Using grounded theory to suggest types of framing information for Computational Creativity

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Abstract. In most domains, artefacts and the creativity that went into their production is judged within a context; where a context may include background information on how the creator feels about their work, what they think it expresses, how it fits in with other work done within their community, and so on. In some cases, such framing information may involve obfuscation in order to add mystery to the work or its creator, which can add to our perception of creativity. We describe a novel method for the analysis of human creativity, using grounded theory. We demonstrate the importance of grounded theory via an ethnographic study of interviews by John Tusa with contemporary artists. By exploring the type of context and background that the artists share, we have developed theories which highlight the importance of areas of framing information, such as motivation, intention, or the processes involved in creating a work. We extend this to consider the role of mystery and obfuscation in framing, by considering what artists *do not say* versus what is explicitly revealed.

1 Introduction

Film, dance, sculpture, music, theatre, architecture, photographs, and visual art are not usually presented to viewers as isolated acts of creativity. Instead, they are accompanied by contextual information such as title, summary, pictures, reviews, resume of the artist, and so on. This context enhances viewers' understanding and appreciation of the work, and enables them to make more informed judgements about the creativity involved. Computational Creativity (CC) has traditionally focused on artefact generation, to the extent that the degree of creativity judged to be in the system is often considered to be entirely dependent on characteristics of the set of artefacts it produces (for instance, see [14]). Very few systems in CC currently generate their own narrative, or framing information. Artefacts are judged either in isolation or in conjunction with a human-produced narrative, such as the name of the system and any scientific papers which describe how it works. We believe that enabling creative software to produce its own framing information is an important direction in the development of autonomously creative systems.

In the following paper, we first describe a novel approach to analysing human creativity, grounded theory (§2). The importance of this methodology is that, we argue, it can be used to derive theories of human creativity which can then be interpreted in computational terms. We then present an ethnographic study of a collection of interviews with artists by arts administrator and journalist John Tusa [16], which is based on grounded theory (§3). Having considered what artists sometimes talk about and ways in which they talk

about it, we move on to consider what they *don't* talk about, in our discussion of the role of mystery and obfuscation in framing information (§4). We then discuss our findings and their implications for CC (§5), and describe related work, including proposals for a dually-creative approach to framing [2] – based upon a more informal manual analysis of human framing – and suggest where our ideas extend the literature on evaluating CC (§6). Finally, we make some proposals for future work (§7). Our key contribution is to demonstrate the value of the grounded theory (GT) methodology for CC, by performing an ethnographic analysis, based on GT, of a collection of interviews with artists. Other contributions include highlighting pertinent aspects of framing information, such as the idea that cognitive aspects play an important role, as well as an artist's desire, intention and processes, which is presented within the context of a chronological framework. Artists use metaphors and analogies to emphasise their answers, while leaving some element of mystery, such as avoiding giving too much detail and employing ambiguity productively.

2 Methodology and assumptions

Grounded theory (GT) is a research method within qualitative research which uses data to derive a theory [9]. It was developed in order to reverse the focus on verification of a theory, instead emphasising the prior stage of discovering which concepts and hypotheses are relevant to a particular area. The method consists in a set of heuristic guidelines which suggest a principled way of analysing data at increasing levels of abstraction. It is intended to be theory-neutral, with concepts and categories emerging during data-analysis. GT is a useful methodology for those CC researchers who aim to simulate aspects of human creativity, since it can be used to produce theories of creativity which are grounded in evidence which has been systematically gathered and analysed. GT has five stages:

1. Research problem: find a problem.
2. Data collection: gather a solid body of rich data.
3. Coding: label the data according to what they indicate - this can be done on a line-by-line level or by synthesizing larger amounts of data. Collect codes (annotations) of similar content, thus allowing the data to be grouped into concepts.
4. Categories: group the concepts into categories, and demonstrate relationships between concepts and categories.
5. Theory: Use the concepts and categories to formulate explanations of the subject of research.

