-creative process.

The **Interaction Modality** dimension allows the user to select how they want to communicate with the AI in the co-creative process. It comprises two parameters, referring to how the user and AI provide feedback and explanation to each other. The choices indicated in Figure 1 are only illustrative of some of the modalities through which the communication between the user and the AI might happen. We acknowledge that the communication channel may vary according to each specific application and that communication might happen through more than one single channel at a time. Offering users the option to select their preferred communication channels can have the benefit of improving the accessibility of the co-creative process. In addition, it might grant for richer, multimodal interactions. For example, the interaction design of prompting in the context of text-to-image generation is limited to the users delivering instructions in natural language to the AI model, ignoring other modalities for co-creativity. Enabling users to interact with the models in other modalities that are not natural language can improve the user experience and give more space to the user's creative expression.

H-AI communication is critical for the design of the interaction between user and technology in co-creative systems [14, 39]. The choice of the channel used for mutual communication between the user and the AI participating in a co-creative process can determine the success in fostering a shared understanding between agents participating in collaborative processes [32]. Conversely, conveying preferences to the AI is imperative to ensure accurate responsiveness to the user's needs, thereby fostering support rather than hindrance to their creative experience [5].

The **Feedback & Adaptation** dimension is divided according to the direction of the communication: from the user to the AI and from the AI to the user.

The feedback that the user gives to the AI can be direct or indirect: indirect feedback is based on the choices that the user makes throughout the interaction, for instance, by accepting or neglecting the suggestion given by the AI [36]; direct feedback is instead given through the communication channel chosen in the **Interaction Modality** dimension. Providing constant feedback, whether direct or indirect, to the AI during the co-creating process can contribute to the adaptation of the AI to the dynamic progression and mutation of creative strategies and ideas that human users usually display throughout a creative process [49, 58].

In turn, the AI can provide the user with different levels of explanation detail, from 'Full' to 'Least'. The explanations given by the AI that are considered by this dimension are different from those of the **Model Operation Insights** dimension mentioned above, as they more specifically refer to the explanation regarding the choices made by the AI in a particular step of the interaction. Different levels of explanations are needed according both to the user's expertise and their aims in the context of a particular process.

The 'Least' level of explanation detail can include, for example, a simple description of the task the AI just performed, with an indication of the parameters that have been used to produce the output at stake. In contrast, a 'Full' level of explanation detail may be directed to more experienced users who want to access the detailed chain of actions performed by the AI for producing a determinate output [60].

The user can decide to leave to the AI the choice to adapt the explanation provided according to their level of expertise. In this case, it is important that the AI gives explanations in a language that the user is familiar with. Among the benefits of receiving explanations from the AI, in addition to the mutual co-adaptation they facilitate [56] and to the increased levels of trust in users it can promote [1, 51], might be a higher level of user satisfaction with the output generated by the AI if the user has more insights on the steps behind the AI's moves [25].

3.3 Interaction Dynamics

The last category of dimensions is Interaction Dynamics, and it includes the dimensions necessary to modulate the level of control that the user has on the process: **Task Management**, **AI Interaction Approach**, and **Task Completion Authority**. This set of dimensions is particularly important, as it immediately impacts the level of agency and control the user has on the system. For a successful H-AI interaction, it is imperative that the user does not perceive a loss of control [25]. The spectrum between too little and too much control must be carefully balanced: "too much control and the tool is less accessible, whereas too little control makes the model output unsteerable by the user" [9].

In the **Task Management** dimension, the parameter *Task assignment* refers to whether the user and the AI are working on the same or different tasks during the co-creative interaction [24]. In carrying out a task, the co-creative agents may alternate in a turn-taking fashion [54] or proceed in parallel. In the latter case, both the user and the AI contribute to specific aspects or components of a task simultaneously, yet independently.

While in the 'Divided task' scenario the participants work on distinct assignments, working in a 'Unified task' scenario in parallel mode involves both the user and the AI autonomously contributing to the overarching task, yet concurrently. This means they can both contribute simultaneously without strictly defined shifts, as is the case instead for the Turn-taking approach. For instance, they can both be working on a drawing and painting on different areas of the canvas. Likewise, in the case of game design, they could both be adding tiles to a level map at the same time.

If working with a turn-taking approach, the user can choose which pace they want for the interventions, from 'Slow' to 'Fast'.

The **AI Interaction Approach** dimension gives users the possibility to control some key ways in which the AI will behave throughout the interactive co-creative process. First, the user can decide whether they prefer the AI to take the initiative or merely to suggest. In this latter case, the AI will suggest options to the user, who can then accept or disregard them [25].

