Strange Patterns: Structure and Post-Structure in Interactive Digital Narratives

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Abstract Structure is key to interactive narrative authoring. It can be perceived at the micro, meso, and macro levels of navigation, and when presented as common patterns creates a toolbox from which authors can build their stories. This structuralist approach to authoring appeals to the engineer's mindset, but post-structuralists would argue that no patterns are fundamental or universal. As Interactive Digital Narratives become more gamelike they turn into Strange Hypertexts, with playful mechanics deeply aligned with their narrative goals. This ludonarrative aspect of IDNs is exactly the sort of shift in perspective that post-structuralism warned us about and suggests that patterns might limit authors rather than empowering them. This chapter reviews the reported patterns in hypertext and interactive narrative, and explores how patterns could continue to be important for authoring in a strange and post-structural world.

1 Introduction

Agency is the defining feature of Interactive Digital Narrative (IDN) and is typically conveyed through player choices that have been arranged into some kind of navigational structure. This structure can be very complex. Patterns are a way of dealing with this complexity by identifying common reoccurring structures or sub-structures. They are therefore a tool for exploring the poetics of IDN.

Although patterns are a part of IDN theory, they are also of direct use in addressing the authoring problem [1]. First, they can be used as a way of informing authors of typical solutions to common problems. Second, they can provide a way for authors to create complex structure quickly within an authoring tool. Third, they can provide a lens by which an author might reflect on an existing structure (this could be directly supported within a tool, but is also possible without software support). In this sense

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they are therefore a type of Design Pattern and provide a toolbox for IDN authors to create structurally sophisticated interactive experiences.

Over the last few decades a number of people have attempted to identify common patterns, but they are seldom presented in context with one another. The philosophy behind patterns is also rarely interrogated. Patterns are a result of a structuralist analysis of IDN, which inherits its approach directly from the structuralist movement of the twentieth century, but that movement has come under serious criticism, and for decades has been unfashionable in narratology and literary criticism.

In this chapter we will review the different patterns that have been proposed for IDN, by looking at the micro level (the key building blocks of IDN that define its different forms), the meso level (sub-structures that solve certain problems, or create particular effects within an IDN), and the macro level (high level structures that define the whole shape of a story, indicate the number of potential paths and alternative outcomes, and therefore capture a key part of the overall reader experience).

We will also explore the structuralist context of the work on patterns, seeing how IDN patterns fit in to the wider structuralist movement. At the end of the chapter we will consider the post-structuralist criticisms of structuralism, and apply them to IDN, shedding light on the shortcomings of patterns and suggesting alternative approaches that might allow patterns to be used in a post-structural way.

The goal is to create both an index of key patterns discussed in the literature, and a theoretical foundation for the use of patterns in the future, which incorporates both their strengths and limitations. We begin with an overview of structuralism, and in particular its manifestation in narratology and IDN.

2 Structuralism, Narratology, and Design Patterns

Structuralism has its foundations in the work of Ferdinand de Saussure who advocated a structural linguistics that focused not on superficial *parole* - actual utterances - but on *langue*, the hidden structures that lie beneath them [2]. Saussure called his approach Semiology, but it was later adopted by the Prague School of linguists who used the term Structuralism, and went on to became a popular approach across a range of disciplines. Broadly speaking, structuralist approaches are more interested in relationships or properties rather than objects or values, where "objects are defined by the set of relationships of which they are part and not by the qualities possessed by them taken in isolation" [3]. Structuralism is thus concerned with the underlying rules and patterns of a given phenomena, rather than its actual elements[1].

The development of Structuralism was heavily influenced by earlier work in literary criticism known as Russian formalism. For example, in *Morphology of the Folktale* Vladimir Propp deconstructed Russian fairy tales into 31 functions which he observed (occurring in order but not exhaustively) throughout all of the 100 stories that he analysed [4]. Later structuralist scholars, like Levi-Strauss, went beyond this

[1] As an example, a structuralist doesn't care that Obi-Wan Kenobi is a Jedi, and Gandalf is a wizard, but does care that they take the same role of a 'supernatural mentor' within their respective stories.

syntagmatic analysis of cultural texts, in his case by recognising common components of myths, *mythemes*, which appear consistently across multiple cultures [5]. This sort of paradigmatic analysis is key to the structuralist approach. Paradigmatic from the root word Paradigm, itself derived from the Greek word for Pattern.

The structuralist approach to narratology has classical roots in Aristotle's Poetics and observations on the typically elements of Greek Tragedy. These persist to modern dramas, where the three act structure (setup, confrontation, and resolution) have become keystones of script writing technique [6].

Freytag's Pyramid, originally published in 1863 [7], also pre-dates the structuralist movement but nevertheless provides a structuralist analysis of drama: an *introduction* leads to *rising movement* and a *climax* (where the protagonist acts, and the story reaches a reflection point) followed by *falling action* and ultimately *catastrophe* (altered in more recent tellings to *denouement* to reflect the possibility of a happy ending). Later structuralists such as Tzvetan Todorov would undertake an analysis similar to Freytag, describing the shape of a story in five slightly more general parts [8]: an *equilibrium*, a *disruption* to that equilibrium, the *recognition* that all is not well, a struggle to *repair* the disruption, and a *restoration* of a (new) equilibrium.

The Russian formalists noted the distinction between *fabula* (the events of the story in the chronological order they occurred) and *syuzhet* (the order in which they are presented within the story) [9]. Todorov and Freytag's structural analyses of stories can thus be said to be concerned with the events of a narrative, as arranged in the syuzhet, and the way that they convey drama and engage the emotions of the audience over time.

Narratology applies just as much to IDN as it does to traditional storytelling forms, for example Wood uses the fabula/syuzhet distinction [10] to talk about different types of interactive narrative games and experiences; however in IDN the focus is often on the interactive element, so Wood uses her analysis to distinguish between those where players have agency over the fabula (so can dictate the outcome of the narratives) and those where they have agency over the syuzhet (the outcome is fixed, but they have control over how it is revealed). In both cases the player agency is managed by an interactive structure, which can be thought of as a kind of state machine managed by a story engine [11]. A simple example would be a hypertext structure, where the state machine is defined through a set of nodes and links.

Structure in IDN research typically refers to this interactive structure rather than the structures that are embedded in the text (or other media content) itself (as concerned Propp, Freytag, or Todorov). A structuralist approach to IDN thus elevates these structures as the subject of study, and looks for common patterns that exist across multiple IDN artefacts.