Our starting point is that analysing examples of human creativity (using a standard methodology such as GT) and translating resulting ideas and theories into computational terms can suggest useful new directions for CC researchers. We do not make any claims regarding

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'true' (versus perceived) creativity or value, or the role of CC in educating the public on making judgements on creativity. Likewise, we omit discussion of ethical issues, such as whether it is ethical to build a system which 'embellishes' how it has generated its artefacts.

3 Using an approach based on grounded theory to discover types of framing information

We have performed an ethnographic study, based on GT, of artists talking about their work in interviews. Our research problem is to discover what types of framing information accompany a creative artefact. In particular, we are interested in what people say (§'s 3.2 - 3.4), how they say it (§3.5), and what they don't say (§4). We used a combined quantitative and qualitative approach to GT, based on individual words (GT is principally used to analyse qualitative data, however it can also be used for quantitative data, as discussed in [9, chap. XIII]). While in GT the resulting theory can be evaluated according to a set of criteria including fit to data, predictive and explanatory power, logical consistency, clarity and scope, due to the preliminary nature of our work, we do not carry out evaluation at this stage.

3.1 Data collection

Sir John Tusa is a British arts administrator, radio and television journalist, known for his BBC Radio 3 series *The John Tusa Interview*, in which he interviews contemporary artists. These interviews have been reproduced as two books in which he explores the processes of creativity [15, 16]. We have analysed all thirteen interviews in his most recent collection, in order to provide the starting point for a taxonomy of framing information. The interviews feature two filmmakers (Bertolucci, Egoyan), two choreographers (Cunningham, Forsythe), two sculptors (Kapoor, Whiteread), one composer (Goebbels), one theatre director (McBurney), one architect (Piano), one photographer (Rovner) and four artists (Craig-Martin, Gilbert and George, Viola), comprising twelve men and two women (Gilbert and George are interviewed together). The interviews have been transcribed and are in *The John Tusa Interview Archive* on the radio 3 webpages.[2] We used this text as our data. It contains 90,860 words: this breaks down into 20,451 words as questions from Tusa and 70,409 words as responses from the artists. In the following discussion, unless otherwise specified, all page numbers refer to this collection of interviews [16].[3]

3.2 Coding

In order to identify anchors which highlight key points of the data, we used automatic methods to identify words commonly used during both questions and answers in the interviews. We did this via the WORDLE tool,[4] written by Jonathan Feinberg, which found 193 different words which occurred frequently enough to pass its threshold.[5] We then formed concepts to describe these 193 words: *Abstract*, *Artists*, *Cognitive*, *Desire*, *Domain*, *Emotion*, *Intention*, *Life*, *Movement*, *Novelty*, *Number*, *Perception*, *Physical*, *Process*, *Qualifiers*, *Size*, *Social*, *Space*, *Time*, *Value*, *Work*, and a catch-all *Other* concept.

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[2] http://www.bbc.co.uk/radio3/johntusainterview/

[3] Although data in GT are typically generated by the researcher with a specific research problem in mind, in our case, since our research problem is to discover what types of framing information accompany a creative artefact, it is appropriate to use data which already exists.

[4] http://www.wordle.net/

[5] Admittedly, this is a very crude method and is not ideal but we see it as a useful starting point. The WORDLE tool omits stop words (words which are frequently used but unimportant, such as "and", or "the"), does not perform stemming and marks capitals as separate occurrences.

Each word was classified as one of these concepts: for example, we classified the words "important", "good", "extraordinary", "interesting", "interested", "great" and "difficult" under *Value* and "new" and "different" under *Novelty*.

3.3 Categories

We used the concepts discovered during coding to suggest categories and then grouped the concepts appropriately and began to consider the relationships between them. We formed the categories CREATIVITY, PEOPLE, ART and PHYSICS. The concepts *Abstract*, *Qualifiers* and *Other* did not fit into any obvious category, so we omit these in the following discussion. We present our concepts and categories in the table below (represented by italics and small capitals, respectively). Each word is followed by a pair of numbers in brackets; this denotes the number of occurrences of the words in the questions and responses, respectively. For example, in the table below, the word "interesting" occurred 25 times in the questions throughout Tusa's interviews, and 60 times in the responses; hence we write "interesting (25;60)". We write the total number of occurrences across both the questions and the responses at the end of each concept. The combined total of all of the occurrences of the 193 words is 15,409.

