

# Biometrics and Artificial Creativity

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**Abstract.** I argue that neither explicit user evaluation nor self-directed exploration of pre-determined spaces of possibilities are viable approaches for implementing artificial systems whose products are recognizable by humans as creative and valuable and, at the same time, as genuinely authored by the artificial system (rather than by the original designer or by the human users): indeed, self-directed creativity requires critical engagement with a creative community, and for now artificial systems are not capable of interacting with human creative communities as peers.

I suggest a possible alternative, which might hypothetically be used to grant some degree of authorship to artificial systems without having general artificial intelligence as a prerequisite: in brief, artificial systems could be trained, through the use of biometrics, to generate products that induce the same types of reactions in humans of recognized creative works.

As this would not draw conscious human decision-making into the production process, there would then be grounds to argue that the products of such a system would have indeed non-human authorship.

**Keywords:** computational creativity, authorship, biometrics

## -4. Painting for zots, or: on the benefits of alien probing

The time has come again for the Intra-Galactic Painting Competition, and excitement is high as humankind (having finally succeeded in contacting the rest of the Milky Way community) has been invited to participate for the very first time. The competition is held once every fifteen galactic years on a randomly selected planet; and, this time around, the honor of hosting and judging it has been assigned to the zot, a thoroughly non-anthropomorphic and very influential species. It is of paramount importance for the future of human civilization that human artists impress favorably the zot judges, as the zots have been known to offer highly favorable trade conditions to those species which they regard as artistically gifted.

But there is a difficulty: in accordance to ancient traditions, the participants are expressively forbidden from using translation devices to communicate with their guests until the end of the competition. Humans knows next to nothing about the zots, and what little they know suggests that their psychological makeup is profoundly different from that of humankind or any other terrestrial species. Thankfully, the Solar System Federation has obtained access to a collection of some of the most significant works of art of the zot civilization; but

the natures of their contents and the reasons *why* they are so well-regarded by the zots are truly anyone's guess.

The night before the start of the competition, Carol and Bob — two of the human participants — are discussing about their submissions over a glass of space ale:

**Carol:** “I thought a lot about this, and I'm pretty sure I made the right choice in picking bluethings as the main theme of my work.”

**Bob:** “Bluethings? What are they?”

**Carol:** “I'm not sure, to be honest, but they are blue. And spiky. Zots love them, that's for certain.”

**Bob:** “Uh. Seems difficult, painting something without knowing what it is or what significance it has...”

**Carol:** “Yes, but I studied their works, and many of their most greatest pieces are *all* about bluethings. Well, bluethings and shinythings.”

**Bob:** “And the shinythings are...”

**Carol:** “No idea, again, but they are shiny — shiny and round. The zots draw them a lot too, so they must be pretty important to them. Oh, and I noticed that whenever a composition contains bluethings, it never contains shinythings unless there is a jagged line separating them, so of course I did the same — it must be a cultural taboo of some sort, and it would not do to offend our guests. But enough about me, what is your piece about?”

**Bob:** “Well, it is just a group of children playing board games...”

**Carol:** “What? But we do not even know if the zots have any *notion* of childhood! And how are they supposed to recognize a board game? I really hope you won't lose us the competition...”

Mutatis mutandis, this would not be too out of place as a hypothetical dialogue between two computer programs for automatically generating creative works for human consumption. No artificial system has yet been built which contains an acceptable model of the overall themes and motivations which drive human creative production and the appreciation thereof, largely because we ourselves are not entirely clear on what these themes and motivations are; but a good number of systems have been built which, much like Carol, generate automatically works in accordance to the “rules” typical of certain categories of human creations. There also exist Bob-like systems, which eschew human imitation entirely and operate through the iterative application of rules which have very little to do with human stylistic conventions; but then, very careful tuning of their parameters and algorithms is necessary if their products are to be appreciable by most humans beyond their novelty value.