The user can also choose the style in which the AI will contribute to the process. By choosing the 'Pleasing' contribution style, the AI will facilitate the user in performing the task they are undertaking, while a 'Provoking' AI will try to lead them in a different direction by making alternative suggestions or by taking the initiative in creating content that is different from what the user would expect. The pleasing vs. provoking alternative is present also in other H-AI interaction frameworks in the CC literature [24, 49].

A provoking agent could also be constraining the user by hindering their process in different ways. The constraints may, for example, derive from having the possibility of only choosing from the suggestions given by the AI. Constraining the user can have the positive effect of enhancing and stimulating their creativity [55].

The level of agency assumed by the AI in the interaction can be modulated by the user through the choice of whether they want the AI to overwrite steps made by the user or not through the *Content control* parameter. In the first case, the AI will have a higher level of agency and initiative, while when not overwriting, the AI will offer the user the final say on whether to accept the suggestions that are provided or to override them manually.

The **Task Completion Authority** dimension, derived from [39], refers to who should decide when the task has been completed. The user has the choice of whether to take full control over the submission decision, leaving it to the AI, or sharing the decision with the latter. In this last case, only if both co-creating partners agree the task can be submitted.

4 CUSTOMIZATION APPLICATION

In this section, we propose an actionable way to develop the UCCC framework into a **customization tool** for co-creative processes, in the form of a mobile application: **Co-CreatAI**.

The Co-CreatAI app – which is presented here as a prototype – could be applied to co-creative tools of different kinds. For instance, it can be used in conjunction with a game design co-creative tool to provide users with the option to customize the various parameters of the interaction that they will have with the AI co-creation partner.

The first option that the app would offer to users is to select the preferred *Customization level* (see Figure 2). The choice made at this initial stage will influence the layout of the app interface for the following steps. If the user chooses the option 'Limited', the next screen will ask the user to select on a discrete slider the level of control they want to have throughout the interaction process: 'Low', 'Medium', or 'High'. The app will then automatically adjust all the framework parameters according to the user's selection. For example, if the user selects 'Low' control, the *Content control* parameter in the **AI Interaction Approach** dimension will be automatically set to 'Overwriting', the engagement of the AI in the **AI Interaction Approach** will be 'Taking initiative', the *Final decision* will be given to the 'AI' alone, and so on.

It is worth pointing out that at this stage the layout of this app is purely for illustrative purposes. The automatic adjustments of the various parameters will depend on the particular co-creative tool the app would be applied to. As we discuss in section 5, the validation of the framework – conducted through the development of a proof of concept which will be tested through user studies – will be crucial to refine the parameters and the choices that the app offers to users.

The interface of the app displayed in Figure 2 is for a mobile application. The choice of prototyping a mobile application, instead