CREATIVITY.
Value: important (27; 56), good (-; 75), extraordinary (-; 34), interesting (25; 60), interested (10; 34), great (-; 59), difficult (-; 34). TOTAL: 414.
*Novelty:* new (21; 75), different (25; 98). TOTAL: 219.

PEOPLE.
Emotion: feel (23; 61), felt (-; 51). TOTAL: 135.
Cognitive: think (104; 442), mind (16; -), believe (-; 34), thought (19; 67), understand (-; 42), knew (-; 36), know (49; 545), memory (12; -), remember (-; 41). TOTAL: 1,407.
Intention: mean (77; 161), try (11; 63), trying (-; 57), point (16; 73). TOTAL: 458.
Perception: see (30; 135), sense (23; 57), looking (14; 37), sound (19; 34), look (13; 84), view (14; -), experience (20; 58). TOTAL: 538.
Desire: want (38; 83), wanted (19; 70), like (54; 347), love (-; 51). TOTAL: 662.
Physical: body (12; -), physical (13; -). TOTAL: 25.
Life: living (-; 34), life (21; 86). TOTAL: 141.
Social: people (67; 250), person (16; 42), human (10; -), relationship (11; -), company (13; -), everybody (-; 41), together (12; 63), culture (10; -), audience (14; -). TOTAL: 549.

ART.
Process: order (-; 39), used (-; 47), use (-; 52), made (18; 105), making (21; 90), make (23; 159), way (52; 266), building (19; 42), process (15; -), done (17; 62), change (-; 50), become (-; 38). TOTAL: 1,105.
Domain: ballet (12; 41), film (25; 59), films (12; -), art (36; 137), music (28; 70), dance (21; 38), theatre (14; 57), show (20; 46), image (11; 44), images (19; -), word (15; -), stage (20; 39), video (16; -) classical (12; -). TOTAL: 683.
Work: pictures (-; 36), pieces (18; -), piece (25; 80), studio (-; 40), working (87; 68), work (87; -), works (15; -). TOTAL: 545.
Artists: artists (-; 39), artist (28; 53), dancers (11; -), director (10; -), dancer (12; -). TOTAL: 153.

PHYSICS.
Space: space (10; 46), room (15; 51), place (-; 43), inside (11; -), world (13; 96). TOTAL: 285.
Time: time (48; 187), long (-; 45), years (19; 92), moment (15; 62), end (13; 35), sometimes (13; 43), day (-; 64), back (42; 74), now (95; 135), never (22; 109), start (15; 38), started (12; -), early (12; -), ever (28; -), always (12; -), still (19; -). TOTAL: 1,344.
Number: one (61; 306), two (15; 59), three (11; -), many (-; 89), first (25; 91). TOTAL: 657.
Size: little (-; 88), huge (13; -). TOTAL: 101.
Movement: go (25; 115), come (27; 69), comes (13; -), still (-; 44), went (-; 50), going (54; 119), came (15; 58). TOTAL: 589.
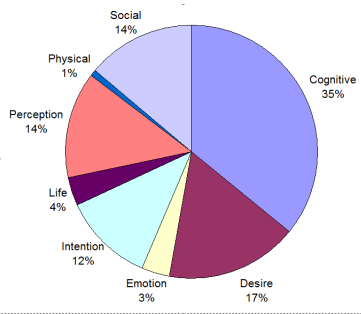
Figure 1. The breakdown of our PEOPLE category, showing concepts *Emotion*, *Cognitive*, *Intention*, *Perception*, *Desire*, *Physical* and *Life*.
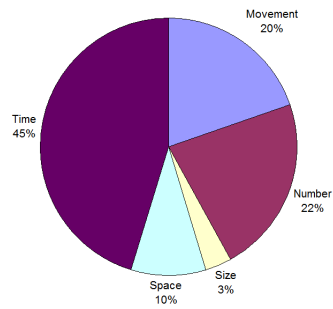
Figure 2. The breakdown of our PHYSICS category, showing concepts *Space*, *Size*, *Time*, *Number* and *Movement*.
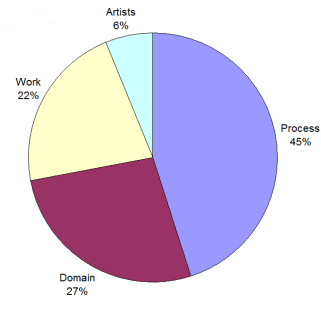
Figure 3. The breakdown of our ART category, showing concepts *Process*, *Domain*, *Work* and *Artists*.

