

Focusing on artists' needs: Using a cultural probe for artist-centred creative software development

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Abstract

One of the ultimate goals of Computational Creativity research is to make novel, better, and useful software that can be used for creative purposes. The new wave of learning-endowed generative systems has highlighted the potential of AI for creative tasks, so demand for creative software development is expected to grow significantly, which in turn entails the need for adapted software engineering techniques. We conducted interviews and used a digital cultural probe that posed as a virtual co-creative companion with unlimited capabilities to collect qualitative data on how creative fellows, from different areas and with no knowledge about generative models, would use an ideal piece of creative software. By following an Inductive Thematic Analysis, we bring forward a set of domain-agnostic patterns of how software can help in creative tasks. These themes - 12 user needs and 8 contexts of use - can be used to organise functional requirements to sustain an improved user-centred development of creative tools, or might even be used as a classification framework for creativity tools and co-creative systems. Finally, we discuss the benefits and limitations of our methodology that can be repurposed for a more suited and artist-centred initial process of functional requirement gathering.

Introduction

Over the course of last year, several learning-endowed generative systems have been put forward such as text2image models (Ramesh et al. 2022), text2video (Singer et al. 2023), text2audio (Agostinelli et al. 2023) and even new conversational agents such as ChatGPT (InstructGPT) (Ouyang et al. 2022) that have been subject of a lot of attention as well as fierce discussions, especially in regard to their use in creative tasks. These discussions usually revolve around topics such as autonomy, originality, authorship, copyright infringement and the potential negative impact these might have on human creators, even leading to artist-led movements against AI-generated products.

Human-centred design methodologies emerged as a way to fight against the development of potentially unethical or detrimental software (Gasson 2003). This kind of methodology places the person at the centre of the design process and has been specifically tailored to make the final product more useful to its users, not only because these processes directly

influence the perception of the involved users, but also because they focus on tackling the real problems of a specific class of people. These often imply the early involvement of users during the initial stages of requirement gathering (RG) to study the desired role the software should play.

The aforementioned automatic generation software is not unique in its capacity of helping with creative tasks. Indeed, we hypothesise that this is only suited for a narrow specific purpose in a wide class of problems that creative workers face daily. We define the class of creative software as any digital tool that users find helpful in what they perceive as a creative task. Applying human-centred design methodologies during the development of this kind of software might facilitate its embedding into society in the long-term (Colton et al. 2015). We then honed in on the question: how do creators think software can help in their creative tasks?

Since functional requirements depend on various factors, such as the task, domain, and humans involved, we believe that bypassing a proper RG process goes against the fundamental principle of human-centred design. Therefore, gathering functional needs directly from artists through a bottom-up approach may be a challenging task, as there is limited literature on this approach. Additionally, there is a lack of general guidelines or tools that can support these individual procedures that focus on functional needs, are artist-driven, and are adapted for creative software. For this reason, we chose to follow a more comprehensive bottom-up approach by involving artists to gather domain-agnostic and general needs for creative software and identify common challenges (ex: the issue of confining the creative process). As a result, we formulated a secondary research question: what methodology can help overcome some of the challenges of collecting needs for creative software?

We conducted a qualitative study in which we interviewed people from several creative fields, who made use of a virtual cultural probe to express their needs over the course of a week. Using Inductive Thematic Analysis, we established common domain-agnostic themes of needs and their contexts of use. We propose two use cases for the resulting themes: a grouping framework for functional requirements for creative software; a categorisation of existing creative software, according to their capabilities. We also believe the methodology we followed can also be used to overcome some of the challenges of RG for specific creative software.

The paper is structured as follows: first, we present previous literature on RG, human-centred design, co-creativity, and cultural probes; we continue by detailing our methodology; next, we present the underlying resulting themes and discuss other additional relevant findings while pointing out the limitations of our methodology and how it can be improved and adapted; finally, we summarise our contributions, provide practical use cases for our themes as well as possible directions for future research.

Related Work

The field of Software Engineering focuses on improving software development methodologies. Researchers in this area agree that the development process should start with requirement gathering (RG) (Rodriguez, Wong, and Mauricio 2017), a task studied in the field of Requirement Engineering (RE). Functional requirements are the capabilities desired for a software system to meet the needs of its users and stakeholders. In contrast, non-functional requirements consider other components of interaction such as performance, security and availability. The development of new kinds of software such as distributed and AI systems exhibit particular challenges and benefit from approaches particularly designed for such contexts, such as RE4DIST (Wirtz and Heisel 2019) and RE4AI (Heyn et al. 2021; Ahmad et al. 2021; Pei et al. 2022).

