

# The Humble Creative Machine

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## Abstract

In this paper, we present a fresh perspective at co-creativity - using human development as a blueprint, we argue that fostering human creativity is a natural evolution of creative machines. We introduce the notion of a “humble” creative machine - one that is less concerned with demonstrating its own independence, and instead uses its (potentially advanced) creative abilities to cultivate human creativity. We present characteristics of Humble Creative Machines and offer examples of existing (almost) humble machines.

## Introduction

The Association of Computational Creativity website states:

“The goal of computational creativity is to model, simulate or replicate creativity using a computer, to achieve one of several ends:  
... to design programs that can enhance human creativity” [our emphasis added]<sup>1</sup>

In practice, however, the quoted aim appears to have been de-emphasized over the past decade or two. According to a 2017 review of the field (Loughran and O’Neill 2017), ICCC sessions relevant to this area have shifted away from ‘Creativity Support Tools’ (ICCC’2010) and ‘The Helpful’ (ICCC’2011) towards co-creativity research and research on making creative systems more autonomous. This is also marked by comments in the influential ECAI paper by Colton and Wiggins that redefines computational creativity, in part to emphasise “the difference between *the systems we build* and creativity support tools studied in the HCI community ... and embedded in tools such as Adobe’s Photoshop, to which most observers would probably not attribute creative intent or behaviour.” (Colton and Wiggins 2012, our emphasis added).

This stage in the development of Computational Creativity mirrors an analogous stage in human development, where a child begins to differentiate from their parents and form their own identity. Erikson’s stages of psychosocial development outline the development of healthy individuals from infancy to adulthood (G.A. O’Reinstein 2020). Often taking

<sup>1</sup><http://computationalcreativity.net/home/about/computational-creativity/>

place in adolescence, humans seek to form their own identity (Lewis 2020; Sutton 2021), which necessitates some form of separation from the parents.

Individuation is of course not the final stage of human development. When a person reaches individuation, they soon begin to move towards taking care of others - often in the form of parenting [(Lewis 2020), (Sutton 2021)]. Analogously, *we would like to propose that Autonomous Creativity is not the final aim of Computational Creativity.*

Another apt analogy comes from academia. A PhD student will often initiate her studies by learning from her advisor, relying on the supervisor’s vision and ideas. As the student progresses in her studies, she gradually develops more of her own ideas, and eventually becomes an independent researcher, often ending up with different views and research interests from their advisor.

If the student stays in academia, before long, she will take on students of her own, and generously share her own vision in order to help the development of her students. Confident in her own research abilities, she lets her students take the spotlight, and likely exhibits less concern when it comes to accurate credit sharing with those she mentors.

In this paper, we propose that Computational Creativity is now sufficiently advanced to take on the mentorship role. This does not mean that autonomous creativity has been fully actualized - much exciting research remains in expanding the autonomy of creative machines, such as elevating their evaluative capabilities. Analogously, Erickson’s stages are inherently fluid and overlapping. A person may encourage the growth of others without abandoning their own development.

The autonomous and mentorship roles need not be conflicting. We propose that the creative engine itself and how it is presented can be viewed as two separate components. The same creative engine can take on autonomous roles as well as supporting roles, perhaps even making the decision on which role it would prefer in different instances.

In this paper, we hope to offer a fresh perspective at co-creativity and encourage the Computational Creativity community to engage in the formation of Humble Creative Machines. We discuss connections to other CC frameworks, and share several systems that already captured some of the vision of Humble Creative Machines.

## Relation to Other CC-Models

There has been a great deal of work on interactive creative systems, however the focus is typically on autonomous behaviour within the interaction rather than supportive behaviour (D’Inverno and Luck 2012; Magill and Erden 2012, e.g.), or on the results of the whole collaboration as opposed to results of other individuals within the collaboration (Al-Rifaie, Bishop, and Caines 2012).

Attention has been paid to dialogues and communication between systems (Bown et al. 2020; Saunders et al. 2010) and some work has been done with peers communicating with each other to give feedback (Corneli et al. 2015; Jordanous, Allington, and Dueck 2015), though this paper’s thesis takes this considerably further forward, in terms of using that peer feedback to support the co-creative partner towards greater creativity.