3.4 Theory

In order to determine the relative importance of each category, we use the totals shown at the end of each category. Curiously, words associated most with creativity (which we categorised in the traditional way as the twin goals of value and novelty, [1]) only occurred 6% of the time. This is similar to the number when seen in proportion to the total (633/15,409). Within CREATIVITY, the concept *Value* accounts for 65% and *Novelty* for 35%. Overall, CREATIVITY accounts for 6% of the categories, ART for 25%, PHYSICS for 30% and PEOPLE for 39%. Figures 1 - 3 contain pie charts which display the relative importance of each concept within the latter three categories.

In figure 1, concerning the breakdown of the category PEOPLE, we see that *Cognition* is hugely important. This suggests that thinking plays a significant role in digesting an artwork; thus lending weight to our argument that framing information, rather than simple perception, is an essential component of creativity. *Desire* also accounts for a large proportion of this category. The philosopher Hobbes very strongly associated desire with motivation, which suggests that artists talk about *why* they work. *Intention*, that is, what an artist means by a specific work, forms the next largest category. *Perception* is perhaps discussed less than one would expect, forming merely 3.5% of the discussion (538/15,409). Of these, 29% concerned *Perception* in general (the words "sense" and "experience") (158/538). Of the remaining 380 words, 86% (327/380) concerned sight, and just 14% (53/380) concerned sound. This is, perhaps, a little surprising, in that the artists speaking included one composer, two filmmakers and two choreographers, to whom sound must be a fundamental part of their creations (although, of course, "seeing" can be used to convey understanding as well as referring to vision). No other sense was discussed.

Our PHYSICS category, shown in figure 2, is interesting in that nearly half of the words concern time (1344/2976): this suggests the importance of chronology in framing information. Also of interest in this category are words concerning *Size*: only two were found – "huge", which appeared exclusively in the questions and "little", which appeared exclusively in the responses.

In figure 3, concerning the breakdown of ART into the concepts *Process*, *Domain*, *Work* and *Artists*, we see that almost half of the discussion concerned processes. This indicates that artists talk about *how* they create their work, which may be in contrast to the romantic notion sometimes held of creativity as being inexplicable (this notion may derive back to ancient Greek ideas, in which a creator was seen merely as a messenger from the Muses).

3.5 Style of answers: metaphors and analogies

GT also suggests that we pay attention to styles of language employed. We found that metaphors and analogies were frequently used to convey an answer. Examples include: "The *Singing Sculpture* was like a waterfall that you watched and watched and watched!" (George, of Gilbert and George, p. 115); "... you just see these rooms full of young people completely eating the pictures off the wall" (George, p. 116); "If you learn a language, for example, if you've learned English as your mother tongue, it's very difficult to erase something like that. And ballet was my mother tongue in dance, so you can't erase it from your consciousness." (Forsythe, pp. 93-4); "I'm sort of like a cat, you know. You ever see a cat sit around and stare at things? In that sense I sit around and stare at things ...." (Forsythe, p. 103). Fully fleshed out analogies are also used, for instance, in *The Conformist*, Bernardo Bertolucci draws an analogy between film and Plato's Allegory of the Cave:

