



# A Framework for Classifying and Describing Authoring Tools for Interactive Digital Narrative

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**Abstract.** Authoring tools are a crucial component in the practice and research of interactive digital narrative design, yet no recent meta-analysis or mapping of such tools exists that would make it possible to comparatively study their defining qualities and characteristics and their effects on the artefacts produced with them. As a first step towards this goal, we created an online resource [1] in which we surveyed and classified over 300 tools. This paper lays out our proposed categorisation and description framework for IDN authoring tools. After exploring our definition of authoring tools and research methodology, we describe 9 categories and 38 descriptors for tool analysis and comparison. We conclude with a sample analysis of Twine [2].

**Keywords:** Authoring tools · Interactive digital narrative  
Interactive narrative design · Interface · Twine

## 1 Introduction

Authoring tools, software that helps non-programmers create interactive digital narrative (IDN) artefacts, have accompanied the development of the field for at least three decades. Indeed, many researchers and practitioners saw the creation of their own tool as a necessary step to fulfil their specific vision for IDN. As Bolter noted, “in this field, everybody wants to have their own authoring tool” [3]. This practice has led to an abundance of tools, about which we actually know very little. To make sense of this abundance, a framework for surveying, categorising, comparing and analysing IDN authoring tools seems a long overdue, necessary effort to improve the discourse and move the field forward. In particular, it will enable scholars and practitioners to recognise specific features, compare different tools and identify areas needing further development. A classification framework will also increase the chances of interoperability between potentially complementary tools. On a more theoretical level, an enhanced understanding of the space of authoring tools will also facilitate an investigation of the relationship between tool and resulting artefact, itself an underdeveloped area in need of attention.

Our twofold aim with this paper is to lay the ground for a framework that could sustain both a categorised mapping of the authoring tools landscape, and a comparative analysis of tools. We approached this with a two-pronged effort:

**Survey and Categorisation.** Our work is a first attempt towards a comprehensive classification of authoring tools, based on an initial survey of over 300 specimens. In addition to tools developed by academics or artists with the specific intent of creating IDN artefacts, the survey covers many tools developed in industry, since these, too, are used (or can be used) for the creation of IDN works. While no comprehensive survey exists today, the real issue is not merely to account for the existing tools, but also to categorise them. We therefore offer a classification that enables sorting any given authoring tool into one of 9 categories. This division currently comprises of 183 specimens that fit our definition of IDN authoring tools (see next section) and keeps track of other tools and tool characteristics relevant to the field through 12 ‘sub-lists’. Ultimately, we hope to convert this overview into an online resource, with a tag-cloud structure, to enable advanced, multi-category search for tools.

**Descriptive Framework for Comparison and Analysis.** A list of 38 descriptors for tool analysis allows for a comparison of different tools from any of our categories. We hope this effort will enable scholars and practitioners to recognise specific features, compare different tools and identify areas needing further development.

## 2 Defining Authoring Tools

We define an IDN authoring tool pragmatically as digital software, which:

- a. Is capable of functioning as an independent and comprehensive workspace (including an independent IDE (integrated development environment) and GUI (graphical user interface)), which allows a prospective author to create an interactive narrative work from start to finish.
- b. Simplifies the authoring process: the design of the storyworld/protostory and/or of the end-user interaction model/protoprocess [4] is simplified and/or made more effective, so that the tools facilitate the IDN creative process better than a general-purpose programming language (or media processing tool) would. A ‘better’\‘simpler’ IDN creative process could mean a workflow that is more directed and integrated, less time-consuming or one that demands fewer technical skills; improved accessibility and tangibility of design strategies and representation structures in the tool’s UI, and/or improved narrative abstraction/conceptualization in the work environment, making these abstract structures and concepts ready-to-hand [5].
- c. Is actively being used/was actively used in the past to create IDN products – focused on interactive narrative aspects – by a community of practice besides the tool’s creator(s).

### 3 History and Past Work

The first software we are aware of that falls fully within our definition of an authoring tool is Donald Brown's *Eamon* (1979) [6], which included a creation kit for adventure games with combat mechanics. *The Adventure System* (1982) [7], a creation kit for Scott Adams format adventure games, is another early candidate. Sharples' thesis [8] from 1984 is one of the first academic texts that explicitly discusses authoring tools. It includes an interactive authoring tool in a dissertation on computer-use in creative writing and English teaching, though the distinction between interactive and non-interactive works authored through a computer remains rather blurred. Conklin's 1987 paper [9] includes an impressive overview of many or most hypertext authoring systems available at the time, but his survey does not focus on narrative hypertext and conflates problem exploration tools with IF tools. In a similarly broad framework, Theng's 1995 publication [10] discusses the significance of design and affordances of a hypertext authoring system, due to its influence on potential end products.