The design of (co-)creative systems is no different, in the sense that it poses its own challenges to the process of RG and elicitation. Not only the new kind of creative systems can make use of different components (distributed data-driven components, real-time or conversational interfaces, or even generative modules) making them very complex systems, but also serendipity is one of the main and most valued characteristics of creative behaviour (André et al. 2009) which becomes one of the biggest challenges when collecting information for designing creativity-support systems since it is hard to confine the creative act to a specific place and time – creativity cannot be scheduled.

Our search revealed that the published literature on software engineering for creative systems is still scarce and that studies focused on RE for (co-)creative systems (RE4CREATIVE) are even rarer; no empirical study on the collection of functional requirements from real potential users was found. Yet, studies show that not only there seems to be “a positive relationship between users’ involvement during RE and system success”(Bano and Zowghi 2013) but also that “the most significant user involvement occurs at the beginning of product development”(Kujala 2008).

Meanwhile, Human-Computer Interaction (HCI) has been attracting attention in the area of creative systems, but the methodologies proposed under this branch are usually more appropriate for analysing the interaction between an already deployed model - or at least a prototype - and usually focus more on non-functional requirements and user experience, being of limited use for acquiring functional requirements. This seems to be what Gasson (2003) criticises when advocating for human-centred over user-centred design.

For example, Kantosalo et al. (2020) inspire themselves in the HCI concepts of modalities, styles, and strategies, and

adapt them to the context of co-creative systems, in this way developing a framework “to equip co-creativity researchers with a domain-agnostic vocabulary to discuss the capabilities and shortcomings of existing and proposed interfaces for co-creation.” (Kantosalo et al. 2020). In another publication, Kantosalo and Jordanous (2021) present several theoretical roles that a computer can play in human-computer creative collaboration. However, while these studies empower researchers with theoretical frameworks for comparing and designing different approaches, they do not directly involve users nor address how to openly collect their needs.

More recently, another similar framework, Co-Creative Framework for Interaction design (COFI), was proposed by Rezwana and Maher (2022a) where the authors take a similar approach, this time by performing a literature review and using concepts from several fields, including Computational Creativity (CC) and Computer-supported cooperative work (CSCW), to inform their thought process and establish interaction models for co-creative systems. They also analysed a total of 92 co-creative systems using COFI, detecting an underutilised space of possibilities in terms of interaction design. But again, while this framework is useful to track and explore the space of interaction design of co-creative systems, the study does not involve users and does not directly focus on their needs nor functional requirements.

Qualitative fieldwork through qualitative research is essential to obtain a deep understanding of not only the needs, but also the contexts of use in which they emerge (Kujala 2008). To that effect, some qualitative studies have been published to account for users’ thoughts and opinions when designing or trying to improve co-creative systems (Rezwana and Maher 2022b; Oh et al. 2018). But both studies focus on specific co-creative systems and do not tap into the deeper functional requirements of the users. Instead, they deduce how AI-to-human communication (Rezwana and Maher 2022b) or co-creative systems’ interfaces (Oh et al. 2018) play an important part in human-AI collaboration and could be improved.

Finally, traditional qualitative studies such as the ones solely based on interviews are not perfect for RG for creative software due to the elusive nature of creativity. One technique that accounts for the unpredictability of relevant events, specifically designed with artists in mind, are cultural probes (Gaver, Dunne, and Pacenti 1999). A cultural probe consists of a physical package with all sorts of tools (e.g. notebook, camera, map) that artists can use freely to capture their moments of inspiration and ideas over an extended amount of time. Nowadays, phones (Bainbridge, Novak, and Cunningham 2010) and even wearables (Lin and Windasari 2019) can act as virtual cultural probes to study, for example, how their continued use can affect users’ well-being. Still, to maximise the potential of the data gathered via a cultural probe, these are usually paired with other types of qualitative techniques such as interviews.

Methodology

As previously mentioned and as defended by Kujala (2008), the benefits of including the user in the early steps of development through qualitative fieldwork are well-known in

the field of RE regarding software usefulness, usability, and acceptance. Accordingly, we propose to follow a cultural probe methodological approach complemented by two interviews to overcome some of the challenges in collecting and understanding general needs for creative software.

The first of these challenges, already mentioned, is related to the fact that the creative process is a continuous, unpredictable, and lengthy process that is hard to confine into a time-bound session. Additionally, it is important to deal with various types of media when attempting to describe general domain-agnostic needs. We also argue that using a cultural probe approach requires fewer resources, as it does not necessarily involve any prototypes or finished products. This in turn leads to more general observations, as the user is not limited to a specific software concept.

We now describe the two main phases of our methodology – data collection and data analysis – in more detail .