If it is not easy to find a common artistic ground between zots and humans, it cannot be much simpler to find one between humans and non-sapient, non-biological, artificial processes; and the fact that such processes are *human-made* does not by itself imply that they are *human-like* in any meaningful sense, no matter the superficial similarities (or lack thereof) between their results and other forms of human expression.

But there is one approach to the problem of painting for zots that the artists of our story failed to consider: they could have attempted to show a variety of works to zots, measured accurately their physiological reactions, and compared them to those observed when they are shown well-regarded works of zot origin. If the zots' reactions in the two cases were similar, then — regardless of the many ways in which their psychological makeup might differ from that of human beings — there would be reason to suspect that their psychological reactions would be also similar; and if instead they were different, it would not be unreasonable to conclude that their psychological reactions are also different.<sup>1</sup>

In what follows, I will argue that essentially the same process, with us taking the role of the zot subjects and our machines taking the role of the human examiners, provides us with a promising avenue for the exploration of creativity through artificial means.

### -3. Two approaches to artificial creativity

One of the main challenges faced in the study of creativity — and, at the same time, one of its most intriguing aspects — is the fact that recognizing the products of creative endeavors is a very context-dependent task. To mention a rather infamous example, a urinal may or may not be considered a creative work depending on whether it is placed in a museum or in its more typical habitat; and, in the former case, its possible recognition as such presupposes the appreciation of a complex set of cultural and historical circumstances. A hypothetical alien, bereft of any knowledge of the history of European artistic movements and of human biological functions, would presumably find the same object just as confusing in both circumstances; and, while they may notice that the placement of such an object in a museum is *less common* than its placement in a bathroom, they would have little way to infer the significance attributed to the urinal in the second case.

More prosaically, cross-cultural recognition and evaluation of creative works is a notoriously difficult enterprise; and it would not be unreasonable to expect this difficulty to only worsen in the case of works generated by nonhuman, artificial processes whose structures and behaviours are, after all, vastly dissimilar from the ones of human beings.

For many products of artificial processes, this is not at all the case. Instead, the processes they originate from are tailor-built to imitate known forms of human creative activity, be it musical composition (Loy, 1989), development of mathematical theories (Colton, 2002), or story creation (Meehan, 1977), and their performance is evaluated on the basis of the degree up to which their outputs can pass as genuine human creations. With some partial exceptions (in particular, Colton's *Painting Fool* (Colton, 2012)), these processes do not contain any attempt to represent the motivations and concerns of a hypothetical, even

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<sup>1</sup> It is also not entirely impossible that the Zot Empire might take umbrage at the kidnapping and probing of its citizens, but you cannot make an omelette without provoking an interstellar war.

vaguely human-like author, contenting themselves instead with exploring, more or less arbitrarily, a fixed and well-defined “conceptual space” (Boden, 2001) whose rules have been known to be compatible with the production of valuable human works.

It is worth emphasizing here that relaxing the constraints of such a system, for example by allowing it to arbitrarily break out from some of the boundaries of the target conceptual space, would not in itself make it more creative. For instance, the fact that the numbering of the sections of the present work starts from minus four rather than from one is a largely pointless deviation from the common conventions of writing which does not increase in any sense its quality. Further changes to this work along similar lines could only make the experience of reading it more and more frustrating: the subversion of expectations can at times be used to convey interesting effects, but breaking them at random is unlikely to improve the quality of the product.

On the other hand, there are also works of generative creativity that cannot be reasonably described as mere attempts to imitate the superficial features of human products. These works emerge from processes, often based on notions from artificial life, which develop and unfold freely and without any expectation of compliance with the conventions of human genres: as an example of this kind of approach, we can mention here Reas’ Process Compendium (Reas, 2010). This very quality, however, makes their evaluation quite problematic. In which sense can we claim such processes to be creative, when the processes producing other non-human but similarly aesthetically-appealing phenomena — for instance, the shapes taken by clouds, or the sound of the sea — are not commonly regarded as creative? Furthermore, when these artificial processes generate truly compelling works, it is generally the result of the careful exploration of their parameter space by part of a human experimenter. But then, could not one argue that this human experimenter, not the artificial process, is the true locus of creativity, and that therefore these artificial life-based approaches are simply another medium for the production of artistic works — an intriguing and largely unexplored one, certainly, but not one that succeeds in separating the phenomenon of creativity from the rest of the human experience?