> .... Plato says, here you have a cave, you have a group of prisoners in chains sitting at the entrance of the cave, turned towards the bottom of the cave, the interior of the cave. Behind them, there is a fire. People pass with the statues, between the fire and prisoners sitting down and the cave. The fire projects the shadows of the statues on the bottom of the cave. So, I was thinking this is exactly – after all, Plato is about 500 BC! – this is cinema! The fire is the projector with the lamp and the sculpture are like the film passing and the prisoners sitting is the audience and the bottom of the cave is the screen.' (pp. 31-2)

4 The role of mystery in framing information

GT has provided methodological guidance for a theory about what artists say about their work. We should also consider what they *don't* say. An audience may not want to know the full details surrounding a creative act, and in some circumstances might prefer instead that a created artefact and the processes which went into its production are shrouded in some level of mystery. This could be for a number of reasons, including:

- When we look at a created artefact, and learn something about the creative act leading to it, if we cannot imagine how we would have come up with such an innovative idea/process, then we assign more creativity to the producer of the artefact. As a society, we value creative individuals, and hence an audience might want to be given an opportunity to bestow such status onto someone, and this opportunity could be lost if no level of mystique is maintained.
- Certain created artefacts such as paintings and musical compositions are important and interesting to audience members because

they can be interpreted in different ways by different people. Audience members might therefore prefer to be told less about an artefact and its production, so that they can exercise their imagination and incorporate the creative act into their own personal experience.

- Other created artefacts, such as proofs to theorems and many linguistic generations are intended to explicitly communicate some idea, and – especially if the idea is complex or possibly designed for humour – it might be worthwhile for the consumer to work out certain details for themselves. Hence, audiences of such artefacts might prefer to have to work to understand the results of a creative act, because they know they will learn more in this fashion.

We therefore see that it might pay dividends if artists, writers, musicians, and even scientists do not give away full details of their creative processes, leaving instead some room for conjectures about how they might have innovated in such novel ways, which encourages audience members to see the producer as more creative; fill in the gaps and make the dialogue more personal; and exercise their minds in order to fully understand and appreciate the results of a creative act.

Moreover, artists, writers, musicians and scientists know the dividends to be gained by maintaining mystery about their creativity, hence they might go to further lengths to add mystery via obfuscation, providing difficult cultural references, or by giving misleading information. In this sense, a creative act can be seen as the production of a mini-drama, with the production of an element of mystery alongside the creative act being very much an important aspect. Rather than being an irrelevant aside which gets in the way of the study of true creativity, the addition of drama can be seen as an integral part of creativity which could be simulated in software. Audiences want drama, whether within the artefact, or surrounding the creative act producing it. Hence, software developed in CC projects could aim to deliver such drama, and this might go some way towards the acceptance of the idea of software being independently creative in society. Such information could be fictional. For instance, Gilbert and George maintain the illusion of being an inseparable duo of living sculptures:

> *JT:* Will the art of Gilbert and George die when the first one of you dies?
>
> *George:* No I think if we fell under a bus today the pictures will live on, I'm sure of that.
>
> *JT:* But will the artist Gilbert and George die when the first one of you dies?
>
> *George:* We always cross the road together. So maybe we have to be careful! (p. 131)

We consider two further areas of obfuscation below.

4.1 Omitting details

It would be impossible for framing information to include all details concerning the creation of a work, or an artists' personal life (nor would it be desirable: it is possible to both over and under-explain). In [16], Rovner alludes to the notion of an appropriate amount of detail when giving framing information:

> *MR:* There was a name to the kind of water I was drinking. I was wearing very specific clothes, because I'm a very specific ... person ...... You know, I did want not to have any eggs in my sandwich at the day, like always I would never eat eggs! And I wanted the bread to be dark and not white, and many many details going on. (p. 216)

Details will always be omitted:

> *JT:* Now you're not a photographer by training, you began life as a dancer.
>
> *MR:* I began life as a baby, actually. At some point yes I was a dancer, for a few years. (p. 202)

Some details may be omitted because they may lead to an image which the artist wants to avoid. John Tusa discusses this with Kapoor:

> *JT:* ...quite a lot of the time... you wanted to avoid the Indian tag. I was rather shocked when I came across an article from 1998... which said that you're the most successful Indian artist living in the West! Nobody would say that now, so is that why in a way you can talk about the Indian influences much more openly, because you're not pigeonholed?" (p. 159).

