The Story Molecule: Narrative as Information

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Abstract

Although there are many theories about how creativity might contribute to a knowledge-based system, none has yet been built that can transform its own logic in a way that will further generate emergent logic, or even produce an artwork independent of human prescription. Perhaps this is because current formalizations of creativity do not take in account an insider's view of how it operates. This paper outlines a model of my fiction-writing process, and assumes that story-making is a key means of organic information organization. Four principles of this assembly process are identified: roles, relations, causality and dissymmetry. These principles offer a new perspective on how conceptual spaces are able to transform, in both artistic and scientific domains, and complements existing ideas about how to leverage the full potential of knowledge systems.

Introduction

In the context of knowledge systems, the term 'narrative' often refers to an interface that enables a human to interact with a machine. The field of narrative intelligence presently encompasses storytelling systems, story support services, even agents that use narrative structures to make their behavior more comprehensible to users (Mateas and Sengers, 1999). But computers still can't generate stories that are meaningful in a human sense. And in the broader scope of knowledge systems, computers still don't learn with anything like human aptitude. Fundamental aspects of information assembly must still be missing from theories of artificial intelligence, and I suggest that one of these is an understanding of the role narrative plays in human information management.

When people organize information, their process is adaptive. As the information changes, or the person's needs adjust, not only do their stories alter but the story-making tools also shift. The current limited attempts to design a system that can mirror this adaptability might be resolved with a deeper understanding of how humans structure narrative. This paper suggests that a particular view of information can enable the transformation of conceptual spaces in both artistic and scientific fields. I will explain what the basic units of narrative are, how that structure improves on current models of creativity, and what this clarity might offer future agent systems.

Demystifying Creativity

It is a perennial debate, born in the romantic era, between the belief that all creative acts are born of (a) some transcendent, inexplicable Dionysian act of inspiration…or (b) hard work. If it isn't obvious already, I come down on the side of hard work. (Twyla Tharp, 2003)

There are mystical aspects involved in the creative process but not as many as outsiders think. I believe there are three main reasons why the muse myths persist. The first is that an art-maker might be articulate, but not understand their creative processes well enough to explain it. The second is that practitioners can be superstitious about formalizing their methods – perhaps they understand that definition resolves ambiguity, and they are reluctant or unable to exorcise the vacillations that fuel their craft.

But the most significant reason is probably that, in order to export a concept from a creative system to a computer-orientated one, an act of translation is needed. A translator needs to speak both languages fluently, and just as problematic is that many concepts do not transfer. The mind of a competent artist is likely to be geared towards ambiguities, discord, tricks involving multiple contexts. This mindset often resists computable models, in which non-conflicting rules are built upon each other like bricks (Worth, 2004).

I was forced to examine my own story-making processes whilst constructing a narrative that referred to numerous scientific concepts. After two years of working with scientist H.T. Goranson, I began to learn how to express those understandings in terms that the sciences could understand. Here, I use my own model of narrative as a lens through which to re-evaluate how systems with self-organizing agency might function. It is an inside view, and as a result, offers elements of structure that are invisible to outside observation.

The Information Molecule

How do humans structure mental input? Every discipline has a different way of considering mental or emotional processes, so their definitions of *information* also vary. To make matters worse, artistic and scientific logics have contrary structures, so it is difficult to express an answer in a way that satisfies both. To find a transferable definition, I began to examine the basic units of those processes.

In *Logic and Information,* Keith Devlin proposes that information could be the basis of a new science, one that would capture aspects of the world that current tools of mathematics and computers can't touch (Devlin, 1995, pp 2). This agenda is also forwarded by the Foundations of Information Science (FIS) group, which is managed by a research center at the University of Salzburg (http://fis.icts.sbg.ac.at/mailings/).

But in order for information to contribute to models of intelligence, much more must be known about its structure. Devlin begins with the definition that information is gained when we learn whether "objects $a_1...a_n$ do/do not stand in the relation *P*" (Devlin, 1995, pp 38). In other words, information is established when we determine: do the given elements have a relationship (or not), and what is that relationship (or absent relationship)?

The narrative equivalent of a fundamental unit is harder to unearth. Theories of narratology identify some prominent features of story - such as Vladimir Propp's helper, hero, or prisoner – but these are not core dynamics. Computers have been programmed to arrange information according to these structures but still do not produce artifacts with the qualities that humans expect of story (Peinado and Gervás, 2006). The problem might be precisely that Propp prescribes roles for his story elements. As I will demonstrate, a story emerges as its elements discover which of their relations are significant. If the central factors have been decided beforehand, the meaning will reflect that prescription, not the imagery itself.