Bolter et al.'s 1987 [11] is likely the first text on authoring tools that focused specifically on the creative work of narrative authoring. Introducing *StorySpace*, it argues for the importance of structuring hypertext authoring of narrative work. Michael Mateas' "An Oz-centric review of interactive drama and believable agents" [12] may be the first overview that focuses exclusively on comparing the structure of interactive narrative systems (including both story generation tools and authoring tools).

Working at the time in Gloriana Davenport's Interactive Cinema group at MIT media lab, Kevin M Brooks' 1999 PhD dissertation [13] is probably the first large-scale academic project dedicated to the development both of an authoring tool for IDN (or in Brooks' terminology, "metilinear story"), and of a theoretical understanding of their fundamental importance to the creation of new kinds of digital works: "This thesis shows that in order to write a metilinear story, one must use a metilinear writing tool from the very beginning." [13, p. 59]. Brooks' PhD dissertation is arguably also the first academic publication to describe an authoring tool (his *Agent Stories*) in depth, and to view it as part of a broad field of new media, that isn't limited to its specific sub-genre (such as hypertext). Later papers [14–17] – focusing more often than not on presenting a newly developed tool – provide their own brief overviews of more or less closely-related previously-developed tools (a list of 14 tools in [18] presenting ASAPS seems to go the furthest). Since these early years, when the field was small enough to comprehensively review and analyse all known tools, we have not been able to locate in the literature a systematic overview study. Instead, more general discussions of authoring tools issues appear, for example, in [19, 20].

## 4 Listing and Classifying Authoring Tools

### 4.1 Categories

To compile the database, the we consulted several existing lists that were created within several communities of practice, both academic and non-academic, alongside any

further tools our group members came across in the process. The two initial main sources used were:

- A list of 14 academically-developed tools referenced or included in many academic papers by members of the ICIDS community, originally compiled by Koenitz [18]. The same list has reoccurred in other IDN-related publications by Koenitz himself, David Thue and others.
- A list compiled by Deglaucy Jorge Teixeira, a researcher of interactive children's book with relevant industry experience in Brazil. Teixeira compiled a list of 39 authoring tools divided into 4 categories. As with all other mentioned lists, a fully referenced 'list of lists' is available online at the tools resource page [1].

Further lists we integrated originated from various sources such as NYU Game Center researcher Clara Fernández-Vara's 'Vagrant Cursor' WordPress page [21], StoryNexus' wiki domain [22], Interactive Fiction artist Emily Short's blog [23], a tool comparison excel sheet maintained by the IF community [24], and other similar web-sources.

At the time of writing, the full database includes a total of 183 tools (146 of which are 'alive') that fully meet all three criteria of our definition (over 100 tools surveyed were excluded since they did not meet the criteria). We believe our database includes the most central and noteworthy tools developed in both academic and non-academic contexts to date, alongside many other tools deemed relevant enough to note. A possible limitation is that we have only been able to look for tools that support English-language authoring, although the database does include some tools that were originally developed in Japanese, German and other languages, and adapted into an English version. A first selection criterion has been applied to the full database to distinguish between tools that are available and actively used at present day ('Alive'), and tools that no longer are ('In limbo'\Dead'). 'Alive' tools were assigned a number, while noteworthy 'dead' or 'in limbo' tools are listed for each respective category without numbers.

We approached the task of classification from two directions: After integrating and meta-analysing the various lists, bottom up distinctions derived from an observation of the actual field of already existing authoring tools and the discourse surrounding them led us to classify the tools into nine top-level tool group categories. This primary level of classification is divided into two groups: Fully self-contained tools and Partially-generative and non-generative tools.

**Fully Self-contained Tools.** These are generative tools, whose end-products are entirely code based, meant to be played on a computer or console, ranging from text to real-time graphical rendering, and sorted into categories as follows:

*Real-Time Graphical Rendering/Game-Creation Tools.* These include: (I) Flexible game engines (e.g. Unity 3D [28]; Unreal [29]), (II) Genre-specific game makers (e.g. RPGMaker [30]; Adventuregamesstudios [31]), geared and templated towards the making of a particular category of narrative games. The genre-specific tools are generally more amateur-friendly.

*Hybrid Text + Graphic Tools.* These include (III) Visual novel authoring tools (e.g. Ren'Py [32]; Kirikiri [33]) and (IV) Other hybrid tools (e.g. ASAPS [18, 19, 34]; IDTension [35, 36], both from academics).