Omitting details about technique increases the mystery and can add to the perceived creativity of an act. Consider, for instance, Cunningham's description of his technique of developing dance and music independently:

> *JT:* Why didn't this come out as a mess? That's still a question?
>
> *MC:* No. Because Cage, regardless of what anybody thinks about what he did, was very clear about structures. And these were structures in time. As he said when asked this question, 'Why do you separate the music and the dance?' once Cage replied, 'Well, you see, Merce does his thing and I do mine, and for your convenience we put it together'.
>
> *JT:* Extremely clever elliptical answer.
>
> *MC:* Yes. (p58)

An extreme example of omitting details is artists who keep their identity secret, such as the graffiti artist Banksy.

4.2 Ambiguous terms

The use of multiple meaning is inherent in artefacts in many art forms, such as poetry and visual art. This also applies to framing information. For instance, consider the title of Tracey Emin's 1995 work *Everyone I Have Ever Slept With 1963-1995*. The most obvious interpretation would be to suppose it is about sexual partners, whereas Emin took a more literal interpretation and included various family members, friends and two unborn foetuses. Michael Craig-Martin talks about deliberately misleading people:

> *JT:* Do you mind when people invest them with the symbolic overtones and read non-realistic things into them?
>
> *M C-M:* No, I love it, and I try to add as many false trails of that kind as I possibly can myself. (p. 47)

He goes on to discuss the ambiguity of a filing cabinet in one of his works, which is perceived in multiple ways, depending on the viewer. When displayed in Moscow, the viewers associated the filing cabinet with the KGB: "it's not just because a filing cabinet has a meaning, its meaning is changed by the context of what I've done and where it is." (Craig-Martin, pp. 47-8).

5 Discussion

We have used GT to suggest theories about ways in which artists talk about their work. Analysis of data such as the set of interviews we use suggests a new direction for CC: enabling creative software to generate some of its own framing information. As with human artworks, the appeal of computer creativity will be enhanced by the presence of framing of a similar nature. Few creative systems currently do this, one being an automated poetry generator currently being developed [3]. In addition to creating a poem, this system produces text which describes particular aspects of its poetry that it found appealing.

We found that cognitive aspects such as thinking and knowing play an important role in framing information, and people are interested in an artist's desire or motivation (why did she do X), intention (what did she mean by X?) and processes (how did she do X?). This is all given within a chronological framework (when was a piece started, how long did it take, and so on). Answers are brought to life via metaphors and analogies, while some element of mystery is left, for example by giving an appropriate level of detail and employing ambiguity in a productive way.

Human framing information has previously been analysed by hand, using a more informal approach [2]. Notably, the more systematic approach taken by GT, which we have outlined here, emphasized several of the concepts that were also highlighted as important by that study, such as *Intent* and *Process*.

Intent has been investigated in collage-generation systems [12]. Here, the software based its collage upon events from the news of that day with the aim of inviting the audience to consider the artwork in the context of the wider world around them. This method was later generalised to consider wider combinations of creative systems and more-closely analyse the point in the creative process at which intentionality arose [5].

Details of the creative process are valid aspects of framing information, which are relevant to both computational and human creative contexts. As discussed above (§4.1), there is a notion of an appropriate level of detail: extensive detail may be dull and the appreciation of artefacts is sometimes enhanced by the absence of information about the generative process. Furthermore, as noted in [2], the extent to which information about the process can be perfectly recalled varies between these two contexts. Human fallibility, often means that not all information can be recounted. Similarly, creative software that appeals to transient or dynamic sources, perhaps on the internet, may not be able to retrospectively recover its sources in full.