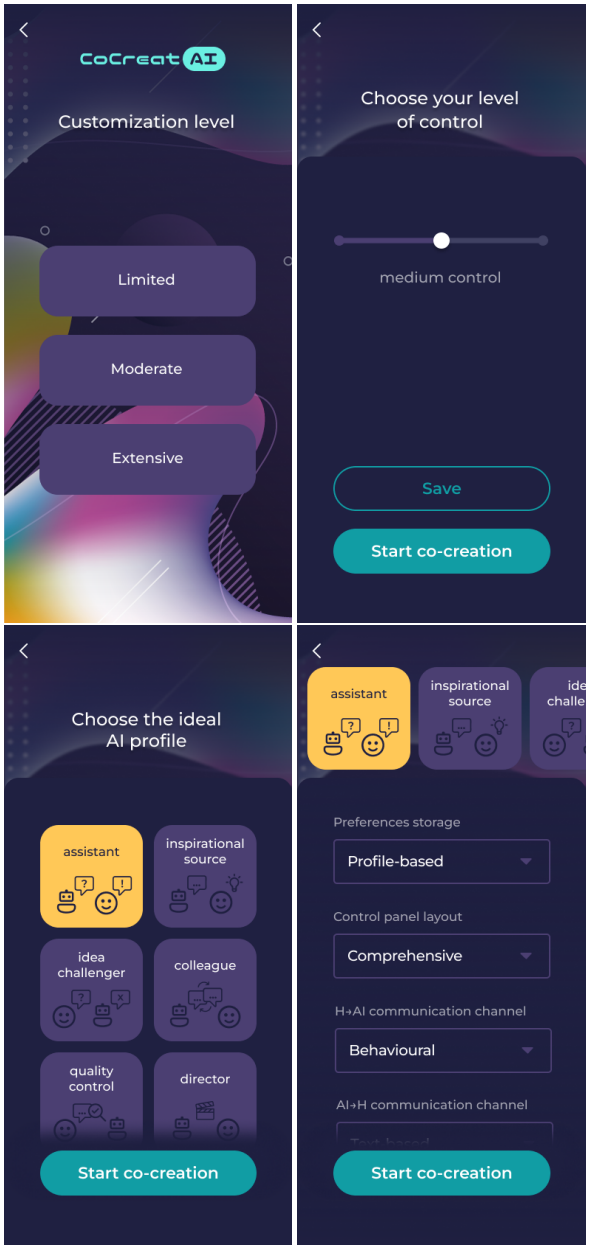

Figure 2: *Co-CreatAI app.* The images show the layout of the mobile app interface to (from upper left) (1) choose the desired customization level, (2) select the level of control in a 'Limited' customization level, (3) choose the preferred AI persona, if the customization level selected was 'Moderate', and (4) choose among the full list of parameters, if the customization level selected was 'Extensive'. (The app's background image is designed by Freepik (freepik.com).)

of a desktop one, was motivated by the consideration of a mobile app as "creativity on the move," enabling users to capture and interact with their creative impulses instantaneously, no matter where they are. However, we recognize that complex creative tasks are typically undertaken on larger screens. Therefore, the first stage of our proof of concept, described in section 5, will be developed as a desktop web application. Besides, the development of a web app is more rapid and cost-effective, which aligns with utilizing incremental funding to support the project's growth.

If the user selects an 'Extensive' customization level, the app will display all the parameters included in the UCCC framework, giving the user the option to select their preferred choice through a drop-down menu (see Figure 2, lower right).

The most interesting case is the one in which the user selects a 'Moderate' level of customization. Here, the app will provide the user with the option to choose their preferred persona for the AI they will interact with throughout the process (see Figure 2, lower left). The **AI personae** we identify are six: AI as Assistant, AI as Inspirational Source, AI as Idea Challenger, AI as Colleague, AI as Quality Control, and AI as Director. In drafting these profiles, we take inspiration from Lubart's work [34], as well as the work of other researchers who investigated the roles of AI in co-creative processes.

Table 1 in Appendix A lists the choices for each AI persona which will be automatically selected by the app when the user chooses one of the six AI profiles. For example, if the user selects 'AI as Colleague', the *Feedback type* in the **Feedback & Adaptation** dimension would be set to 'Direct', the *Task assignment* would be 'Unified, the AI *Contribution style* would be 'Pleasing', and so on. We acknowledge that for some of the dimensions the selections for each of the AI personae will depend on the specific co-creative tool the CoCreatAI app is applied to (e.g., for the Communication channel and Intervention pace). In these cases, in Table 1 we left the indication of the default choice.

The option that the application offers to choose among a set of different AI personae serves as an augmentation to user experience. Through this device, users are afforded the opportunity to align the co-creative process with their individual preferences and creative approaches. This customization feature not only enhances user engagement but also addresses the inherent variability in human preferences for collaboration and acknowledges the necessity to tailor the co-creation environment to the diverse needs of individual users engaged in creative processes [30].

5 LIMITATIONS AND FUTURE WORK

The recent explosion of GenAI technologies and the ease and accessibility of their interfaces are gradually shifting the agency away from users and toward the AI model, limiting the control that users can have on directing the creative process [30]. One of the key aims that guided us in the creation of the UCCC framework, is to reflect on the fundamental dimensions of H-AI interactions that can give users the power to be in control of the distribution of agency between themselves and the AI they are co-creating with.

The modality-agnostic nature of the UCCC framework can be seen as a strength, as it does not limit the reflection on the modulation of agency between users and AI to one particular field of

application. At the same time, however, it may be deemed a limitation of the framework, as necessarily some of its parameters, e.g., the *Communication channel*, provide only an illustrative guide and not a comprehensive list of all the possible options users could choose from in different kinds of co-creative processes. Depending on the nature of the practice to which the framework is applied, more nuance may be required than the one expressed in the framework presented in this paper. For example, a user may want to modulate the **AI Interaction Approach** differently in various stages of the same co-creative process.

An additional constraint of the current UCCC framework is the potential technical impracticality of implementing a customization tool that enables users to select from all the listed dimensions and parameters.