Data collection

A total of 21 people participated in our experiment, with ages ranging from 24 to 50 years old. From those, 12 identified as male, 8 as female and 1 as non-binary. In terms of creative fields, there were 2 people from Cinema, 1 from Cooking, 6 from Creative Writing, 3 from Design, 9 from Music, 3 from Painting, 1 from Photography, and 2 from Theatre. These fields overlapped for some people and 4 of them were also teachers. Participants had different levels of relationship with their art, ranging from fully professional to hobbyists. All data were gathered in May 2022.

We first conducted a semi-structured introductory interview (30-60min) with each participant, asking general questions about their education, occupation, and their views on creativity and creative activities. In this interview, we introduced the concept of our digital cultural probe, which we named POCKET Artist (POCA), and that posed as a hypothetical creative machine capable of attending to whatever request was sent by the artist. Participants interacted with POCA through WhatsApp: we set up a dedicated phone number to which the artists could send messages. They were free to use any of the media formats currently available on the platform (audio, text, images and videos). There was only one guideline for the type of requests sent to POCA which was that it could only use the same means provided by the instant messaging application to answer back, e.g. if a participant were to ask for a cake, POCA could only send back a recipe for it and not the cake itself.

To avoid any frustration, the participants were explicitly informed that POCA would not execute their requests. In any case, they were instructed to send their wishes as if the program was able to provide the wanted result just the same and to think about it as their “ideal creative partner”. The upside to this is that participants were only limited by their imagination - and the platform’s interface as previously mentioned - regarding their requests, something we highlighted during the first set of interviews¹. With this experiment, we expected to collect which types of necessities

¹The scripts followed during the interviews are available at: <https://github.com/Superar/POCA>.

artists have during their day-to-day lives regarding creative activities and also which elements of their creative process they are willing to share with a machine.

After one week of interaction with POCA, another semi-structured interview was conducted (30-90min) to understand how they integrated the system into their routines and the hindrances to such integration. We also asked some questions about how the interaction with POCA affected their overall creative experiences, as well as some general questions about each participant’s perceptions of creativity, creative processes, and creative machines. Through these final questions, we aimed to consolidate the possibly unreported needs they felt during their week of interaction with POCA as well as to better comprehend artists’ worries and misconceptions regarding the field of CC. In the end, we presented a text2image tool, DALL-E 2 (Ramesh et al. 2022), and followed a use case exercise to understand more concretely how such generative tools could help.

In total, we collected 31 hours and 31 minutes of audio from the interviews, besides 135 interactions sent directly to POCA through WhatsApp in a wide range of formats: text, audio, images and photos, or even links to pages and videos.

Data Analysis

For data analysis, we followed a method for Thematic Analysis known as Provisional Coding (Saldaña 2021, p. 144), in which the data are categorised according to a predefined set of codes that can be obtained in many ways; in our study, we decided to use a pilot study for this purpose. We utilised Whisper (Radford et al. 2022) to automatically transcribe the interviews² and Notion³ to facilitate the coding process.

Pilot Study For our pilot study, we first conducted an Open Coding process, segmenting the data from interviews and interactions with POCA for three participants into Units of Meaning (UoMs), each of which was then summarised into one to three sentences. Through Axial Coding, we drew connections between each of such descriptions according to their meaning and relation to the main research question, resulting in clusters known as categories. This process was done iteratively three times until we reached nine categories organised and described in depth in a codebook⁴, a document containing a detailed description, inclusion criteria, exclusion criteria, points of confusion, and examples for each category, which would be used to guide the next step of the Provisional Coding. Each UoM could be included in more than one category (Saldaña 2021, p.80). The Open Coding process was performed by three researchers separately, but the entire Axial Coding was done collaboratively, to incorporate different aspects and views into the analysis.

Final coding Following the next step, the data of another 12 participants⁵ were segmented into UoMs according to

²Quotes were translated to English by the authors.

³Available at: <https://www.notion.so/>

⁴The codebook obtained during the pilot study is available at: <https://github.com/Superar/POCA>.

⁵Due to time and resource restrictions, we were not able to fully evaluate all data from the 21 participants. A total of 15 (3+12)

their relevance to our research question; we highlight that the material of a participant was not segmented by the researcher who interviewed them. Then, the researcher who had not yet seen the participant's data coded these UoMs according to the codebook, selecting the level of confidence they had in their decision (easy, hard, or very hard). Subsequently, we carried out the same Open Coding and Axial Coding process described above for the cases considered hard and very hard; this process resulted in a new organisation of the knowledge which required a re-coding of all data according to this new schema, culminating in the final themes we present in the next section of this paper: 12 themes representing user needs, 8 other regarding contexts of use, and 3 related to other aspects.