These common patterns matter when it comes to the IDN authoring process. Using common patterns in design can be traced to the idea of *Design Patterns* first put forward by Christopher Alexander as a way of capturing architectural design ideas [12]. It has become especially popular in software engineering, specifically within Object Oriented Languages like C++ [13] where particular patterns of interacting objects that solve certain common problems can be identified and shared (examples include

abstracting object creation to a Factory, restricting object instances via a Singleton, or separating data and behaviour through a Model/View/Controller architecture).

Software patterns have been adapted to games. Björk and Holopaine identify a number of areas where patterns can be applied, including player progression, player rewards, game space (virtual worlds), and social patterns [14]. Specific examples include Lewis et al's work on motivational patterns in social games [15], and Carstensdottir et al's research on Narrative Progression Mechanics (which are effectively Björk and Holopain's player progression patterns) – for example distinguishing between choosing options in an explicit narrative interface, or performing a choice using the game mechanics within the game world [16].

In this chapter we are also concerned with interactions, but in our case it is the patterns within the interactive structure itself (the state machine created by authors that determines how readers can progress). These structures effectively manage both how the fabula expands and how the syuzhet unfolds. Understanding useful patterns is thus critical for informing both IDN authoring education and the design of authoring tools (which may want to explicitly support common patterns).

The next section explores these structural patterns in depth, and then the following section addresses the criticisms of *post-structuralism*, and looks at what shape a post-structuralist approach to IDN patterns might take.

3 Structural Patterns

In the IDN, Hypertext, and Interactive Fiction literature patterns tend to be expressed at three different levels. *Micro patterns* are the building blocks from which stories are constructed, they tend to have low level function, combine easily with each other, and form a kind of grammar, meaning they are often the defining feature of a particular IDN form. Links are micro patterns, and navigational hypertext is the associated form. *Meso patterns* are medium level structures (built from micro patterns) that create particular effects within a portion of a narrative or solve particular problems. A Cycle in a navigational hypertext is a meso pattern. *Macro patterns* are large scale patterns constructed from micro patterns, and which may contain many meso patterns, they describe an entire IDN, and imply a certain interactive experience. The Broomstick is a macro pattern, it is a linear story with a final choice leading to several alternative endings (and thus looks like a witch's besom broom when drawn).

In the following sections we will explore some of the patterns that exist at these different levels.

3.1 Micro Patterns

Micro Patterns are the invisible building blocks of IDN; they are so ubiquitous within certain types of IDN that we do not usually perceive them as patterns at all.

Links may be the **Foundational** structures of navigational hypertext [17] but they are not the only structure. Hypertext often traces its roots back to Vannevar Bush and his future gazing paper 'As We May Think', which describes a near instant access knowledge machine (The Memex) based on micro-fiche and *Trails*, sequences of documents that are laid down by readers, and which can be reused by others [18]. In his conceptual Xanadu design, Ted Nelson also describes *Transclusions*, an alternative to navigation between documents where a chunk of text or media is dynamically drawn into a document and presented in-line [19]. This mechanism allowed Nelson to propose a Permascroll, where all writing is stored once, and transcluded when needed rather than copied many times. In the early hypertext systems of the 80s and 90s this idea was adapted to create *Virtual Documents*, structures that transcluded many different sources of information into a single page, and this approach lives on today through content management systems, and data-driven documents [20].

Nevertheless links became the dominant micro-structure in hypertext (leading Frank Halaz to decry the 'Tyranny of the Link' [21]), and were the subject of endless reinvention and deconstruction. One approach is to create **High Level Generalisations**, where the link structures become more complex and expressive. These patterns reached their most sophisticated incarnation within Open Hypertext Systems as these hold links as first class objects. Figure 3.1a shows an example Open Hypertext Protocol (OHP) Link. The Link itself has a type, describing why the link exists (for example, 'defines')), and contains a set of Endpoints that hold the direction for each end of the link (typically a source or destination). Endpoints have a DataRef that specifies a particular location within a Node, which in turn references a given document or piece of media. With OHP it is thus possible to have semantic links with multiple sources and destinations within arbitrary documents. For example, in Figure 3.1a we see an explanatory link with one source on a word in a document, and two destinations, a specific area within an image, and a scene within a video.

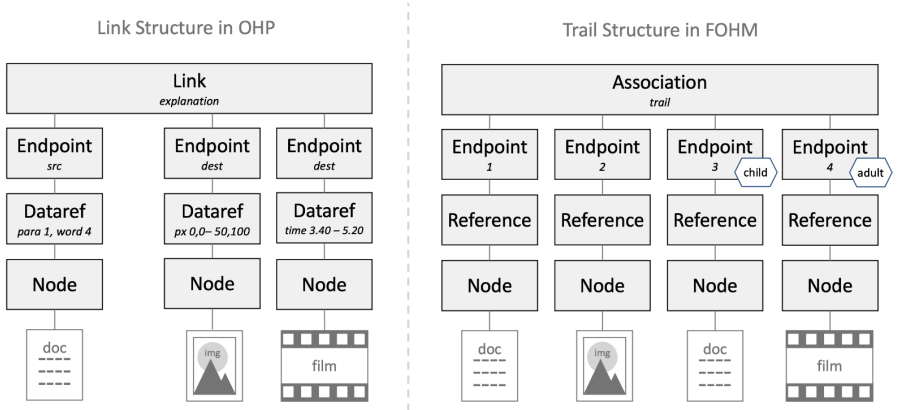

Fig. 1 (a) Left: A Link represented in OHP. (b) Right: A Trail represented in FOHM

My own work on the *Fundamental Open Hypertext Model (FOHM)* is a further generalisation of the OHP Data Model that attempts to break the tyranny. FOHM extends endpoints so that they can have any semantics, meaning that as well as links other structures can be specified [22]. So for example, in FOHM a trail is simply a type of Association (FOHM's general term for link) with enumeration (position in a list) rather than direction specified within its endpoints. FOHM also adds context specifiers to every element that determine in what context those elements are visible, and behaviour specifiers that can modify context. This enables hypertext systems that use FOHM, such as Auld Linky, to drive adaptive hypertext experiences [23]. For example, in Figure 3.1b the structure is a trail (of whole documents, images, and videos), where the last item depends on whether the viewer is an adult or a child.

An alternative to this approach is to create **Low Level Generalisations**, where the links are deconstructed into structural atoms that can be combined like Lego blocks to create more complex structure. In the Semantic Web links are re-imagined as RDF triples [24][25], made up of a subject, object, and predicate, that create a web of knowledge using URIs as symbols in knowledge domains defined by schemas. For example, we might declare that a given 'Document ID' (the subject) was 'Created' (the predicate) by 'Person ID' (the object). Further triples might then add additional metadata, such as the document's version number, by using the same Document ID as the subject; or create relationships to other entities, such as a conference, by using the Document ID as the object.