Not all aspects of framing that we have identified in the ethnographic study in §3 have a clear analogy in CC. For example, concepts within the PEOPLE analysis, such as *Emotion*, *Desire* and *Life* currently have limited meaning in the computational context. This was also noted in [2], although the authors commented how it does make sense to talk of the *career* of a software artist, namely its corpus of work and aspects such as the audience's response, to which it might refer. These difficult-to-capture aspects of the artist's background further support the proposals in [2] of a dually-creative approach to framing in the CC context. This method describes how creative software might be enhanced by the introduction of an automated story-generation system, with the responsibility of producing appropriate framing information. It was further imagined how this might be extended to allow an interactive dialogue, akin to an interview, between a computer artist and its audience. Aspects of the generated story might also feed back into the process of development of the artefact itself, in a cyclic manner. Given the artists' use of metaphor and analogy in the Tusa interviews (§3.5), tools which were able to perform these tasks (see [7, 8]) might be integrated into the storytelling aspect. Our discussions on mystery in §4 suggest that there is a valid place for both fiction and omission within framing information. Additionally, our ethnographical study demonstrated the vast variety of framing information. These both represent significant challenges for contemporary automated story-generation systems.

6 Related work

6.1 Computational accounts of types of framing information

In [2] we presented an informal approach to framing information for CC. In particular, we suggested ways in which motivation, intention and processes could be interpreted in computational terms. In this paper we have given these terms a firmer grounding in data on ways in which humans talk about their creative acts.

6.1.1 Motivation

Many creative systems currently rely upon human intervention to begin, or guide, a creative session and the extent to which the systems themselves act autonomously varies widely. In some sense, the level to which these systems could be considered self-motivating is inversely proportional to the amount of guidance they receive. However, it is possible to foresee situations where this reliance has been removed to such an extent – and the human input rendered so remote – that it is considered inconsequential to the creative process. For instance, the field of Genetic Programming [11] has resulted in software which can, itself, develop software. In the CC domain, software may eventually produce its own creative software which, in turn, produces further creative software, and so forth. In such a scenario, there could be several generations in an overall geneology of creative software. As the distance between the original human creator and the software that directly creates the artefact increases, the notion of self-motivation becomes blurred.

Beyond this, the scope for a system's motivation towards a particular generative act is broad. For example, a suitably configured system may be able to perform creative acts in numerous fields and be able to muster its effort in directions of its own choosing. With this in mind, we can make a distinction between *motivation to perform creative acts in general*, *motivation to create in a particular field* and *motivation to create specific instances*.

Our analysis suggests that, in the human context, the motivation towards a specific field is variously influenced by the life of the artist, their career and their attitudes, in particular towards their field and audience. Several of these are distinctly human in nature and it currently makes limited sense to speak of the *life* or *attitudes* of software in any real sense. By contrast, we *can* speak of the *career* of a software artist, as in the corpus of its previous output. This may be used as part of a process by which a computer system decides which area to operate within. For example, we can imagine software that chooses its field of operation based upon how successful it has previously been in that area. For instance, it could refer to external assessments of its historic output to rate how well-received it has been, focusing its future effort accordingly.

The fact that a computer has no *life* from which to draw motivation does not preclude its use as part of framing information. All those aspects missing from a computer could, alternatively, be simulated. For example, we have seen music software that aims to exhibit characteristics of well-known composers in attempts to capture their compositional style [6]. The extent to which the simulation of human motivation enhances the appeal of computer generated artefacts is, however, still unquantified. The motivation of a software creator may come from a bespoke process which has no basis in how humans are motivated. The details of such a process, and how it is executed for a given instance, would form valid framing information, specific to that software approach.

6.1.2 Intention

The aims for a particular piece are closely related to motivation, described above. A human creator will often undertake an endeavour because of a desire to achieve a particular outcome. Our ethnographic analysis suggests factors, such as attitudes to the field, which contribute to this desire. Certainly, by the fact that some output is produced, every computer generative act displays intent. The aims of the process exist and they can, therefore, be described as part of the framing. In the context of a computer generative act, we might distinguish between *a priori* intent and intentions that arise as part of the generative process. That is, the software may be pre-configured to achieve a particular goal although with some discretion regarding details of the final outcome, which will be decided during the gener-

ative process. The details of the underlying intent will depend upon the creative process applied. For example, as above, software creators might simulate aspects of human intent.