To counteract the limitations mentioned above, moving forward in this research we will develop a proof of concept of the app that will embody the principles and dimensions outlined in the UCCC framework. This proof of concept will be a functional system that users can interact with, providing a tangible experience of the co-creative process.

To ensure the effectiveness and user-centricity of this work, we will adopt an agile development approach in order to build our system incrementally, with user feedback guiding each iteration. By engaging with users early and frequently, we aim to:

1. Validate the utility and usability of each dimension identified in the UCCC framework.

2. Refine and adjust these dimensions based on real-world user interactions and preferences.

3. Potentially identify and integrate new dimensions that emerge from user feedback and changing needs.

In the proof of concept, the dimensions' details will be communicated to the end-users by using User Interaction (UI) elements such as tooltips, modal windows, instructional overlays, or FAQ sections. The development of this proof of concept will be of crucial importance for answering questions such as: How to build a co-create app based on the rich dimensions of the UCCC framework? How to adapt user feedback into future human-AI co-creation processes? Which dimension of the framework is the most critical?

We aim to apply this proof of concept to the field of **game design**. This choice is motivated by the multimodal nature of game design and by its rich literature on co-creativity [28, 39]. As the production of video games involves a great diversity of content (such as the creation of 2D and 3D assets, levels, characters, narrative, sound, game mechanics and physics, and the definition of rules and objectives) and the creative process can be spread over several stages from ideation, generation, testing, refinement, to dissemination, there is a large scope for exploring the multiple dimensions proposed in the UCCC framework.

6 CONCLUSION

In this paper, we presented a novel **user-centered framework for H-AI co-creativity processes** (UCCC), inspired by previous work in the CC and HCI literature on co-creative interactions between humans and technology. The novel contribution of our framework lies in the identification of a comprehensive list of the key dimensions responsible for the modulation of **agency distribution** between human users and AI in co-creative processes, an increasingly relevant field due to the rapid development of GenAI technology for the generation of creative content.

We closed the paper by suggesting an actionable way of implementing the proposed UCCC framework into a customization tool that can be applied to co-creative tools of various natures to allow users to tailor the interaction with the AI according to the multiple parameters contained in the framework.

ACKNOWLEDGMENTS

We are grateful to Monash University's SensiLab for the opportunity to participate in their workshop on co-creative AI in Prato in June 2023, which sparked the conversations that gave rise to this work. We also wish to thank the reviewers for their helpful comments on this paper. This work was supported by the UK EPSRC Next Stage Digital Economy Centre in the Decentralised Digital Economy (DECaDE) (EP/T022485/1), by the RKEI Award 2023-2024 of the University of Edinburgh, and by the FCT – Foundation for Science and Technology, I.P./MCTES through national funds (PIDDAC), within the scope of CISUC R&D Unit – UIDB/00326/2020 or project code UIDP/00326/2020. The second author is funded by Foundation for Science and Technology (FCT), Portugal, under the grant 2021.07047.BD.

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A AI PERSONAE

Table 1: *Table of AI Personae*. The table displays the six AI personae the user can choose from and the corresponding selection of each parameter which is automatically selected by the CoCreatAI app in respect to the chosen AI persona.

		AI Persona					
		Assistant	Inspirational Source	Idea Challenger	Colleague	Quality Control	Director
							
Control panel layout	Minimalist						x
	Moderate		x	x	x	x	
	Comprehensive	x					
Communication channel (U→AI)	Text-based			x	x		
	Voice-based						
	Gesture-based						
	Touch-based						
	Behavioural	x	x			x	x
Communication channel (AI→U)	Text-based	x	x	x	x	x	x
	Voice-based						
	Visual						
	Haptic						
Feedback type (U→AI)	Direct			x	x		
	Indirect	x	x			x	x
Explanation detail (AI→U)	Full			x			
	Moderate				x	x	
	Least	x	x				x
Task assignment	Unified task		x	x	x	x	x
	Divided tasks	x					
Processing approach	Turn-taking	x	x	x		x	x
	Parallel				x		
Intervention pace	Slow						
	Normal	x	x	x	—	x	x
	Fast						
Engagement	Suggesting	x	x				
	Taking initiative			x	x	x	x
Contribution style	Pleasing	x			x	x	
	Provoking		x	x			x
Content control	Overwriting					x	x
	Not overwriting	x	x	x	x		
Final decision	User	x	x	x			
	AI						x
	User and AI				x	x	