One issue with RDF is that it is difficult to make statements about statements (as RDF triples do not themselves have an identifier to which you can refer), for example perhaps I want to say that the triple above was created on a particular date. RDF's somewhat clumsy solution to this problem is called Reification (meaning to make the abstract concrete), and involves replacing the original triple with three new triples of the form 'Triple ID' (the subject) has 'Subject' (the predicate) 'Document ID' (the object); this is clumsy as it breaks many of the systems that reason using RDF, although I can now make statements about it by adding new Triples with the Triple ID as subject.

Reification in RDF highlights a core problem with all structural approaches to data, which is that it is always possible that you need to reify relationships in order to make statements about them, and then you might want to reify those relationships, creating a possible infinite recursion[2]. The low level generalisation of links reached its peak in the Elucidate-Analogize-Delete (EAD) model, part of the structural computing movement [26], which has reification built in. In EAD structure is reduced into its simplest form, a structural atom, representing a relationship between two things. The power of EAD is in defining reification as a live recursive operation, called 'elucidate', so that a structure can be modified at run-time to be as granular as required.

The context element of FOHM is a hint that there is a third approach to micro patterns, **Constraint-based** structures, where the structure is not static, but emerges

[2] For example, a Dataref in OHP is the reification of the relationship between the Node and Link so that there is somewhere to store the anchor information, and the Endpoint is the reification between the Link and the Dataref so there is somewhere to store the semantics of the relationship.

through applying rules and behaviours. *Adaptive links* are the most common, these have conditions that must be met before those links can be seen or followed. Adaptive Links are a key micro structure in IDN (in tools such as Twine, and can be traced back to early systems such as StorySpace where they were called Guard Fields [27]), but in the last twenty years an alternative structure has emerged: the *Storylet*, which is the basis of sculptural hypertexts [11]. At their most basic storylets are a piece of media with a set of constraints that must be met before that media can be viewed, and a set of behaviours that can set variables to meet those constraints [28]. For example, a paragraph of text that describes a car accident and which sets a variable to remember this fact, coupled with a second paragraph that describes the aftermath but which requires that variable to be set before it can be read. A set of storylets creates a sculptural hypertext [11]. This contrasts with Calligraphic hypertexts built with links. In Sculptural hypertexts everything is initially connected and connections are sculpted away by applying constraints, in Calligraphic hypertext nothing is connected until links are explicitly drawn between them [29].

Despite this distinction storylets are similar to adaptive links (and can be modelled consistently alongside them in a model like FOHM, the difference is simply that adaptive links have a source endpoint in a specific node, whereas storylets have an open source endpoint that can be read from anywhere [30][3]). This consistency means that storylets and links can be combined into hybrid structures. For example, StoryNexus uses *higher level storylets* that combine a storylet with a number of adaptive links: a root event (which has constraints) is thus combined with a set of choices (the alternative links), each of which applies a different behaviour [31].

In this way all manner of micro patterns are possible, Table 1 shows an overview of those discussed here. Any authoring tool needs to choose which of them it will support and how flexibly it might allow them to be combined into hybrid structures. The effect on the authoring experience is significant. For example, combining storylets and links allows StoryNexus authors to create sculptural hypertexts with many choices [11], whereas StorySpace 3 supports both networks of links and storylets, but separates them into different spaces [34]. Storylet support has also recently been added to Twine (which is otherwise based on adaptive links) showing that new micro patterns can also be added to tools over time, expanding their expressive power.

3.2 Meso Patterns

Meso patterns are particular combinations of micro-patterns that can be used to achieve specific but local effects within an IDN. The literature on meso patterns is sporadic, there are a few noted academic papers that perform systemic analyses to identify them, but much is held as craft knowledge and is recorded more informally in the documentation of systems or the blogs of writers and developers. The non-exhaustive list of meso patterns presented here is drawn from five different sources:

[3] [30] is a paper that pre-dates the term Storylet, and actually describes them as 'context-source links' containing story fragments, but they are functionally identical to storylets

Type	Micro Pattern	Source	Description
Foundational	Links	[17]	A simple binary navigational connection between two lexia
	Trails	[18]	A sequence of linked lexia
	Virtual Documents	[20]	A set of lexia with rules on how they should be aggregated
	Transclusions	[19]	A connection between two lexia that causes the second to be automatically inserted into the first
High level	Navigational Links (OHP)	[32]	An n-ary link with direction and type
	Associations (FOHM)	[22]	A general association, with semantics on the relationship and each member
Low level	Structural Atoms (EAD)	[26]	A general binary connection that can be recursively reified at runtime
	Triples (RDF)	[24]	A three way semantic relation with subject, predicate, and object
Constraint-based	Adaptive Links (Twine)	[33]	A link with contraints based on state
	Storylets (low level)	[29]	A lexia with contraints based on state, and rules that change state
	Storylets (high level)	[28]	A storylet with internal structure so that different rules may be applied depending on player choice

Table 1 Micro patterns

Mark Bernstein's classic ACM Hypertext paper 'Patterns of Hypertext' published in 1998 [35], which reports a number of calligraphic patterns (what Bernstein also refers to as *complex link structures*) observed in published hypertexts. Bernstein is chief scientist at Eastgate systems, and many of the hypertexts used as a source were written in StorySpace and published by Eastgate.

Emily Short's 2016 blog entry on 'Small Scale Structures in CYOA' also looks at calligraphic patterns [36]. Short is an experienced narrative designer and interactive author who worked extensively with the INFORM 7 project and is Creative Director at Failbetter Games. The article is a description of the patterns that Short finds useful in her own work and is aimed at the Interactive Fiction Community.

Peter Mawhorter et al's 2014 paper 'Towards a Theory of Choice Poetics' was presented at the Foundations of Digital Games (FDG) conference and explores a number of *choice idioms*, effectively patterns that look not only at navigational structure, but also the way that the structure is framed, how the options are presented, and what are the outcomes [37]. The paper is written from the perspective of narrative games and is neutral in terms of micro-structure, instead focusing on moments of decision regardless of implementation.

Charlie Hargood and I wrote a 2016 ACM Hypertext paper which explores patterns of sculptural hypertext in the context of location-based narratives [38]. The patterns are extracted from an analysis of 40 different locative stories created by creative writing students. In these stories location is treated as just another constraint, and so the patterns also apply to any storylet based experience.