*Interactive Fiction Tools.* These include: (V) Hypertext tools (e.g. Twine [2]; StorySpace [37, 38]) – lexia-tree based structure, navigated by clicking portions of the text that function as link; (VI) Parser tools (e.g. Infrom 7 [39]; VaryTale [40]) – command-interface-based textual narratives [41]. Navigated by either an open-language command/dialogue board, such as in adventure games, or a system that facilitates a menu of commands through different, more approachable interfaces.

Generally, parser artefacts incline towards open navigation and are meant to feel like a world-generator, whereas hypertext is more like a choose-your-own-adventure book, often focused on narrative delivery and style rather than on proto-game-mechanics. This isn't an absolute distinction, however: game engines enable authoring via text, and many can produce text-based IDNs, and many IF engines afford real-time graphical rendering. Yet the primary ontology of the respective tools divides them, through their respective UIs, affordances and rhetoric, into either graphics or text. The hybrid list is composed of tools that highlight both textual and visual/pictorial representations as crucial elements, close to equally important in a typical resulting artefact.

**Partially-Generative and Non-generative Tools.** These tools support authoring with externally produced (e.g. recorded) assets: (VII) Interactive Video/documentary tools (e.g. Klynt [42]; Korsakow [43, 44]); (VIII) Augmented/mixed-reality tools (e.g. Aris [45]; StoryPlaces [46, 47]); (IX) VR/360 video tools (e.g. SceneVR [48]; VRDoodler/Haven [49]) – 'VR' is a hybrid category, as the concept is commonly used as a blanket term for both computer-generated, fully self-contained works typically developed through game engines, and 360 video works that import digital footage.

The strong differences in terms of design process and affordances between working with recorded or pre-rendered assets or real-world locations, on the one hand, and digitally generated storyworlds, on the other, justify our use of this difference as our primary classification. However, as the affordances for manipulation, integration and personalization of captured footage grows exponentially with technological developments, this division is increasingly not as distinct as it once was.

In addition to our main classification, other types and qualities of authoring tools were assessed during our bottom-up review process as relevant for further analysis. These groups, however, were not fit to form their own category. We thus have 12 additional sub-lists. 6 of them keep track of a certain purpose or quality of authoring tools, spanning both tools that were included in or excluded from our main overview: Academic tools (1); E-Learning Tools (2); Gestural Interface Tools (3); Interactive Journalism Tools (4); Mixed-Initiative authoring tools (5) and web portals for authoring (6). Other types of tools, excluded from the main lists were listed due to broader relevance to the field, for various reasons. These include: Prototypes/Under-development tools (7); Historical authoring tools (8); Middleware/interpreters (9); Story generation/procedural AI authoring tools (10); Tangible/material UI tools (11); and Writing aid/interactive tools for linear writing (12).

## 4.2 Descriptors

We further developed a system of 38 descriptors for the analysis and comparison of authoring tools, which attempts to describe which place a particular tool occupies on the widest definition available of the IDN expressive space. The underlying theoretical insights were gleaned primarily from two complementary theoretical models that strive to comprehensively describe the space of IDN/IDS: Koenitz's SPP model [11], which regards IDN as a system, and Knoller's userly text model [25–27], which regards IDS as interactive experience (see also a proposed synthesis of these two models in [4]). These insights were then crystallised into a list of descriptors describing what qualities of authoring tools are most pertinent and may be deducible via direct examination of tools themselves: their interface, design process, usage, etc.

Our approach to the analysis of tools has been strongly phenomenological: though some descriptors relate to a tool's structure and technical capabilities in isolation, our more complex categories relate to the authoring process itself as a *designed experience for experience design*. Owing to this approach, our focus is on analysing the authoring tools' affordances, rather than their functional potential, acknowledging, for example, that two tools that enable the same functionality (for example, designing timed events) can strongly differ in how salient this function is in their interface, and/or how simple it is to design and, thus, differ in the extent to which it should be a prevalent affordance.