Computational collaborators in human-machine co-creativity frameworks are rarely seen with comparable levels of agency to the human partners (Bown 2015; Jordanous 2017). Resulting limitations and restrictions are being placed on progress in human-machine co-creativity (Kantosallo and Jordanous 2021). However, other fields of creativity research have suggested roles for computational partners that are connected to our suggestions in this paper. For example, take Lubart’s role categorisations of a computational partner in a human-machine co-creativity scenario: the computer as “nanny”, “pen-pal”, “coach” or “colleague” (Lubart 2005). These closely resemble the generally enabling effect of the computational partner on the human collaborator; however Lubart’s roles give no recognition to the importance of the computational partner’s creativity in enabling the human collaborator (Jordanous 2017). The creativity of the computational partner is optional and de-emphasised, whereas in our proposals the creativity of the computational partner is essential; they are a peer that can support others in their creative area.

Casual creators aim to give the user an “intrinsically pleasurable activity, rather than as an extrinsically-motivated way to accomplish tasks.” (Compton and Mateas 2015). Examples of casual creators place most creative effort on the machines, while enabling an easy and enjoyable way for the user to explore the creative space. Consequently, the user gets to reap the joy, and perhaps even wellness benefits of engaging in a creative activity, but does not necessarily grow in their creative abilities. Furthermore, in an interaction where the machine carries most of the creative complexity, dependency on the machine is likely to arise - by contrast, humble machines aim to make the person creatively independent of the machine (see the following section for more details). The goals of casual creators and humble machines are in some sense opposites of each other - casual creators wish to keep the process easy for the user, letting the machines do most of the work, while humble machines help the user gain proficiency until the machine itself becomes unnecessary.

Perhaps the most closely related to our vision is work on Mixed Initiative Co-Creativity. Relying on research from human creativity, (Yannakakis, Liapis, and Alexopoulos 2014) delve in depth into how a creative machine can

assist humans in the creative process. In particular, they discuss how the classical iterative process in which the machine takes on a primarily generative role and the user engages in evaluation, is connected with human creative processes such as lateral thinking and creative emotive reasoning.<sup>2</sup> Our paper takes on a complementary approach - instead of demonstrating that machines are able to foster human creativity, which was effectively argued by (Yannakakis, Liapis, and Alexopoulos 2014), we focus on how to accomplish this task. In particular, we put forward specific characteristics that machines that aim to foster human creativity should aim for, and present a vision for how powerful creative machines can elevate human creativity.

## Humble Creative Machines

In this section, we introduce several criteria for humble creative machines. These criteria, at their core, allow the system and its interactions to focus on the user and the user’s capabilities rather than the machine and what it can independently.

### Flexibility

We propose that humble creative machines should be flexible in a couple of ways. The first is flexibility in its range of interaction. Ideally, the system should be able to either do all of the work (autonomous) or none of the work (support tool), and everything in between. The configuration applied in any specific interaction should depend on the user’s skill level or preference.

For the novice who requires a more guided approach, the system can offer heavy support (ex. only requiring the user to act and evaluate in various stages of the process). Meanwhile, for the expert who only needs occasional inspiration, the system may take a more passive role, and be available for the user as much and when needed.

The second type of flexibility is in the quality of the output. Being capable of sophisticated creative artefacts, the humble creative machine is able to consistently provide expert level engagement to a user. However, the machine should be able to reduce its own level of expertise to better meet the user at their current level of creative development. For instance, a co-creative poetry machine capable of elaborate metaphors may choose to use simpler language that would be a better fit for the users stylistic preference or significantly beyond their current abilities (effective learning takes place when done incrementally).

### Learning & Independence

The humble creative machine’s flexibility directly affects its ability to lead its users to learning and fostering independence from the system itself. With flexibility, the system is able to gradually adjust its level of interaction and quality of outputs to meet the user at their level of expertise. This offers a gradual learning apparatus tailored to the user. Similar

<sup>2</sup>We recommend the work of (Yannakakis, Liapis, and Alexopoulos 2014) as complementary reading to the current paper, particularly to those wishing to gain insight into how machines can meaningfully support the human creative process.

to teaching or coaching scenarios, the system can bridge the gap in knowledge and expertise. This can gradually change overtime as the user becomes more of an expert and needs the system less and less. As such, it is crucial that the system is able to step back and allow the user to engage more deeply in the creative process as they gain the ability to do so. This may be accomplished through either the system detecting growth in the user, or the user having sufficient control over their interaction with the humble creative machine as to reduce their reliance on it as desired.

## Creative

Being a creative system, a humble creative machine should be capable of making creative contributions in its co-creative interactions. At minimum, it should satisfy P-creativity, having the ability to come up with surprising, valuable ideas that are new to itself (Boden 2009). Building on the idea of P-creativity, we further suggest that a humble creative machine should be able to produce output that is surprising, valuable, and new to their human partner.

## User Friendly

A user friendly interface with a natural flow, which easily adapts to the user as they grow in their creative abilities, will form the foundation for communicating between the human and the humble machine, allowing for effective learning and growth to take place. At minimum, the co-creative process should not be undermined by unnecessarily complex interactions that would hinder learning and engagement.