Intent has been investigated in collage-generation systems [12]. Here, the software based its collage upon events from the news of that day with the aim of inviting the audience to consider the artwork in the context of the wider world around them. This method was later generalised to consider wider combinations of creative systems and more-closely analyse the point in the creative process at which intentionality arose [5].

6.1.3 Processes

In an act of human creativity, information about the creative process may be lost due to human fallibility, memory, awareness, and so on. However, in a computational context there is an inherent ability to perfectly store and retrieve information. The majority of creative systems would have the ability to produce an audit trail, indicating the results of key decisions in the generative process. For example, an evolutionary art system might be able to provide details of the ancestry of a finished piece, showing each of the generations in between. The extent to which the generative process can be fully recounted in CC is, nevertheless, limited by the ability to fully recreate the sources of information that played into the generative process. Software may, for instance, use information from a dynamic data source in producing an artefact, and it may not be possible to recreate the whole of this source in retrospect.

One system that produces its own framing is an automated poetry generator currently being developed [3]. In addition to creating a poem, this system produces text which describes particular aspects of its poetry that it found appealing. In order to fully engage with a human audience, creative systems will need to adopt some or all of the creative responsibility in generating framing information.

Details of the creative process are valid aspects of framing information, which are relevant to both computational and human creative contexts. As discussed above, there is a notion of an appropriate level of detail: extensive detail may be dull and the appreciation of artefacts is sometimes enhanced by the absence of information about the generative process.

6.2 Computational Creativity Theory

In [4, 13], two generalisations were introduced with the aim of enabling more precise discussion of the kinds of behaviour exhibited by creative software. The first generalisation places the notion of a generative act, wherein an artefact such as a theorem, melody, artwork or poem is produced, into the broader notion of a *creative act*. During a creative act, multiple types of generative acts are undertaken which might produce framing information, F, aesthetic considerations, A, concepts, C, and exemplars, E; in addition to generative acts which lead to the invention of novel generative processes for the invention of information of types F, A, C and/or E.

The second generalisation places the notion of assessment of the aesthetic and/or utilitarian value of a generated artefact into the broader notion of the impact of a creative act, X. In particular, an assumption was introduced that in assessing the artefacts resulting from a creative act, we actually celebrate the entire creative act, which naturally includes information about the underlying methods, and the framing information, which may put X into various contexts or explain motivations, etc., generally adding value to the generated artefacts over and above their intrinsic value.

The introduction of these two generalisations enabled the FACE and IDEA descriptive models to be introduced as the first in the fledgling formalisation known as *Computational Creativity Theory*. In this paper we have extended this model by further exploring the notion of *framing*.

6.3 Methodology

Although the explicit use of grounded theory as a methodology to derive a theory from data is new to CC, Jordanous [10] uses a corpus linguistic approach on text in academic papers, in order to generate a component-based definition of creativity.

7 Future work and conclusions

Creativity is not performed in a vacuum and the human context gives an artefact meaning and value. This study highlights the value of GT in analysing human creativity and how this motivates and underpins the development of more sensible approaches to the automated generation of framing information, such as complementary story-generation. We intend to continue to develop a theory of framing information and to consider computational interpretations of our theory. We will then formalise these interpretations and develop ways of evaluating them, so that they translate into falsifiable claims that people can make about their creative systems. We expect that these will used to both guide and evaluate progress in this direction. In this way, we envisage that systems which produce artefacts such as choreography, music or visual art will also produce contextual information, which will enhance our understanding and appreciation of the work, and enable us to make more informed judgements about the creativity involved.

We intend to apply GT to other aspects of CC, such as investigating viewers' perceptions and responses to creative work. As with framing, we expect that using GT to inform our analysis will enable us to develop theories that highlight important aspects of different areas of human creativity. This data will be extremely valuable as we seek to further formalise different aspects of CC theory.

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