Findings and Discussion

Throughout the last axial coding, three different classes of themes emerged. Two of these classes directly reflect the theoretical separation between need and context of use presented by Kujala (2008) for which we present the respective themes in the next two subsections. In a single UoM, sometimes only the need might be addressed, leaving out the context (e.g. "Recommend a song"), other times the opposite might happen (e.g. "I need help with school"), but they are often together, even if implicit. In addition, themes in qualitative studies are not always clear and obvious. A natural consequence of this is that UoMs are usually multi-theme.

The last class of themes relates to several user comments on other non-functional components or even their general views on technology such as specific interaction requirements, use cases where they prefer not to use software, and even opinions on the applied methodology. These are exposed and discussed in the last subsection.

User needs

The first facet expressed by the themes describes the needs that users have related to the role the machine plays or is expected to play. For this purpose, we used the Kujala's (2008) definition of needs: "[...] problems that hinder users in achieving their goals in a specified context of use."

In total, we found 12 themes related to general user needs, each one corresponding to a specific role, that we summarized in Table 1 and proceed to elaborate.

Recorder A simple but prevalent need participants expressed was to have a recorder; a sort of digital vault to store mostly ideas, but also references and other types of information for later consultation. Usually, this recording was an end in itself - "POCA for me served as a place, a site, a method for a repository of ideas and relationships that I came across last week while researching or having some kind of idea connected to the creative process." (P4; Cinema); but sometimes this also happened when artists wanted to increase their productivity or were developing an artefact as well. Additionally, some participants felt the need to ask questions they did not want to share with other people or

participants were analysed, corresponding to 416 UoMs gathered from 102 interactions and about 18h of recorded interviews.

simply to vent: "[POCA] is just a vent, it will just be for me to vent what I need." (P18; Theatre, Creative Writing)

Gatherer Artists mentioned, in many occasions, the necessity of finding already existing pieces of work or general information, e.g. product prices, term definitions, or study techniques. When asking for recommendations, this search is generally guided by some input: other artefacts (e.g. images, poems, songs), a concept - "[...] the concept of ghost time travel was the kind of thing I'd like to explore with POCA" (P4; Cinema) - or a piece of information (e.g. an author's name or a music genre). Users also ask for specific building blocks for their own work, such as words, colour palettes, fonts, excerpts of text or video, and templates.

Operator Machines are often required to perform the role of technical tools, producing reliable and predictable effects depending on user actions and parameters. Some examples are software for manipulating, composing, and editing content as well as software capable of creating simple products or stimuli, such as transcribers and metronomes. This also includes hardware interfaces, such as drawing tablets and Virtual Reality (VR) devices. As mentioned by a participant, these tools are already essential in their creative process: "[Software for manipulating scores and mixing,] [...] not being part of the final artistic product, [...] were already important to get to the final artistic product." (P21; Music, Teaching)

Generator Autonomous generation was an often sought need as well and appeared in all contexts we identified. Sometimes participants wanted to materialise some idea they had, develop some artefact or have a new source of inspiration. Participants also found it could be interesting to make up for their shortcomings outside their creative domain: "People like me, who can't [really] draw, often have this feeling that if they could draw, they would draw great things. [...] And [...] throwing ideas around and seeing them turn into images without knowing how to draw is a very cool thing, isn't it?" (P18; Creative Writing; Theatre) But other times participants wanted to generate different possibilities or solutions for chores they also have - like producing images for digital marketing - or even to help them with their personal lives - like generating recipes given a set of ingredients. Finally, many participants were unfamiliar with DALL-E 2 (Ramesh et al. 2022) but found its capabilities interesting, and even came up with new ideas for similar applications: "I [could give DALL-E 2] music. Because a lot of the time I make up stories while I'm making up a song [as an exercise for kids in my classes]." (P21; Music, Teaching)

Variator Presenting possibilities is a popular request, especially when the user already has a provisional but not perfect solution. In those cases, users seem to value the ability to provide several different and unexpected variations of one artefact provided as input, while keeping its most important features. This idea can take the form of a synonyms suggester, a prompt-guided image modifier, a paraphrasing tool, or even a stage direction planner: "it would be very handy, for example, to be given proposals of alternative [stage] routes for the same space" - (P18; Creative

Table 1: Summary of the themes regarding user needs

Name	Description
Recorder	User inputs something to be stored but expects no special output
Gatherer	User prompts for some possibly aggregated information that is dispersed in a repository
Operator	User provides controlled instructions that have a predictable effect on an artefact
Generator	User provides a prompt and expects a novel previously unexisting artefact
Variator	User provides a base artefact and an optional prompt, and expects alternative variants of the artefact
Mapper	User provides an artefact and expects an artefact in a different media
Completer	User provides an uncompleted artefact and expects extended or completed versions of the artefact
Analyser	User provides an artefact and expects an objective analysis or description of the artefact
Critic	User provides an artefact and expects a subjective opinion on the artefact
Instigator	User does not expect to interact, they expect the software to actively remember them
Organiser	User does not expect any input nor output but expects some background rearranging behaviour
Enabler	User has a problem and expects to find solutions through continuous brainstorming interaction

Writing, Theatre). These alternatives are always evaluated and filtered by the user to be either used directly or to inspire a new user-made variation that is more adapted to the new use case or to the new constraints.

