University of Southampton

Faculty of PHYSICAL SCIENCES AND ENGINEERING

ELECTRONICS AND COMPUTER SCIENCE

WEB SCIENCE

AUTHORING DIGITAL INTERACTIVE NARRATIVES

by

Sofia Kitromili

Thesis for the degree of DOCTOR OF PHILOSOPHY

[March 2021]

University of Southampton

Abstract

The introduction of Storyspace, a hypertext authoring tool for digital and interactive fiction, at the first Association for Computing Machinery (ACM) Hypertext conference in 1987, brought forward a set of digital and interactive storytelling opportunities that offered new and exciting narrative possibilities. There has been progressive development towards the implementation of new and interesting authoring tools offering different narrative components for the creation of digital and interactive stories. There is however, one particular concern mentioned by several scholars and experts in the field that prevents this new discipline from fully spreading its wings. The tools have a level of complexity in their use and process of writing which requires authors to conceptualise their story through a specific narrative pattern and attempt to create that using the constructs of the tool. This poses an 'authoring problem' specific to digital interactive narratives. This report presents an investigation of the authoring problem through the identification of an underlying authoring process and major issues that surround it. First presented, are autoethnographic story adaptations conducted to enable understanding on how digital interactive authoring tools affect storytelling, and how they influence the authoring process. Then, a systematic literature review on the work discovered so far on digital interactive authoring tools and the authoring process. Lastly, an analysis of interviews with digital interactive authors on their personal authoring experience and difficulties they encounter. The report concludes with a summary of the main findings which involve the identification of an authoring process model for digital interactive narratives, a list of authoring issues and a mapping of those issues onto the authoring process. A final discussion explains the importance of the authoring process in interactive narratives, how that process reflects the actions of authors and how the tools can be built to accommodate those actions by considering where in the authoring process many of the authoring issues can occur and how those can be remedied to alleviate the authoring problem.

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I declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

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Kitromili, S., 2020. **Tools make it possible authors make it real**. In: Authoring for Interactive Storytelling 2020. Presented at the 13th International Conference on Interactive Digital Narratives, Bournemouth, UK, p. 3.

Sofia Kitromili, James Jordan and David E. Millard. 2020. ***What Authors Think about Hypertext Authoring***. In Proceedings of the 31st ACM Conference on Hypertext and Social Media (HT'20), July 13-15, Virtual Event, Florida, Orlando, USA. ACM, New York, NY, USA, 9 pages. https://doi.org/10.1145/ 3372923.3404798

Sofia Kitromili, James Jordan, and David E. Millard. 2019. ***What is Hypertext Authoring?*** In Proceedings of the 30th ACM Conference on Hypertext and Social Media (HT'19). Association for Computing Machinery, New York, NY, USA, 55–59. DOI:https://doi.org/10.1145/3342220.3343653

Kitromili S., Jordan J., Millard D.E. (2018) ***How Do Writing Tools Shape Interactive Stories?***. In: Rouse R., Koenitz H., Haahr M. (eds) Interactive Storytelling. ICIDS 2018. Lecture Notes in Computer Science, vol 11318. Springer, Cham

Signature: ..... Date:

Acknowledgements

One must begin by thanking the people who supervised this work and be grateful that albeit the stories told around about being on a doctorate journey in a relationship with supervisors, this one was successful through and through.

To Dave and James, for being the best duo of supervisors any student could hope to have. If I did another one, I would ask you to supervise it again.

To mum and dad, for accepting graciously that their eldest daughter spent her twenties draining their funds rather than living the life and filling her bank. Also, for always accepting my choices, no matter how much you wished otherwise.

To grandma, for her pride in the grandchild that turned down jobs and refused to settle down unless she became a Dr, and for following mum and dad in the fund support whenever necessary. To grandpa, who missed by a little the chance to live as grandparent of a Dr but whose memory will carry it through.

To my little sister who has been around, mostly driving me crazy while studying for her own dream and for being a bright young lady who got the greatest of jobs on graduation, thus picking up the rent once my funding ended. Otherwise, we might have missed the roof over our heads.

To my colleagues and friends in Southampton, who have been going through the same journey as me and were able to share the joys, hurdles and most of all breakdowns that came with it.

To my friends from home for being there and for looking up to what I do in my life.

To the authors that talked to me, and to every author out there with a story to tell.

To Winchester, for being the loveliest place to write a thesis.

To all, thank you immensely.

Chapter 1 Introduction

1.1 Storytelling

Stories are an essential element in people's lives, found non exhaustively in books, films, theatrical plays, songs, games, and events that depict one's daily life. One way or another, everyone experiences a story every single day, as everyone reflects and organises their days regardless of tasks or interactions. Stories are a necessity. They are references to the past, narratives that describe the shaping of cultures, recollections that shape the future, and for the most part, entertainment that at present allows individuals to escape ordinary days and mentally immerse themselves in the story space created by another person. Immersion allows the readers, to project emotions and feelings that have no true impact in their personal lives except perhaps to teach a lesson or educate and inspire (Molnar and Kostkova, 2015; Murray, 2017).