## **-2. Two loops in human creativity**

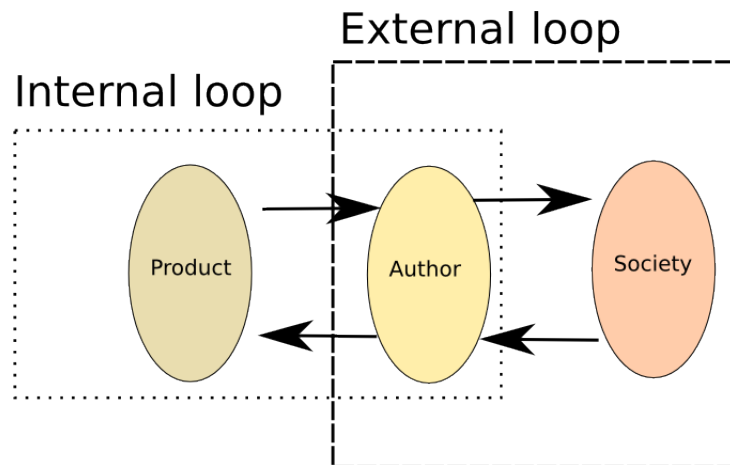
Many theoretical models of the human creative process have been produced (Runco and Albert, 1990; Kozbelt et al., 2010), and it is not within the scope of this work to discuss any of them in detail. One fairly non-controversial observation, however, is that creative activities involve on one hand the individual author as they incrementally build and evaluate their works, and on the other the society in which the author lives as it provides them with established techniques or conventions and influences their self-evaluation criteria.<sup>2</sup>

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<sup>2</sup> A topic which *is* somewhat controversial, instead, is the relative degrees of influence of the characteristics of individual author and of those on their their society on the results of the author’s activity.

Thus, without making any strong commitment to any theory of creativity, we can reasonably recognize at least two distinct feedback loops as having a role in the creative process:

1. The *internal loop*, through which the author evaluates the products of their own activity and uses the results of such evaluations to direct their future activity;
2. The *external loop*, through which the very criteria used by the author to evaluate their own work are updated by such means as the observation of other people's reactions to the author's works or the author's own evaluation of others' works.



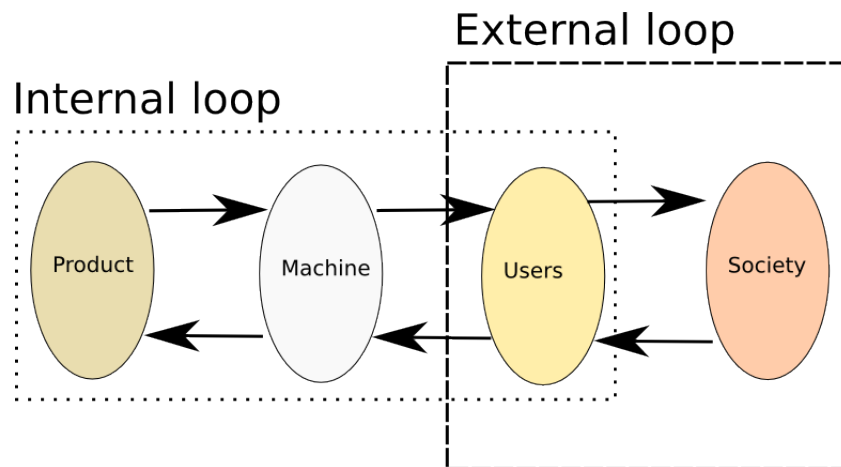
**Fig. 1.** Human creativity: internal and external loop.