Mapper The task of translating an artefact into a whole new media is not usually straightforward, due to the several ways you can encode characteristics of the original artefact into the new one. Yet, participants reported that generating songs from images, images from poems or “for example, to provide a song and receive an image would be something very interesting.” (P4; Cinema) The participants want the outputs to complement the original artefact, for example in social media, or even to further inspire them by contrasting with previously developed ideas based on the original artefact. There is also great applicability of mapping tools to make art more accessible. By making an artefact available in several media the artists depict a reality where they could effortlessly reach a wider public and allow some people that could not appreciate their artefacts before due to sensorial limitations to finally experience .

Completer Participants also refer the need of completing artefacts. It might be related to a lack of expertise, motivation or time to do a specific part, or even because using other generated components may be crucial or beneficial. One of the mentioned cases was related to the specific surrealistic collaborative method, the exquisite corpse: “I like to create alone but that way I can’t do exquisite corpses. Besides, scheduling sessions [with people] is hard. I want some entity that is always available for artistic partnerships. Can you complete my drawing? [...] Or my text? Or my song?” (P3; Painting) Tasks like image inpainting, extending or completing a musical opus, or finishing a rhyme scheme are great examples of use cases. Sometimes artists want the system to perfectly mimic the provided part, other times they ask for contrasting elements or even a mix of both. Lastly, users prefer to use the system’s output as it is, although sometimes participants might want to decide upon its quality possibly asking for new completions or variations of existing ones.

Analyser Another task users need the machine to perform is analysing a given piece of work, extracting and making some of its intrinsic characteristics explicit. An example is textual analysis – “If [POCA] could go through the whole document and identify precisely those [word] repetitions, so I could correct them later, then that would be great!” (P7; Creative Writing) Other examples are the identification of shapes and lines in paintings or the recognition of music tempo and progression. There were cases in which the artist wants the machine to analyse themselves by understanding their behaviour (e.g. when they are more productive) or by extracting characteristics of a performance (e.g. movements made while conducting an orchestra).

Critic Having a personal critic in some sense that could provide feedback or a second opinion was also an observed need. It is closely intertwined with the role of Analyser, where the user inputs an artefact, but differs in the sense that the expected output here is an opinion. For example: “I like to receive input, not necessarily from a human being. Just the fact that [POCA] could give some kind of feedback of ideas, of concepts [...] could be enough to make what I do creatively a little richer.” (P3; Painting); “[...] what would help me a lot [...] is to have proofreaders who go a little beyond identifying typos [...], saying if the text is well constructed, if in that language it makes sense [...], to be my little pocket proofreader.” (P7; Creative Writing)

Instigator A majority of creators mention a program that could challenge or remind them to be creative, for example, by imposing conditions on their creative process or by providing daily/weekly challenges: “I think it would be very interesting to have a program that you open and it throws you into a totally different situation than the one you are in now. In a way that makes you uneasy enough to be able to produce thoughts and emotions.” (P19; Painting, Design); “Maybe a machine that would help me do [a creative writing] exercise every day would be a way to stimulate my creativity for writing.” (P12; Music, Creative Writing). The machine should also actively remind artists of important tasks and relevant ideas in an appropriate time, which can help them feel more

motivated to extra develop their creativity.

Organiser Keeping things organised is always a time-consuming task: “I have difficulties in organising [...] [so] all my requests [to POCA] had to do with that, a way to help me organise my ideas and bringing them back another time.” (P2; Painting) Even when there are ways to quickly record things, that does not mean they will be organised, and many times entail a posterior organisation process, which can be overwhelming. The act of recording is not the relevant part of this scenario, nor is the moment when the user wants to gather some of that information back. Instead, this role focuses on the active processes the users think the system should undergo to self-organise a repository according to its user’s goals, by actively finding relationships among the data, identifying collisions, possible problems, missing information or ambiguous constraints. This involves crawling in other repositories to rectify or complement the available data, or even calculating metrics for the user; and includes use cases such as organising finances, projects, schedules, documents and references, playlists, or even a shopping list. Such different use cases make these processes quite complex to adapt to each user’s necessity. Besides, the organisation process sometimes cannot be externalised to a virtual assistant or secretary as it is a vital part of the creative process.