The final two sources are both material released by Failbetter Games (and therefore the author is obscured). The first is a blog report of a presentation given at the The Story conference held in London in 2010 which reflected on the narrative patterns Failbetter had used in its sculptural narrative *Echo Bazaar* [39]. The second is a page on design patterns from the Storychoices wiki which supported authors of the (now defunct) StoryNexus platform [40]. Written in 2012 it reports patterns that have been 'successfully used in storygames'.

Tables 2 and 3 show a summary of the 51 meso patterns in these sources. The names are all taken directly from those sources. Each is given a number so that cross-referencing between the patterns is clear. The descriptions are written using terminology taken from adaptive hypertext, some specific terms are worth defining:

- **Node** - a packaged media item (typically text). In calligraphic systems this would be the source and destinations of links, in sculptural systems it is a storylet
- **Path** - a navigational route through a set of nodes, controlled by either a network of links (calligraphic), constraints/behaviour (sculptural), or both (adaptive)
- **Choice** - an alternative set of nodes presented to the reader as the next potential navigational step (regardless of mechanism)
- **Constraints** - logical rules that must be met before navigation to a particular node can occur (regardless of implementation)
- **Variable** - elements of state that can be checked by a constraint, or modified by behaviours (regardless of implementation)

In almost all cases the meso patterns can be applied regardless of the underlying micro structures. This is because calligraphic and sculptural hypertexts are equally expressive, its just that some things are easier to do in one form than another. There are three exceptions. A *Simple Chain* is a pattern that allows storylets to function like a chain of calligraphic nodes and links, and is therefore superfluous in calligraphic systems. A *Missing Link* requires a hotspot in the text to function, and is thus not really applicable in sculptural systems where options typically appear after the content has been presented (and may or may not work in games, where the presentation of onward choices is highly variable). Finally, a *Montage* really requires a link with multiple destinations (to simultaneously open multiple nodes[4]), this is not supported in any existing sculptural systems, although in theory it is possible.

Broadly speaking the reported patterns are either structural, semantic, or presentational, or a combination of any two of these. This is shown in the Type column of Tables 2 and 3 using shortened names: Str, Sem, and Pres.

Structural patterns are defined purely by the shape of the navigational paths through the narrative. They are defined as a *sub-graph*. For example, Bernstein defines three types of *Cycle*, all of which are defined purely in terms of nodes and paths. Figure 2 shows his three types of cycles demonstrated with eight nodes.

[4] This is how the Montage pattern is defined in Bernstein's original paper: "several distinct writing spaces appear simultaneously, reinforcing each other while retaining their separate identities". However a broader interpretation is possible, what Bernstein refers to as "architectural montage", and this might apply to transcluded content within a node regardless of the micro-structure, as well as the richer environments found in some narrative games.

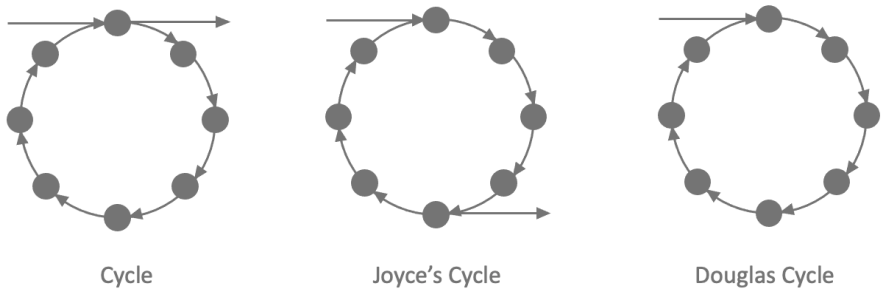

Fig. 2 Bernstein's patterns (like these cycles) are defined purely through navigational structure

Semantic patterns define a *particular way* of using IDN elements for an effect. For example, Mawhorter et al define a number of choice patterns in this way, such as *Blind Choices* where the narrative has not provided sufficient information to understand the consequences of a choice, or *Delayed Choices* where the consequences are not immediate. In both cases the structure is irrelevant, its the setup and payoff within the story itself that forms the pattern.

Presentational patterns are the rarest, they define how something should be *presented* to the reader to create an effect. For example, Bernstein defined *Neighbourhoods* as sets of Nodes that have a common presentation to distinguish them from nodes outside of the set – for example, a story interspersed with epistolary nodes (such as diary entries) where those are presented in italics and have different borders to distinguish them from the other nodes in the story.

We also see some patterns that are defined in two of these three ways. The most common is structural combined with semantics. Such as the *Beggar's Banquet* where the structure is a sequence of nodes, and the semantics are that the reader progresses at a known cost, but with the promise of a reward at the end as compensation; or *Counterpoint*, where the structure is two separate chains of nodes with navigational chances to switch between them, and the semantics is that each chain represents a different logical part of the story (for example, switching between different character point of views).

There is only one example of a semantic/presentational pattern, this is the *Interstitial Counterpoint*, the semantics is the same as Counterpoint (two logical parts of the story), but here rather than defining the parts structurally they are separated by presenting one part in the interstitial interface of the system (the example Bernstein gives is by using descriptive file path names).

Similarly there is only one example of a presentational/structural pattern. The *Unchoice* is structural in that it requires a node with only one onward path, but is also presentational as that onward path must be presented specifically as a choice with one option (rather as simply a way of progressing, such as a 'Next' button.

Meso patterns can support authoring by providing them to authors as either inspiration or as part of a toolbox they can use in their creations [1]. But structural patterns could also be identified by the system at runtime allowing them to be