These two loops are necessary components of any genuinely creative process: indeed, the activity of an author bereft of the internal loop would be nothing but mere automatic reaction to external stimuli, whereas an author bereft of the external loop would lack any means for updating their own evaluation criteria, and would thus have no way out of their solipsistic cycle of self-evaluation and optimization according to a pre-defined, static ideals.

But this poses a serious problem for artificial creativity. Building an artificial agent with an external loop towards a human creative community of richness comparable to that of the loops linking humans authors to it would appear to require endowing the artificial agent with human-comparable cognitive and linguistic abilities; and this, despite the advances of artificial intelligence, still remains an unsolved task. Do we have to give up, and accept that artificial creativity requires general-purpose artificial intelligence?

Maybe not. A potential alternative solution, perhaps, might be to piggyback on the evaluation functions of human users, for instance by having them rate the quality of the artificial agent's products and attempting to incrementally improve the average quality of its solutions. This is the approach exemplified by much interactive evolutionary art, from Dawkins' Biomorphs (Dawkins, 2003) to Draves' Electric Sheep (Draves, 2005). However, in this case, it is not at all clear that the artificial agents involved — as opposed to the systems composed by these agents and the human evaluators — may be considered in any sense creative.

Indeed, the locus of agency — and, therefore, of creativity — of such systems does not lie within the artificial process, but instead solidly within the human beings evaluating its products. If the human users wanted the process' results to become dull and uninteresting, they could easily succeed; and if they wanted them to improve, they could only succeed up to the degree to which *they* can correctly evaluate the quality of partial improvements on the current product. The machine takes part to the internal loop, but not to the external loop, whereas the human evaluators take part to the external *and* to the internal loop; thus, the artificial agent appears to be taking a role more akin to that of a tool (if a somewhat unpredictable one) than to that of a creator. Nevertheless, interactive evolutionary algorithms show much promise: by providing human authors with a vast repertoire of themes and possibilities that they might not necessarily have developed autonomously, these algorithms are very well-suited for performing the role of *creativity-enhancing tools*.



**Fig. 2.** Interactive evolutionary art. Note that the human users are part of both the internal and the external loops, whereas the machine is only part of the internal loop.

## -1. Artificial creativity through biometrics

In the previous section, I suggested that interactive evolutionary art is not usually quite an example of artificial creativity because the onus of evaluating the results of the algorithm lies entirely with the human user. But a natural question at this point would be: how does this differ anyway from the way in which the creations of a human author are evaluated by their community? The answer, in short, is that peer evaluations do not generally rob human authors of their autonomy, because human authors are not typically in thrall of their peers. They instead listen to their opinions and motivations, arguing — occasionally quite vociferously — about their validity or lack thereof, and more than occasionally rejecting them altogether. It might not be incorrect to claim that, nonetheless, this implies that authorship is in some sense *shared* between the direct creator and the community whose teachings and overall opinions affected their choices; but, in any case, it is clear that while human authors do generally seek the approval of their public, their activity is up to some not insignificant degree self-directed — they face their critics as peers, not as slaves. This is not the case for generative programs, whose activity is entirely determined by their users' evaluations, by random or pseudo-random events, and by the possibilities and preferences inherent to their programming. The first two kinds of influences mentioned cannot be reasonably compared to a human author's own autonomous decisions; and as for the third one, it constitutes a true case of artificial authorship only insofar as such possibilities and preference have not been designed by the programmer with the express purpose of causing the program's products to be of a certain specific quality.