Enabler During the experiment, artists sometimes felt stuck, without knowing what to do next, so they expressed wanting help with this by discussing their artefacts, brainstorming ideas, or being provided references for inspiration. In essence, they wanted help enabling their creative process. For example, one participant said “[...] during the execution of this work, [which is] already in progress. At some point I would stop and think that I don’t really know how to proceed with it. So I went and brought to POCA how I can move forward with that. Not necessarily expecting obvious answers” (P2; Painting). Finally, this need emerged in all but one of the contexts of use, including wanting help unlocking personal life decisions, improving personal development, or solving logistics tasks and problems.

Contexts of use

Recalling the definition by (Kujala 2008), needs arise in specific contexts of use. In this subsection, we strip the former from the UoMs and focus on the latter. While a need is something actionable, a context is defined by the surrounding circumstances and is often relative. The same user need can appear in two distinct contexts, for example, a generated picture can inspire the user or be shown in a class.

Overall, eight different contexts of use were gathered from the data. We now provide further details on them.

Inspiration Inspiration is often seen as the spark that ignites the creative process, providing the artist or creator with the initial idea or vision for their work. So it is only natural this was one of the most mentioned contexts, especially when gathering references and information to inspire artists: “So I go to museums [related] to the themes that I want to work on at the moment. [...] And I get a lot of visual references. And after that I manage to create some things.”

(P19; Painting, Design) Other times, artists simply wanted to record a reference they found inspiring or sought inspiration by asking to be challenged or stimulated, for example by autonomous generation: “Today, I would like to illustrate stories created [from keywords]. If I gave the elements ‘elephant’, ‘tea’ and ‘vampire’, what would [POCA] give me to illustrate?” (P3; Painting) Finally, sometimes participants did not want just mere references, but to be fully immersed in a different reality or ambience that allowed them to be fully inspired by it: “So we want this play to be a play with medieval characteristics, okay? [POCA] will look for the medieval historical context, [...] the type of clothing [...], [...] the type of music [...] and bring already these tools to study and to create [...]” (P18; Creative Writing, Theatre)

Ideas If inspiration is the spark that ignites the creative process, ideas are its fuel. They might be hard to find, or even be already present subconsciously. The biggest need related to ideas is having a way to store them somewhere so they do not get lost in the future, and ideally they would be organised automatically. The flip side to this is the need to be able to access these ideas effortlessly and at any time, from one’s portfolio. Other needs related to ideas are discussing, evolving, bringing about, reminding, instigating, and exploring ideas in collaboration with creative software to unlock the creative process: “Sometimes I thought, [...] if I take this idea and try to explore in POCA, [...] it gave me [...] that freedom. [...] I think POCA can also serve as an option for [...] exploration.” (P13; Music)

Artefact Development When people think about artists’ needs, usually what comes to mind is the materialisation of creative ideas into the final piece of work – which can be material, performative or any other format. A machine can perform various roles in this context, from helping the artist to organise their process and drafts – “[POCA] would enable me not to get too disorganised and to know what I still had missing” (P18; Creative Writing, Theatre) – to allowing them to overcome their limitations – “I am a lyricist-composer. So, my greatest aptitude is writing the lyrics. But not the harmony. So, a program that would give me the harmonic options [...] Gee, that would help me a lot.” (P12; Music, Creative Writing) Artists already use technology to produce and manipulate their work and find all kinds of information; but they still also seek alternative ways of thinking and collaborating. Conversely, some artists fear that the human aspect of art might get lost due to technology: “I wouldn’t have experienced nor gained a shred of what I experienced with the person who made those drawings. [...] That accompanied a human process between us, seeing another person feeling what I wrote and transforming it into drawings through their own sensation.” (P18; Creative Writing, Theatre)

Productivity Another prominent context of use is to manage (access, organise, save, or control) some kind of resource, e.g. material, people, venues, time, motivation, or energy. Artists mention explicitly that they could use computational tools in such context to concentrate on their creative tasks and be more productive: “Something that would

[...] not let you procrastinate for so long. Or prioritise those creative ideas a bit more, that would be [...] too exciting.” (P5; Music, Creative Writing) The machine can help with unavoidable adjacent tasks, usually not directly related to the artist’s own main creative process, such as bureaucratic matters or even “with the creative tasks which I take no pleasure in and have to do anyway” (P21; Music, Teaching).