No.	Meso Pattern Name	Source	Type	Description
1.	Cycle	[35]	Str	A path that starts and ends on the same node
2.	Joyce's Cycle	[35]	Str	A *Cycle* (1) but with direct entry and exit nodes
3.	Douglas Cycle	[35]	Str	A *Cycle* (1) with no exit points (effectively an end state)
4.	Contour	[35]	Str	A set of *Cycles* (1) with potential navigation between cycles
5.	Sieve	[35]	Str	A tree representing layers of choices that direct readers towards distinct outcomes
6.	Split/Join	[35]	Str	Two paths with a shared start node and a different but shared end node (representing a choice that is resolved)
7.	Rashomon	[35]	Str	A *Split/Join* (6) within a cycle (1)
8.	Parallel Threads	[38]	Str	Two sets of nodes that progress independently producing an effect like *Counterpoint* (26)
9.	Gating	[38]	Str	*Parallel Threads* (8), but where progress in one thread is unlocked by progress in the other
10.	Concurrent Nodes	[38]	Str	Multiple nodes with the same set of constraints
11.	Alternative Nodes	[38]	Str	A set of nodes that cover the entire set of possibilities for a sub-set of variables
12.	Mark of Cain	[39]	Str	A variable that once set excludes a whole sub-set of nodes, the opposite of *Phasing* (30)
13.	Venture	[39] [40]	Str	A sub-set of nodes that all raise a variable, which eventually can be 'spent' (reset) to access a different sub-set of nodes
14.	Simple Chain	[40]	Str	A set of nodes controlled by a common variable that changes in value and progresses a player through the set (a meso *Canyon*)
15.	Python	[40]	Str	A start node that unlocks a sub-set of intermediate nodes, a *Phase* (30) that once explored to a certain point exits to a final node
16.	Pyramid	[40]	Str	A *Python* (15), but with multiple sets of intermediate nodes, *Phases* (29), where each is smaller than the last
17.	A Carousel	[40]	Str	A *Python* (15), but with multiple sets of intermediate nodes, *Phases* (29), and multiple potential exit nodes
18.	Midnight Buffet	[40]	Str	A *Midnight Staircase* (32) but with multiple variables, whose different combinations open different sub-sets of nodes
19.	Grandfather Clock	[40]	Str	A subset of nodes that builds a variable, which can be spent (reset) to progress a second variable - works with many other patterns
20.	The Road with Many Faces	[40]	Str	A *Python* (15) or *Carousel* (17) where a second independent variable also builds, occasionally unlocking unique content
21.	False Choice	[37]	Str	A choice where all options lead to the same node and have the same behaviour
22.	Re-enterable Node	[36]	Str	Several *Cycles* (1) that all return to the same node, similar to *Contour* (4), useful for dialogues or gameplay loops
23.	Limited Re-enterable Node	[36]	Str	A *Re-enterable Node* (22) but where there is a limit on the number of revisits that is less than the number of *Cycles* (1)
24.	Gated Re-enterable Node	[36]	Str	A *Re-enterable Node* (22) but where certain *Cycles* (1) are protected by constraints

Table 2 Purely Structural Meso Patterns

No.	Meso Pattern Name	Source	Type	Description
25.	Dead End	[37]	Str/Sem	A choice that prematurely leads to an ending, with no further onward paths
26.	Counterpoint	[35]	Str/Sem	The interleaving of two logically different sets of nodes (e.g. character POV)
27.	Overviews/Tours	[35]	Str/Sem	A *Split/Join* (6) where paths are rhetorically similar, but have different levels of detail
28.	Mirror World (Structural)	[35]	Str/Sem	*Mirror Worlds* (44), but with identical structure
29.	Tangle	[35]	Str/Sem	A sub-network of navigational options with few clues to guide readers choices, a network of *Blind Choices* (39)
30.	Phasing	[38]	Str/Sem	Grouping a set of nodes together using a common constraint as a way of managing progression or perspective
31.	Unlocking (Easter Eggs)	[38]	Str/Sem	A subset of main story nodes that together unlock a diversionary node with non-essential content
32.	Midnight Staircase	[39] [40]	Str/Sem	A *Venture* (13) but with multiple sub-sets of nodes where the variable might be spent (potentially available at different points)
33.	Beggars' Banquet	[40]	Str/Sem	A *Simple Chain* (14) or *Pyramid* (16) where is made clear that progressing has a toll, but the end has a reward
34.	Confirmation Choice	[36]	Str/Sem	A sequence of nodes that allow a choice to be made, but which encourage you in stronger and stronger terms not to make it
35.	Track Switching Choice	[36]	Str/Sem	A dual sequence of interconnected nodes that represent two sides of a choice, and which allow players to change their mind before finalising
36.	Scored Choice	[36]	Str/Sem	A *Track Switching Choice* (35) but the outcome is based on all choices, rather than just the final choice
37.	Chaper One Sorting Hat.	[36]	Str/Sem	Multiple paths with the same start and end node, typically used at the beginning of a story, meso version of *Sorting Hat*, variant of *Split/Join* (6)
38.	Endgame Time Cave	[36]	Str/Sem	A *Sieve* (5) placed at the end of the story to create alternative endings (especially for cumulative choices)
39.	Blind Choice	[37]	Sem	A choice where the outcomes are not well signposted (e.g. because of a lack of information or description)
40.	Dilemma	[37]	Sem	A choice where both options are equally attractive or unattractive
41.	Flavour	[37]	Sem	A choice with minor consequences
42.	Delayed	[37]	Sem	A choice where the difference in outcome is not immediate
43.	Puzzle	[37]	Sem	A choice where the merits of the choices are not obviously apparent (e.g. because of clues)
44.	Mirror World	[35]	Sem	Multiple parallel paths with alternative voices or perspectives
45.	Missing Link	[35]	Sem	Content that implies a link, even through there is none
46.	Faust's Tea Party	[39]	Sem	A node that changes a pair of variables such that you gain with one but lose with the other
47.	Interstitial Counterpoint	[35]	Sem/Pres	*Counterpoint* (26) with one set of content set between writing spaces
48.	Montage	[35]	Pres	Multiple nodes juxtaposed together
49.	Neighborhood	[35]	Pres	Logical sets of nodes that can be identified through proximity, or common ornamentation/landmarks
50.	Navigational Feint	[35]	Pres	Content that reveals structure, without providing exhaustive navigation (e.g. a map)
51.	Unchoice	[37]	Pres/Str	A choice with only one option

Table 3 Semantic and Presentational Meso Patterns

presented differently from the rest of the structure (similarly to a spatial parser [41]), and can also be baked into authoring tools as templates that allow for the easy creation of common structures. For example, the StoryPlaces authoring tool uses *Phases* as a central way of managing progression [42]. Semantic or presentational patterns could be tagged by authors, also allowing them to be distinguished in the interface (for example, using different colours or symbols for different types of choices).

3.3 Macro Patterns

Macro patterns describe the overall structure of an entire work. Rather than solving specific problems or creating short term effects they instead capture something of the overall feeling of the whole experience, suggesting to authors the sorts of interactive stories that they could be telling. Macro patterns appear in traditional narratology. The Hero's Journey (or Monomyth) from Joseph Campbell's *Hero with a Thousand Faces* is the most famous example, and captures the common events and character archetypes that reoccur in myths [43].