The following Table 1 exemplifies our framework using the example of Twine, a popular hyperfiction authoring tool:

**Table 1.** Classification example: twine

Descriptor	Value
Name	Twine
Creator & affiliation	Chris Kilmas, American indie game designer
Year of release	2009 (Twine released 2014)
Category	Self-contained>IF>Hypertext
End-product media type(s)	Link-based interactive textual fiction
Main target audience	Amateur IF enthusiast, independent artists
Vitality	Alive
Number range of products made	1,000–10,000
Homepage	<a href="https://twinery.org/">https://twinery.org/</a>
Publishing portal link(s)overview of products made	IFDB portal: <a href="http://goo.gl/So2Wpp">goo.gl/So2Wpp</a> <a href="https://twinery.org/">https://twinery.org/</a>
Textual analysis sources	Porepentine manifesto: <a href="http://goo.gl/fU5smt">goo.gl/fU5smt</a> Friedhoff, Jane. "Untangling Twine: A Platform Study." DiGRA Conference 2013
Sample end-product(s)	<i>Sacrilege</i> (Cara Ellison 2013): <a href="https://unwinnable.com/wp-content/uploads/2013/04/Sacrilege.html">https://unwinnable.com/wp-content/uploads/2013/04/Sacrilege.html</a>

(continued)

**Table 1.** (continued)

Descriptor	Value
Tutorial(s)	<a href="http://twinery.org/cookbook/">http://twinery.org/cookbook/</a> Tutorial playlist by Dan Cox: <a href="https://goo.gl/R1VZQf">https://goo.gl/R1VZQf</a>
Ownership type	Open-source; community-run
Latest stable release version	2.21 (January 2018)
Cost	Free
License type	GPL v3; Allows self-publishing
Programming language(s) written in	Javascript (V1 in Python)
Programming language employed in work-process	Twee; Harlowe\Sugarcube\Snowman
Role of coding in the creative process	Optional (basic branching story can be written without code, basic coding implementations are required for counters, conditionals, etc.)
Work platform(s)	Linux, Mac OS X, Windows, Web application
Import formats	Full HTML compatibility Twine1: Images: PNG, GIF JPEG, WebP, SVG Twine2: HTML only All media formats can be embedded into a Twine story via HTML but this is quite clumsy and requires some coding knowledge
Export formats	HTML
Interface screenshot(s)	
Main design window(s)	Basic lexia space page is Twine's only window
Primary Design Unit(s)	Passages – unified text lexia unit structure
Work-environment UI model	Lexia space
UI-modelling type & level of abstraction	High; Extendable objects (additional lexia are created by customising existing lexia)
Design interface intuitiveness	Very high
Initial learning curve complexity correlation	Very low
Advanced authoring complexity correlation	Medium
Degree of emphasis on narrative structuring	Medium
Prevalent narrative elements & concepts	Story progression\Events - choice based textual links between lexia Support for conditionals, counters, inventory, stats, RPG battles, randomisation

(continued)

**Table 1.** (continued)

Descriptor	Value
Prevalence of procedural elements	Supplementary-optional
Main available procedural authoring elements	Conditional linking (if-; else-if); Randomisers; counters (+procedural linking), ‘combat’ stats
Available end-product interaction model(s) & degree of flexibility	Point-and-click text; very low
End-product platform & control interface	PC (mouse), Smartphone (touchpad); no
Additional key interaction design affordances	None

Unfortunately, the scope of this paper does not allow for a nuanced explanation and discussion of our descriptors and the reasons for their inclusion. A more thorough presentation of the parameters, alongside a table comparing two additional central tools (Unity and ASAPS) to Twine, can be found on our online resource website [1].

## 5 Conclusion: Limitations and Future Work

Because our current list of descriptors traces the existing field of authoring tools, it isn’t future proof, as it does not address what may be significant for the design of future authoring tools. We are particularly curious about tools that would model and connect the design of interfaces [50, 51, 54], interaction models and user experience [25, 52] with narrative design – particularly through embodied/gestural interfaces [26, 53]. These are accounted for in our models, as well as in IDN artefacts, but are at best implicit in IDN-specific authoring tools.

The full list, and even the list of active tools that fulfil all of the criteria, was too long to treat in equal and sufficient depth in a comprehensive meta-analysis. Therefore, we chose a set of 16 tools that we pragmatically deemed to be particularly interesting and relevant for further research on the topic. Our next planned step is to conduct comparative analysis of these tools through our framework. We further plan to integrate all tools, lists and sub-lists into a digital matrix, allowing prospective users to further explore these tools in a comparative context via, e.g. a tag cloud. This should further help uncover possible clusters and patterns within the data.

Our work can also serve to map the IDN field as a whole: its territories, borders and relevant qualities. We hope it will also evolve into a useful resource for prospective authors interested in interactive narrative and looking for the right tool to support them. However, the nature of this kind of pioneering effort is such that some aspects of our proposed framework might rightfully be criticised and omissions on our part are entirely likely. Consequently, we see our work as the start of a community resource that will improve over time, through further scholarly discourse.

To conclude, we invite the ICIDS community not only to keep track of this project and use its output, but also to collaborate, to get involved in improving the framework and, eventually, to submit tools and analyses.



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