Skill Development Expertise, practice and skills are crucial parts of being an artist, and teachers play a crucial role in developing those. Maybe, that is the reason why participants would like software to fulfil that role: “just like a real teacher, who I could contact, anytime, to ask something, make something clear, evaluate what I did, provide a reference.” (P19; Painting, Design) In this context, the software can also detect difficulties, provide examples and feedback, manage study time, provide methods or even suggest exercises. These exercises can be directed for a specific hassle, technique, standard, domain, or even intended to stimulate general creativity or other mental capacities. Two non-exclusive kinds of general creativity exercises are referred to: those that impose constraints on the process; and those that provide inspiring stimuli or concepts as a starting point. These exercises not only can make the artist learn how to deal with creative blocks, but also learn more about themselves and their limitations: “one thing that would help me [...] would be the identification of moments of optimal creativity. [...] What I should do to become more inspired and/or produce more.” (P3; Painting)

Teaching Artists, while being eternal students, are also experts and consequently often turn out to be teachers as well. Teaching has its own challenges, and software can play a big role in making it easier to handle. Participants refer to remote classes and reference gatherings as cases where they already use software. Other new cases where software can become handy are the emulation of conditions for an evaluation or specific performance, the provision of personalised feedback for students or the analysis of how teachers can convey their ideas more effectively. Generation of content for classes is yet another great request: producing slides, notes or summaries, creating more fun and motivational activities for children, or even customised exercises: “for example, I need to create some sheet music reading exercises for this student, [...] a simple reading, [...] I can simply go search in a book [...] but I always think: let’s try to do something more customised to fit her difficulties. So I could have an assistant to which I could say: “[...] my student has these difficulties [...] I need two reading exercises”, [...] and it generates them.” (P5; Music, Creative Writing)

Social interaction Technology is a powerful tool to foster social interaction and cooperation – “[...] this tool could be used from the various perspectives of the various stakeholders [...] and they would basically be working on a common platform, simultaneously, for the same thing.” (P18; Creative Writing, Theatre) On the other hand, there is also a concern that digital communication is harmful to general social interaction: “This amputation of the human and communication capacities with each other that we are voluntarily

doing [...] is deeply harmful [...] because these people have no means of expressing themselves.” (P18; Creative Writing, Theatre) Sometimes the user does not want to interact with other people and the machine might be a way to avoid that – “I had a place where I could ask all the questions without holding back, without upsetting anyone. And I could be inside that question as long as I wanted and not as long as the other person wants.” (P21; Music, Teaching)

Personal Life Many participants refer that the best way software can help in their creative tasks is to help them have more time for the creative process, by taking over other necessary tasks inescapable to humans: “if it could do those things, to help me have more time, to optimise my time [...] We have time, right? But we have so many things to do, that if it could do those small things for us [such as groceries list], that would be great.” (P12; Music, Creative Writing) This includes deciding what to buy, where to buy it for the best price, how to get there, and what and how to cook with it afterwards. Other tasks can include helping users deal with their insecurities and negative feelings such as tediousness, frustration and anger, providing company while sharing their positive emotions, or motivating and encouraging them. In short, participants refer that software seems potentially useful in making the user feel well and comfortable in general, by recommending new habits or customised new experiences (such as a new haircut style or new music to hear) while also allowing the user to have the last call.

Other Aspects

Interaction When talking about the functional requirements with participants, aspects pertaining to how users would prefer to interact with creative software inevitably arose. Since there is much more available literature on this topic than regarding functional aspects and since this was not our main focus, we decided to keep the study of these aspects to the minimum necessary to explain the benefits of our methodology. However, we believe they deserve a longer and deeper analysis. Nonetheless, it is relevant to notice that despite the limited interaction model provided by WhatsApp that we instructed in the first interview, participants were still able to devise new and different modes of interaction such as real-time interfaces or even a VR partner.

There were several different aspects that were mentioned by the participants regarding non-functional requirements for their ideal creative tool : autonomy, intrusion, involvement, availability, adaptability, customisation, expertise, learnability, human likeliness, social and emotional skills, collaboration, cooperation... In short, participants agreed that an ideal POCA should be available, adaptable and easy to use, as human-like as possible, while also allowing users to overcome natural or communication barriers without ever subordinating human-to-human social interaction.

Non-Necessity It is important to consider in which situations and why some participants in the study did not feel the need to use POCA. This is a significant aspect of our research, as it contradicts the assumptions that machines should and will be used by artists and bodes well for Gason’s (2003) argument supporting human-centred design.