There has also been work on macro patterns in transmedia, although these tend to focus more on how the narrative interacts with the various media channels and instances within the wider transmedia experience. For example, Pratten defines three broad types of transmedia story [44]: a *Transmedia Franchise*, where each element is a self contained story, but comes together to form a broader narrative (e.g the Matrix trilogy, graphic novels, and films; or the Star Wars Universe), a *Portmanteau Transmedia* where a single story is split across multiple platforms and cannot be experienced properly in any single one of them (e.g. Alternative Reality Games), and *Complex Transmedia Experiences* which combine the two, so that parts can be experienced independently, but full understanding is only possible through the whole (e.g. the TV show Lost with its associated websites and games).

IDN macro patterns are different from both of these approaches in that they tend to capture the agency that a reader has within a story, by mapping out the navigational shape of the work and giving a sense of the number of different paths through it and the potential endings. While Walton and Suckling's notion of modular and fractal choices differentiate generally between structures where choices are constrained and return to a core path (modular) and those that ever expand the story (fractal) [45] there is very little academic work going beyond this and looking at specific IDN macro patterns, although a number are common parlance amongst practitioners. These are neatly presented by Sam Ashwell in his 2015 article *Standard Patterns in Choice-Based Games* published on his personal blog [46]. Ashwell identifies eight IDN macro patterns, shown in Figure 3, to which I have added a common variation (the Broomstick) [47].

Ashwell presents a number of patterns with a strong directionality, from a start node to one or more end nodes. The *Time Cave* is an unrestrained IDN where every choice leads to a new branch, this creates great variety and high levels of agency, but also causes a *combinatorial explosion* of options [47]. The other directional patterns

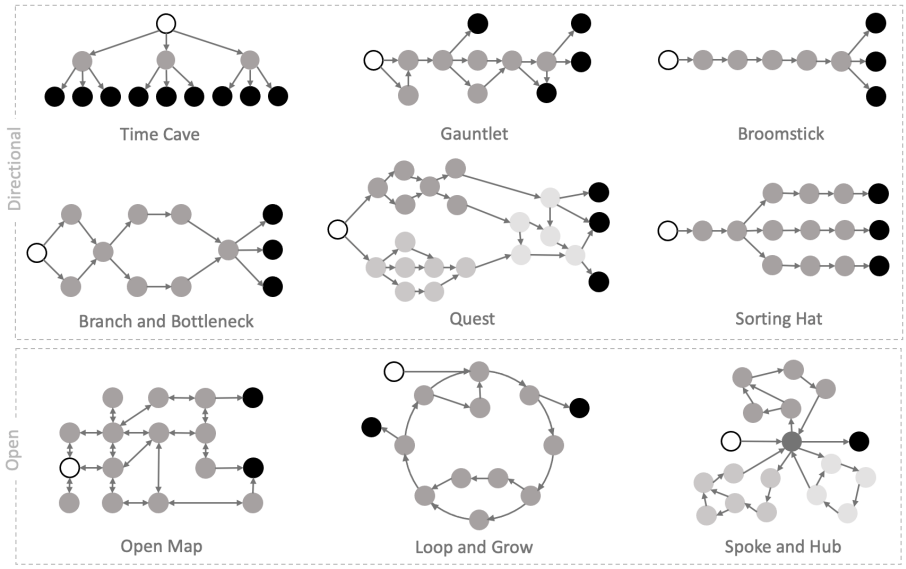

Fig. 3 Ashwell's Standard Patterns; with white start nodes, black end nodes, and logical sets of intermediate nodes shown in shades of grey

are alternatives that are designed to avoid this problem by constraining choice in different ways: A *Gauntlet* has a central linear path which the reader can stray from but quickly returns, genuine agency is thus left to the end, where a final choice will lead to alternative resolutions (the *Broomstick* is an extreme version of this, where the final choice is the only agency in an otherwise linear story [47]). Gauntlets make it easy to manage agency as any meaningful choices are deferred to the very end of the story, and are popular in games as the otherwise common path makes it easy to create a consistent play experience and to use expensive assets efficiently. A *Sorting Hat* is similar to a Broomstick, but the key choice occurs early rather than late in the story. The reader is thus funnelled into one of several linear stories. *Branch and Bottlenecks* are a compromise pattern, where branches in the story lead to genuine variation, but are quickly resolved back into the main narrative (this structure is essentially a sequence of *Split/Joins* – one of our meso patterns – and is typically referred to in narrative game design as the "string of pearls" approach [48]). The points of convergence also act as bottlenecks, where key narrative information can be conveyed. Finally, *Quests* are more complex structures where modules of the story (networks of nodes exploring a particular scene or event) are connected together in a Gauntlet, or in a Branch and Bottleneck, this scopes most of the variation and agency within the modules and allows the overall narrative to progress towards a common set of conclusions.

In addition to these patterns Ashwell also sets out three more open structures, where the reader is not pushed inexorably towards a conclusion, but instead can wander within the narrative. When presenting these patterns Ashwell assumes end

states that readers can eventually choose to take, but it is also possible to use them without end nodes, and instead allow readers to simply exhaust the story, and choose themselves when to stop.

Open Maps are a set of nodes where readers are free to move back and forth, often using constraints and behaviours to modify the content of those nodes between visits. These nodes could represent literal locations, but more abstract waypoints are also possible. An Open Map is the structure assumed by INFORM 7, although that also changes the interaction interface (from selecting options to a parser).

In *Loop and Grow* the reader navigates a repeating cycle of nodes, but on each repetition constraints and behaviours cause the nodes to change and new options to become available. In *Spoke and Hub* a set of these cycles start and end at a single hub, allowing readers to return and relaunch into a different cycle each time. Loop and Grow and Spoke and Hub are patterns that work respectively as macro scale versions of the meso patterns *Cycle* and *Contour*.

Although not depicted in Figure 3 Ashwell also describes 'Floating Modules', which is a story style where the navigation between nodes (or at least between modules of nodes) is managed purely through constraints and behaviours. This is actually a sculptural hypertext (as described in Section 3.1). However, as we have seen, storylets support a wide variety of meso structures, and Short points out that they can also be used to create any of the macro structures as well [49] (the way that Ashwell describes them 'floating modules' is really a type of Quest, where the starting node of each module is a Storylet, which is a good match to the combined storylet and link structures used by Failbetter).

Throughout these descriptions it is clear that many macro patterns are actually meta patterns, which allow for the arrangements of other macro patterns. For example, Spoke and Hub where each spoke could be its own macro pattern, or Quest where each module could be built with its own macro pattern, or Sorting Hat where each branch could lead to a different macro pattern. This high level building block approach is also the one I took in my work with Charlie Hargood when we looked at types of locative experience, resulting in the Canyons, Deltas, Plains (CDP) model which is a broad brush language for describing locative sculptural hypertexts [50].