Roland Barthes and Lionel Duisit get closer to the core, by drilling into the structure of meaning-making (Barthes and Duisit, 1975). They describe the basic unit of narrative as a 'function', which is commonly understood to be a 'metaphor' (Bache, 1980). Unfortunately when Barthes and Duisit try to describe this basic unit in detail, their model becomes complicated and vague. I eventually turned to another artistic field for further clues.

Actors cannot hide in a tangled argument. Their theories are regularly tested in the public arena, with face-to-face feedback. But perhaps the best reason to turn to acting for a definition is that it is simultaneously a model of human interaction as well as performed narrative. If we want to know how the action of the world translates into a net of meaning in our minds, this is a discipline with one foot in the flow of reality and another in story-making mechanics.

Constantin Stanislavsky's theories continue to be the most influential in theatre and film for the way they facilitate realistic interactions between actors. Part of this influence is due to the humanness his method represented, the break away from the non-realistic acting traditions that preceded it (Strasberg, 1965, pp 41). Stanislavsky created a more believable model of relations between people by highlighting the way that inner (emotional) and outer (situational) contexts participated in their interactions. Instead of reproducing pre-determined physical positions to represent each emotion, the actor's body became both a vehicle and an engine for emotional intent. Stanislavsky identified this embodiment as a psycho-physical verb and declared it to be the basic unit of acting, now known as a 'beat.' Paul Kassel succinctly explains the concept:

> All performed actions can be viewed as transitive verbs invoking something done toward a direct object. (Kassel, 1994, pp 181-182).

The actor's basic unit is an entity forming a (motivated) relationship with another entity. This is strikingly similar to Devlin's mathematical model of information, but there is an important difference between them.

A theatrical world is comprised of roles. Unlike the mathematicians' object, which is closer to the linguistical *noun*, a role player's identity is conditional on the situation they occupy. If placed in a different context, aspects of their behavior, and therefore identity, will shift. Indeed, a quality valued in actors is their ability to transform during a scene, or from one role to the next. So the first structural difference the arts would lend to computable models is conditionality. Instead of the discrete *object-relation*, my information molecule is a conditional *role-relation*.

Before describing the architectures made possible by this shift, I need to introduce another concept: causality.

Causality

Narrative establishes itself as a causal network. Stories model what has emerged, and what it will become. Traditional tales employ causal determinism, a sense of events unfolding in time, whilst post-structural stories deliberately loosen that grip and create maps of associative logic. In both cases, a form of causal reasoning helps determine how these informational units fit together.

Fortunately, there is wide agreement on the importance of causality in narrative. Jack Bickham, the author of *The 38 Most Common Fiction Writing Mistakes,* puts it bluntly:

> For every cause, an effect. For every effect, a cause. A domino does not just fall for no immediate reason; it has to be nudged by the domino next to it (Bickham, 1997, pp 31).

Imagery without causal order is simply a list. (Note: *list* is not a neutral term. A writer's *list* is a collection grouped into a common category; a programmer's *list* is nearer to the writer's idea of *sequence*). While a writer's list does contain information, it is based on only one associative link, such as "Houses for Rent." Stories, by contrast, use causality to create a web of connections. This difference was noted in E. M. Forster's definition of story:

> *The queen died and then the king died* is a chronicle, but not a narrative. *The queen died and then the king died of grief* is a narrative (Worth, 2004).

Just as the king's death could be significant for many reasons, causal narrative links are multiple and can create far-reaching networks. This multidimensionality drives the pull of organic information assembly. A list is only able to carry the reader in one direction: what belongs in this category? After that criteria is spent, the reader isn't urged to climb further because no other rungs are available.

Causality is just as important to science. Schools of discussion are devoted to definitions of causality, striving to span the many domains to which it can be applied. Philosopher Daniel Hausman bases his definition on symmetry in an attempt to unify this diversity. Symmetry governs notions of form, which is central to story.

Hausman's definition of causality depends on *causal priority* and *nomic connection* (Hausman, 1998, pp 274). Causal priority stems from asymmetry – causes are independent from one another, whilst effects are dependent on causes (Hausman, 1998, pp 63). He then establishes those dependent links as *nomic*, an association that is "necessary or lawful" (Hausman, 1988, pp 253). While one event may cause another, events are so multifaceted that only some parts of a cause relate to some parts of an effect. I adopt these parameters for narrative information, particularly because they avoid the problematic premise of intervention (Hausman, 1998, pp 86). Narrative causality is not a chain of force, but a domain of shapes that fit.

Shape is the engine of story. A narrative emerges from a relational system of images, which operate as metaphor does. Metaphor creates meaning by matching one constellation of elements with another and drawing equivalences between them (Bache, 1980). But no two metaphors are exactly the same, and so non-symmetrical factors encourage new equivalences to be drawn. The roles and relations of one image extend those of another when indirect connections are found. And as every geometer knows, when a relationship is formed, a space is defined.