Our analysis revealed that some participants rejected the idea of human-like creative machines, especially when the machine is perceived as an alternative to human creativity, personal experiences, and feelings – “[...] computers are a human creation [...], but they should be at the service of the human, it should not be an alternative to the human.” (P18; Creative Writing, Theatre) Participants also did not want to substitute their own creative process with POCA: “[...] if I’m substituting myself for another mechanism, I’m taking away some of the pleasure that gives me that process, isn’t it?” (P21; Music, Teaching) Another aspect to highlight are the limitations the artists assumed the machine had: “I think I was left thinking a lot about what would be doable or not” (P2; Painting); “it is not possible to be bold because there is a technological limit to boldness.” (P21; Music, Teaching)

On the other hand, some participants viewed technology as an opportunity to adapt: “we have to move around, we have to be artists in other ways, just as many others have been, the contexts change” (P19; Painting, Design). Additionally, machines present an important aspect of democratisation, allowing the artist to overcome technical and accessibility barriers. While they prefer to not replace their own creative process with software, they do not like depending on others who might not want to outsource their creativity. For example: “[...] instead of having a person with a computer in hands and feeling that I was really being heavy, [...] there could be some system here that allowed me to walk by her side without carrying the weight [...]. Depending on others is an anguishing thing” (P18; Creative Writing, Theatre)

Methodology The single fact that we were able to gather evidence about when users prefer not to use software and where people detached the imposed interaction limitations, re-imagining other kinds of interaction, as explored in the last two subsections, is in itself already a sign of the benefits of this methodology. However other benefits and limitations were also explicitly mentioned.

Qualitative studies usually have a direct impact on how users perceive their tasks and methods. Our study was no different: artists felt the study itself had a beneficial impact on the perception of their creative process and the role of technology in it, often even motivating them to exercise more of their creativity. Having a familiar, available and accessible cultural probe which can manage several media was also explicitly pointed out as an advantage: “The idea of bringing this to WhatsApp, for example, is phenomenal. Basically, everyone that I know, artist or not, uses it.” (P15; Creative Writing) “My grandma with 80 plus years and being illiterate uses WhatsApp.” (P15; Creative Writing)

On the other hand, some still mentioned that WhatsApp is not the best tool to precisely and effectively discuss certain artefacts. Besides, and despite the alerts, people still felt underwhelmed when interacting with POCA, since it could not fulfil the provided demands, leading participants to forget about it throughout the week. Some solutions to this problem would be using a functional prototype, openly available software, or even a person. However, all these might either imply additional costs or confine the user to focus on the interaction instead of the potentially available functions.

Related to this point, some participants mentioned that they were not able to abstract from what they thought a machine could do: “POCA is so abstract that is not so easy to understand in a concrete form.” (P18; Creative Writing, Theatre) Besides forgetting about it, people also reported moments when they did not interact with POCA because they did not want to interrupt their creative immersion, felt embarrassed, or thought a machine was not capable enough. Yet, these moments of no interactions still allowed the user to ponder on those needs and allowed us to discuss those cases on the last interview. The last limitation of our approach was the duration of the collection: “one week [...] is too short.” (P18; Creative Writing, Theatre)

Conclusion

In this paper, we bring forward a methodology that we used to uncover a set of 12 general user needs and 8 contexts of use, which allowed us to better understand what artists want from their current and future creative tools. We consider both the proposed methodology and the user-informed findings to be a step forward in involving artists in the design of creative software and the field of CC.

This methodology can be adapted and applied with an existing specific system in mind or even in the early stage of development of a new (co-)creative system, by confining it to one creative field, for example. In this case, new and more specific needs or contexts might be uncovered that can be used to specify tailored and detailed domain-specific functional requirements. In any case, our own themes already provide an ample base to classify functional requirements. They can also be used as a system categorisation framework, assessing which needs and contexts are addressed by a system, in this way better highlighting its strengths and exposing its shortcomings. For example, ChatGPT (Ouyang et al. 2022) can generate new text fairly easily and reliably (Generator), but it cannot really gather resources or sources of information consistently or trustworthily (Gatherer). For systems that have yet to be built, our themes are also useful to serve as a starting point for design exploration.

Finally, further research includes the analysis of the remaining data that could bring forth new information, although we believe we achieved data saturation with 15 participants. Another direction can be the exploration of some of the limitations identified, for example, comparing our results with results using a responsive POCA, even if by means of a Wizard of Oz (WOZ) (Thelle and Fiebrink 2022). Another evident direction would be to extend the duration of the data collection. We also restricted this study to the topic of artists’ needs, but the data contained information on other aspects such as interaction features, or even artists’ emotions, perceptions, and fears, all of which are valid and pertinent directions to follow too. Ultimately, a more formal definition of our themes and framework implementation could be advantageous, as well as comparing our themes with current theoretical interaction frameworks for co-creativity (Kantosalo et al. 2020; Rezwana and Maher 2022a; Kantosalo and Jordanous 2021) and studying how they can be used jointly.

Author Contributions

All authors contributed to the concept and execution of the study, including contacting the participants, carrying out interviews, segmenting, and analysing the data. This paper was also written and revised by every author.

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