Canyons are a linear sequence of nodes (often laid out along a real world path), *Plains* are sets of nodes that can be visited in any order (often arranged in open spaces), and *Deltas* are a tree of nodes, where at each point the reader is given a choice (often choices correspond to junctions and branches in real world paths). These correspond to the some of the meso and macro patterns we have already seen. Canyons are Simple Sequences (meso), Plains are Open Maps (macro), and Deltas are Time Caves (macro). The locative experiences did not really include any cyclic structures (Loop and Grow, Spoke and Hub), perhaps because of the reticence of physically located visitors to loop back on themselves [51].

The key insight of the CDP model is that most existing locative experiences can be described as a hybrid of these three structures configured in different ways. For example, Figure 3.3 shows how Viking Ghost Hunt can be modelled as a plain where each node leads to a delta [52] (players move to one of several starting points in Dublin to start an interactive AR ghost story), and Riot! can be modelled as a set of

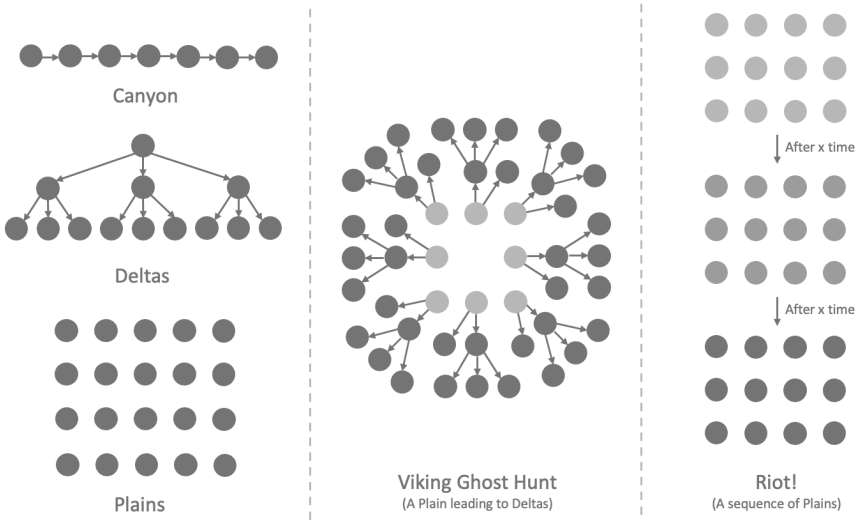

Fig. 4 Canyons, Deltas, Plains – applied to Viking Ghost Hunt and Riot! Sub-patterns of nodes are shown in shades of grey. (Note, in a Plain all the nodes are connected to all the other nodes, but for visual clarity these connections are omitted here)

overlapping plains where each plain is replaced with the last [53] (players explore a riot occurring in a city square, they are free to wander, and as time progresses the sets of available nodes changes creating a virtual play that unfolds around them). A system that supports all three can thus structurally support the vast majority of locative experiences (this was the starting point for the StoryPlaces system, build around a sculptural IDN engine).

Similarly to meso patterns, macro patterns can be used both educationally for authoring (setting out appropriate high level shapes for IDNs) and as a direct part of authoring tools, as templates, quick ways to sketch out broad designs, or intelligent identification of structures in order to help layout or present otherwise tangled relationships.

We started this chapter by making the case for structure as a tool for understanding complexity, and the micro, meso, and macro patterns described in this section show how this can be done. They are a structuralist approach to IDN poetics, aiding with both analysis and authoring. Patterns provide a way for authors to make sense of complexity, helping them to think about that structure in a more modular and manageable way, which can be indirectly or directly supported by authoring tools. But structuralism as a philosophical movement is not without criticism, so in the next section we will explore what that criticism is, and what it means for how we might use IDN patterns in authoring.

4 Interactive Narratives and Post-Structuralism

Structuralism as a movement within the humanities was displaced in the later parts of the twentieth century by post-structuralism, an encompassing approach that is less interested in the structures themselves than it is in why those structures were identified, and what are the consequences of foregrounding them.

4.1 The Post-Structural Complaint

In 1967 in an invited lecture titled *Structure, Sign, and Play in the Discourse of the Human Sciences* Jacques Derrida suggested that an 'event' had occurred in the conceptualisation of structures. Derrida argued that while structuralists could play with alternative structural analyses of different phenomena those structures were always centred in some way that was assumed to be fixed. In other words they were always grounded in certain cultural, social, and technological contexts. The event Derrida referred to was the ending of this assumption, and the acceptance that the centre of different structural analyses both could and inevitably would change as those contextual factors evolved. By accepting this chain of substitutions, centre for centre for centre, structuralists could engage in *freeplay* where all of the structural elements are mutable [54].

Post-structuralism therefore embraces structuralism as a partial mode of analysis, but rejects it as revealing universal truths, as these truths might prove to be ephemeral when the centre of that analysis (which might not be clear to the analysers) changes. It is thus part of the more general intellectual movement towards post-modernism, which rejects grand narratives and embraces epistemic instability.

Roland Barthes' *Death of the Author*, published the same year, applies this idea directly to literature, arguing that the meaning of a text is not magically embedded when it is authored, but is instead conjured by the act of reading, and influenced more by the contemporary context of the reader than the historical intentions of the writer. Although Barthes is a touch-stone for IDN scholars, who have long argued over whether the player agency of IDN can be seen as the ultimate realisation of the Death of the Author [55], a post-structural viewpoint raises orthogonal questions about structural patterns in IDN. In particular it questions whether patterns are genuinely universal, implies that common patterns could form artificial constraints on authors, and suggests that any pattern analysis is itself rooted in historical biases, and influenced heavily by contemporary technologies and their affordances, which are destined to change. Obsolescence is built in.

Yet a structuralist approach appeals to an engineering mindset, which is less concerned about *accurately* reflecting reality than it is about modelling that reality *sufficiently* to create working machines. When criticisms are raised about Patterns in the technology sphere they are that patterns are indicative of a failure of expressiveness in underlying representations, such as the 'revenge of the nerds' response from Paul Graham: "When I see patterns in my programs, I consider it a sign of trouble.

The shape of a program should reflect only the problem it needs to solve. Any other regularity in the code is a sign, to me at least, that I'm using abstractions that aren't powerful enough." [56]. This is a cry for more structure, not less.