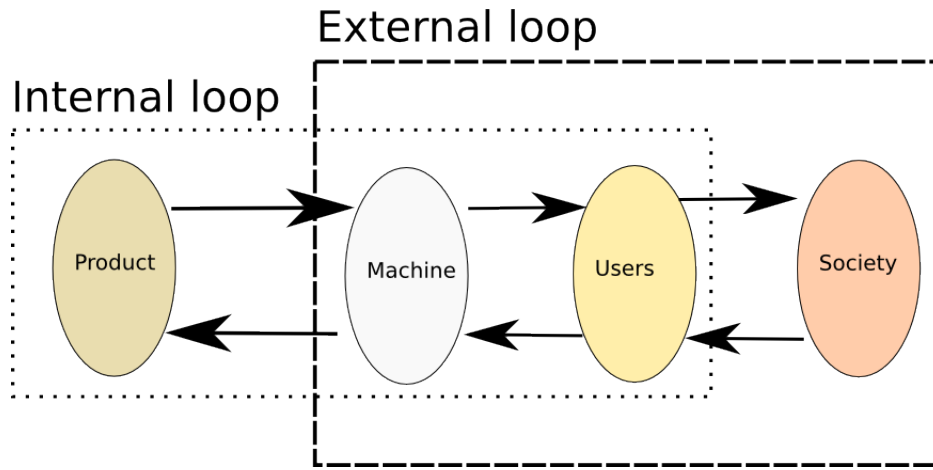
Our imaginary critic is, thus, not entirely wrong, and we have to retract to some degree the overly strong claim made in the previous section: an interactive evolutionary system *can* indeed be granted authorship, but only up to the measure in which its behaviour is not a function of the user's evaluations, of random events, or of the designs of its own author. This, however, does not resolve all our problems: indeed, what we would ideally want to have would be an artificial creative system whose products were “human-like” enough for us to evaluate and appreciate. This puts us in the same situation of the zots mentioned in **Section -4**: we want works of value to us, and we want them out of entities which are almost entirely unlike ourselves, whose choices we do not want to have to micro-manage, which lack any even vaguely accurate model of ourselves, and which are not capable of communicating with us as equals. How can they possibly succeed?

One possible answer, the one this work has been driving towards, is the following: if an artificial process could measure human involuntary reactions to high-quality works of human creativity, it could then — at least in principle — iteratively update its products<sup>3</sup> while attempting to increase the degree of simi-

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<sup>3</sup> Far more ambitiously, if we wished for the machine to eventually become capable of generating valuable works without constant biological feedback, we might attempt to make it optimize its production *algorithm* through some form of genetic programming, rather than its individual products. In essence, this would be equivalent to having the machine attempt to iteratively build a model of the features of humankind

larity between our responses to them and our responses to the above-mentioned human works.<sup>4</sup> This would put the agency in the creative process firmly out of the reach of human consciousness, thus leading to the situation depicted in Figure 3: the machine is now taking part in the internal loop of creation and self-evaluation, but also — through the monitoring of the involuntary reactions of its human users, which now are *not* making decisions in its place — in the external loop of interaction with the larger human community.



**Fig. 3.** Interactive evolutionary art through biometrics: now both the human and the machine are part of both loops.

## 0. Conclusion

In this work, I discussed some of the difficulties inherent to the problem of creating non-human agents which are capable of creating novel and valuable-to-humans works without relying exclusively on human decisions (made either at implementation time or at execution time); and I suggested a possible approach based on the use of biometrics. There already exist works of generative

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which are relevant to our appreciation, or lack thereof, of its products. Starting from the perspective of Figure 3, this would amount to pushing the human users entirely out of the internal loop of creation and self-evaluation.

<sup>4</sup> In order to prevent plagiarism, we might also want to add the additional requirement that the algorithm's products should be sufficiently different from all the human-made examples used to find the human physiological responses to high-quality work. This might or might not be necessary, depending on the specific characteristics of the algorithm; it could be also be the case that such a program would not be likely to produce any given example anyway.



art which rely on biometrics, such as for example (McGee et al., 2011; Fan and Weber, 2012; Hail, 2014) or — insofar as emotion detection goes — Colton’s Painting Fool (Colton, 2012). But to my knowledge, the reason for using biometrics in most such systems resides more in allowing users to visualize artistic representations of their internal states than in measuring the similarity between the users’ current internal states and the internal states of humans experiencing high-quality works as a metric for self-optimization. Colton’s Painting Fool is somewhat of an exception, as it can detect the mood of the scene and produce a work which reflects it (see (Colton et al., 2008) for details): this is much closer to the kind of approach described to this work, and a valuable starting point for further research along these lines.

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