Defining a Conceptual Space

The problem of how to transform a conceptual space has become central to computer-related creativity. It was initiated by Margaret Boden's observation that "creativity occurs within a conceptual space, where much of what passes for creativity emerges from an exploration of this space, but where most dramatic forms of creativity necessitate a transformation of this space" (Veale, Gervás and Pease, 2006, pp 206). Unfortunately, Boden did not define that space, and while many have tried, artists are beginning to argue that most of these formulations assess creativity through an artist's external behaviors or products, instead of their internal processes (Tijus, 1988).

My own process depends on the following model. A conceptual space is formed by the informational structures that are fed into it. These roles and relations suggest rhythms of causality, which are abstracted until they become the 'logic' and also the space. I then manipulate this field in a way that is understood as a story.

Further details about the structure of conceptual spaces can be gained from the scientific notion of a *causal field*. A causal field represents the sum of all previous phenomena in a domain. It is the context that makes an event possible (the way gravity makes a plane crash possible) as opposed to the direct cause of an event (the way complete engine failure makes a plane crash certain).

A direct cause stands out when the existing field cannot account for an event. Proving probable cause in a law court depends on the same distinction. However, a legal proceeding acknowledges that events are multifaceted, and that only some parts of a causal situation will be relevant to an effect. A lawyer's aim is to establish which elements comprise the usual domain and which are rogue, so that the direct cause – and therefore accountability – can be determined (Einhorn and Hogarth, 1986).

In the arts, a context is not separate from the elements that comprise it. But the legal notion of probable cause suggests that causal fields and direct causes might not be distinct either. Scientist Isao Murayama observes that science re-orders its model of causality whenever an element appears that cannot be explained (Murayama, 1994, pp 201). These examples suggest that the triggers that cause a conceptual space to transform exist within the space itself. The trick is knowing how to activate them.

Dissymmetry and Self-Assembly

The universe is dissymmetrical and I am persuaded that life, as it is known to us, is a direct result of the dissymmetry of the universe or of its indirect consequences. (Louis Pasteur, 1874)

Symmetry is understood to be equivalence, proportion and order (Collins Concise Dictionary and Thesaurus, 1991, pp 737) but definitions of its related terms – asymmetry, dissymmetry, antisymmetry – tend to vary. When I use the term *dissymmetry*, I am referring to an entity in which some parts form equivalences and others do not. In the same way that a metaphor can extend the dimensions of two related images, dissymmetry contains the ingredients needed for creative growth: like and unlike fragments.

Dissymmetry provides an answer to Boden's question about how a conceptual space can reach beyond itself in order to transform. Any molecule of information that has been modeled on life will be angular. Few real things are smooth, exhibiting perfect symmetry. The design challenge for a computerized creative system is to work out how it can assemble information so that qualitative equivalences are found and dissymmetrical elements exploited.

In a synthetic narrative mind, the contradictions discovered in a pool of information would propel a surge of self-assembly (Goranson and Cardier 2007). Links to associated data would provide the means to resolve the

incongruities, but the incorporation of these new elements would in turn create different dissymmetries, generating further surges of retrieval. As *Figure 1* shows, a story builds towards symmetry, a process that is complicated by its use of dissymmetrical bricks:

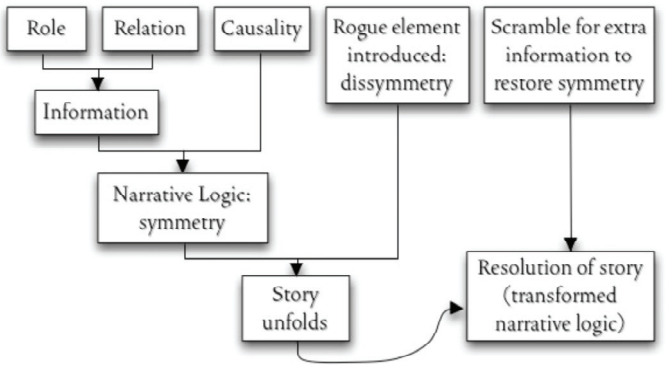

Figure 1. The Narrative System

Writerly problems can be solved using these principles. Most tales begin when a rogue element appears, and a reader follows the unfolding story in order to see how the existing system can evolve to accommodate it. If I want a reader to keep turning the pages of my novel, I depend heavily on the information I leave *out*. A seductive writer scatters a trail of information molecules that do not fit, but almost might, if just a few elements would change...

Conclusion

It makes sense to construct a narrative-based knowledge system as a writer would imagine it, instead of how a theorist would write about it. In essence, a system based on narrative principles would be driven by notions of dissymmetry resolution and causal reasoning. This 'story molecule' creates the possibility of networks that are a web of conditional relations instead of swinging signposts. It would be a step towards narrative as humans experience it, a glimmer of true intelligence.

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