4.2 A World Without Patterns

If we are concerned about the restrictive view encouraged by patterns there are, of course, alternative ways of capturing craft knowledge and informing design. Exercises in Style is an approach demonstrated in Raymond Queneau's book of the same name [57]. Queneau sets out the same short story in 99 alternative styles, providing a rich set of comparable examples that others are free to draw from as they see fit. The same approach has been taken in IDN, for example, Mason and Bernstein present a similar set of exercises for the use of links [58], developing a set of examples of how links might be used to punctuate a single paragraph of text.

Another approach is to develop classification hierarchies, which map out the design space and provide definitions of categories [59]. While not directed at authoring these help authors contextualise their work, and can provide inspiration. Classifications can be along multiple dimensions, for example Ryan Javanshir and I classify transmedia stories using the narrative relationships between the parts (story), how participants move between parts (navigation), and how they participate in those parts (instance), triangulating the position of any given transmedia story using all three [60]. Classifications are themselves a structural approach (similar to the narratological work of Todorov on Genre [61]) although they do not necessary classify based on interactive structure. A less structural version of this approach is to focus on defining vocabulary, in these cases structure is less important than definitions, although key examples, such as the ongoing INDCOR initiative, still structure that vocabulary around a taxonomy with top-level categories. In the case of INDCOR these are authoring, artefact and critical discourse [62].

Finally, it is possible to create a set of heuristics, sometimes called a toolkit, that provide rules-of-thumb that designers can follow. For example, the principles laid out by Matt Brown in his 2018 GDC talk on lessons drawn from The Sims on fostering emergent storytelling [63], or the toolkit developed by the StoryPlaces project that provides guidance on creating effective locative storytelling experiences [51].

4.3 Post-Structural Patterns

Bernstein coined the term *Strange Hypertexts* to refer to hypertext systems that are playful with their mechanics and presentation systems. Narrative games are the ultimate realisation of this [64], in these strangest of hypertexts the game mechanics and presentation choices can themselves convey elements of story. In game design this is called *Ludonarrative*, examples include the inaccessible choices in *Depression*

Quest reflecting the mental health of its protagonist [65], or the phantom limb experience of losing a sibling in *Brothers: A Tale of Two Sons* [66].

Perhaps the embracing of ludonarrative is an example of one of Derrida's shifts in the centre, and the consequences for patterns is profound. Firstly, the narrative functions of established patterns are brought into question (as they are affected by the interaction mechanics) – is a cycle still a cycle when it is triggered by Max's power to initiate a restricted rewind in *Life is Strange* [67]? Secondly, ludonarrative reveals that interactive structures are themselves part of how narrative meaning is built, which implies that specific (rather than generic) structures may be needed in every IDN that are tailored to the narrative being told.

In our own work on multiplayer narratives we discovered that our designs often required patterns, but that these patterns were specific to each experience. We called these *Uncommon Patterns* and they offer a post-structural approach to patterns [68]. To support uncommon patterns an authoring tool needs to provide not only a way to create a story using patterns as building blocks, but to assemble new meso patterns from micro patterns such that can be reused again and again. This could be realised through something as simple as structural cut and paste, or more complex approaches such as domain specific languages (DSLs) that support reuse (for example, with functions or macros).

Ludonarrative and the lure of strange hypertexts may well be behind the proliferation of IDN platforms and authoring tools [69]. Uncommon patterns might be a way of mitigating against this proliferation, although I suspect that this mitigation might be limited, as flexibility of form seems baked into the IDN medium, and in resisting it we are like Canute commanding the tide away.

Perhaps the best approach is to see established IDN forms and the common patterns described in this chapter as islands of stability in a swelling sea. They are good to introduce people to IDN, and to act as refuge for those who are still acquiring their technical skills, but ultimately the deep ocean will only be explored by those developing bespoke tools and patterns that tell stories in specialised ways. Uncommon patterns represent a compromise, and their mere existence might encourage exploration around the shore.

5 Conclusions

In this chapter we have set out to understand the different sorts of structural patterns found in IDNs. Although the literature on patterns is sporadic, we have still managed to identify patterns at the micro, meso, and macro levels.

Micro patterns like links and storylets are the building blocks of IDN, we have seen how they really represent two alternative means to represent structure: calligraphic where structure is explicitly drawn (using links), and sculptural where is emerges through the interplay of constraints and behaviour (expressed in storylets). We have also shown how more complex link models can express both forms simultaneously, as well as allowing for lesser known patterns (such as trails).

Meso patterns solve local problems or create particular effects within an IDN. Through a review of five different sources, we have described 51 different meso patterns that broadly fall into three categories: structural (defined purely through navigational relationships), semantic (based on the particular use of interactive narrative elements), and presentational (referring to ways in which those elements can be shown to a reader to create different effects). There are also hybrid patterns, that combine two of these elements (for example, a structure used in a particular way).

Macro patterns describe the broad shape of an entire IDN, revealing the different paths through the work and the different end states. We explored six directional patterns that are defined by alternative paths from a start to an end, three open patterns that describe ways in which IDNs might be structured to allow readers to wander more freely (with or without a final exit), and three patterns from locative narratives that map to how people navigate in physical spaces. We also saw how macro patterns can themselves be combined to create hybrids.

We also explored the assumptions of structuralism and how they apply to patterns, causing us to question the universality of patterns, especially in light of ludonarrative where the interactive structure is itself seen as a way of conveying narrative information – implying that standardising approaches across stories could be harmful. Rather than abandon patterns altogether, we have suggested that they are a starting point for authors, and that a post-structural approach would be to extend their use with uncommon patterns, patterns that can be defined by authors, and which are particular to a given narrative project.

Through this process we have created an index of categorised patterns that is a resource for both educators and authoring tool designers. We have also established a structural theory of patterns that is aware of structural limitations, and provides space for post-structural thought.

This index is of course based on a limited set of work, partly because of a lack of formally published patterns, and could and should be extended. In addition, the impact of ludonarrative on these existing patterns is not clear and remains an open research question. There is also a lack of work on how patterns might be incorporated into authoring tools, for example [1] outlines how patterns might be utilised indirectly through mechanisms such as cookbooks, directly by supporting features such as templates or DSLs, or invisibly by designing the patterns directly into the authoring interface itself, but more work is required to understand the affordances of these approaches and to evaluate their impact. This includes the need to better understand uncommon patterns, and how they might best be expressed and used by authors.

Patterns are a powerful but mostly untapped tool for IDN authors. I hope that by setting out patterns in context, explaining the strengths and weaknesses of the pattern approach, and suggesting possible avenues for post-structural patterns, the information in this chapter will support a new generation of authoring tool designers, and inspire new and stranger IDN works.

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