## Examples of (Almost) Humble Creative Machines

While no previous systems have been created to accurately represent our vision for humble creative machines, some previous systems capture important aspects of this concept. We discuss two machines which approximate our vision.

### LyricStudio

LyricStudio<sup>3</sup> is a co-creative lyrics machine. Considering the properties outlined above, the system meets both flexibility criteria. It offers a flexible engagement process, whereby the user chooses how much of its suggestions to utilize, is free to alter any of the recommendations, and may write in their own ideas. LyricStudio also contains options that can make the lyric suggestions be simpler or more complex. The system automatically reflects the user's writing style, even as it develops over time.

The lyrical suggestions provided by LyricStudio are creative the sense they are novel and useful. In particular, LyricStudio's generation are novel every time, and useful in the sense that tens of thousands of users have utilized them in the development of their own lyrical material.

LyricStudio has been designed to be highly user friendly consisting of a single minimal page. All of LyricStudio's

<sup>3</sup>LyricStudio is a commercial Computational Creativity system that assists users in the creation of lyrics, developed by CC researchers: <https://lyricstudio.net/>

capabilities (rhyming, mirroring of language and style, etc) are applied by default, with several advanced features available through a setting panel. The primary interaction with the system is through the "New Suggestions" button, which the user activates as needed.

LyricStudio can be moved closer to the vision of a humble creative machine by increasing its own creative capabilities. Although one can imagine creating an autonomous variation of LyricStudio, this capability has not been developed. As such, the level of assistance that it can provide to novice is limited to providing a single line at a time. It is possible that some new users would benefit from more extensive assistance.

### Impro-Visor

Impro-Visor (Kondak et al. 2016; Goldstein et al. 2019) is a music notation tool for producing monophonic lead sheets, specifically intended to help the improviser. Improvisation advice is offered in the form of note coloration, database of licks, and, importantly, automatic lick generation from grammars. We find impro-visor to be a close candidate to being a humble creative machine.

Impro-Visor is an excellent fit for those with some musical expertise. By improvising along with the user, Impro-Visor can give those new to improvisational trading the confidence and experience to grow in their improvisational abilities. Designed for those with some musical experience, Impro-Visor does not currently offer functionality to support those new to music making.

Impro-Visor leads to learning and fosters independence. It offers the experience of learning by doing - users naturally improve through practice. Further, engaging with an creative computational agent eliminates fear of embarrassment, which can make it challenging to master improvisation by practicing with a fellow human musician.

The melody suggestions provided by Impro-Visor are creative artefacts. In trading mode, Impro-Visor offers original melodies that fit with the selected style and the musical session. Using music theory and other domain knowledge, the system is able to provide to the user useful options to finish a desired piece.

The utility of Impro-Visor for supporting human creativity can be greatly improved by making the system more user-friendly. Complex setup and a rich interface can make it challenging to get started and effectively utilize this powerful system. While perhaps less central to CC in general, in the context of enabling human creativity, offering the system through a user-friendly interface can be key for achieving the goals of humble creative machines. There is an opportunity to make Impro-Visor a highly applicable tool for developing musical creativity by improving its setup and simplifying its options, letting the user focus on developing their creative capabilities through a seamless process.

## Conclusions and Discussion

In this paper, we introduced a new perspective at co-creativity, as a mature role that can be taken on by creative machine agents. We propose the notion of a "humble" creative machine, which intentionally prioritizes the creative

development of its human partners over demonstrating its own creativity capabilities. Drawing on the works of Erickson's stages of psychosocial development, we propose that the focus on fostering human creativity through a creative machine marks an advanced stage of development in computational creativity.<sup>4</sup>

We propose several properties that humble machines should satisfy in their fostering of human creativity. The "humbeless" of the machine stems from its willingness to step aside and reduce their own creative contribution when this would better serve to cultivate the creative abilities of their human partner, and fostering independence, that is, helping the user to develop creative abilities to the point that the machines becomes unnecessary.

We presented a couple of examples of systems that capture some key elements of humble machines. However, the broad vision of a humble machines remains open - a machine capable of autonomous creativity that includes the ability, when it so chooses, to apply itself towards the creative development of its human partner, or perhaps even a fellow machine.

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<sup>4</sup>It is worth clarifying that co-creativity does not always signal an advanced stage. Human intervention can also utilize as a necessity to enable a machine to be creative. Using Erickson's model, we suggest that a return to co-creativity as machine creativity becomes more advanced can represent a meaningful form of progress.