Behind each story lies a person and an authoring tool, for if stories are to be relayed to an audience they need to be created somehow. Mediums of creation have been: word of mouth, carving tools and styluses, pens and pencils - and following the print era - typewriters, word processors in computers, cameras, specialised software and ultimately the web, which embedded storytelling in websites and social media allowing an escape from the pipelines of traditional content creation (Writing: Making your Mark, 2019). All of these tools are means that have been implemented to mediate the craft of creating a narrative, and according to Bolter and Grusin (1999) remediate the art of storytelling. For a story to come to life, authors must have an idea and their choice of authoring tool at hand. Those need to come together through a progressive and cohesive cooperation towards a narrative that will ideally leave the audience satisfied to a point where they cannot think of a different ending, or at least an ending that will give them satisfactory closure (McKee, 1998). Good stories begin in the minds of authors, and they come to life through the authoring medium each author chooses to

write with. Whichever the tool of choice, an author understands that their story's format and structure will depend on the type of stories their authoring medium is built to create (Dormans, 2006). The narrative of a film may start on a piece of paper, but to become a film the storyteller needs a camera. The narrative in a book starts and ends on a piece of paper, so the author is adequately equipped with a pen or a word processor. The narrative in a game is delivered via an authoring platform which in turn communicates with a game engine and those together create a game. Whichever the medium, *"the success of a writing tool depends on the success of the work written with its aid"* (Bernstein, 2016, p.205). Arguably it is true that for a product to be successful, then the tool used to create it succeeds in making that possible. The interaction between an author and a system seems to contain an enhanced level of complexity in the creative process as scholars in the field of digital interactive narratives have been addressing when discussing that the challenges of authoring with these complex tools, make authoring a difficult process. (Bernstein, 2018; Green et al., 2018a; Spierling, 2018; Spierling and Szilas, 2009; Stefnisson and Thue, 2017).

This report will present and discuss the use of tools that are used for digital interactive storytelling with a focus on hypertext and other text-based literary forms. Forms which Aristotle could not predict in his poetics when technology was not available, but whose poetics are used as a basis to develop relevant knowledge (Koenitz et al., 2015a). This is a form where stories are digital, interact with the reader, and are created with specialised digital interactive authoring tools. To create digital and interactive stories, authors must use these tools, that are closely related (but simpler), to those used in game engineering and development. To assist in the craft of digital interactive stories, tools have been built for the past thirty years to help many people write. However, the technological nature of the creative tools and the complex aspect of conceptualising how to make a story interactive, have been causes for an authoring problem. The mind of an author using them becomes no longer concerned only with a potential authorial block, but also with the fact that their mind must align with the functionality of a tool, to map and design an interactive, non-linear, and multi-sequential experience for a reader.

This makes authoring digital interactive narratives a very difficult and complicated process.

1.2 The storytelling problem

Storytelling has transformed into an art that is embedded into many disciplines and environments such as literature, education, business, and the media. Stories are easier to imprint in our memories because they are interesting and able to project a steer of emotions (Green, 2004). A story is more likely to stay in one's memory forever, whereas anything else will potentially begin to fade or disappear. One will remember *Homer's Odyssey* and *Little Red Riding Hood* forever but will forget *Pythagora's theorem* as soon as one chooses to major in a non-mathematical course.

Murray (2017, p.362) summarizes the need for storytelling in all its forms in the following paragraph:

"We need stories in every medium we can master, truth and fiction, ephemeral and enduring, unlinear and interactive, secret stories between lovers or family members, mass entertainments shared by millions. We need this creative practice for its own sake, but more than that, we need the process of continuously expanding our means of storytelling, because it allows us to expand our ability to know who we are and to collectively reimagine who we might become."

Storytelling was born with people and as people evolve so does storytelling. The latest form which according to Kriegel et al. (2007, p.55) is regarded by many as the "*next revolutionary narrative medium of the future*", is the interactive form. An interactive story allows the reader to interact with the content. This type of story has been introduced as early as the 1930s in a book by Doris Webster and Mary Alden Hopkins called *Consider the Consequences!* (Webster and Hopkins, 1930). The book is written in such a way that allows the reader to determine the fates of the book's protagonists through a selection of branching choices on the plot, which depending on the choices the reader makes, lead to an associated ending. The book has three protagonists and a total of 43 different ending possibilities (Katz, n.d.). The most common encounter of

branching choices in books known to the globe were the 1970s children's selection of books *Choose your own adventure*[1] identified as "*interactive game books"* ("History of CYOA," n.d.). Similar to Webster's and Hopkins's book, *Choose your own adventure* books were created in such a way, that would give readers' the option to choose their own adventure via offering them a set of choices in the narrative, that represent the main character's decisions thus offering multiple plots to a story. Such stories have been deemed as "*multiform*" by Murray (2017) who uses the term to describe narratives that tell a single plot through multiple mutually exclusive versions.

Interactive stories as opposed to conventional stories offer a sense of immersion to the story that as Szilas (2010) puts it allow one to live the story as opposed to just seeing it. While early references to interactive stories have been non-digital, the latest development of interactive stories have almost exclusively been digital. The most common medium to use and interact with a digital interactive story is the personal computer. In its simplest form a digital interactive story is a set of pages on a screen. Unlike in a book, the reader may at any point in the interactive story be offered a set of choices that when followed transport them to another part in the story hence disrupting the order of reading the narrative. It is a form of story that can have many story paths, many endings, and many ways of reaching each ending. The linear narrative path transforms into a non-linear narrative maze. Aristotle's ideal myth as through the notion of being *whole*, makes a digital interactive story unfit for that purpose. Agreeing to some extend with Aristotle, McKee (1998) describes that an ideal story is one that maintains a linear account of the chronological events without confusing the audience, and which answers all questions raised in the plot without open endings or unresolved situations. A less ideal story is one that leaves some room for open endings, but the plot is still presented in a sequential order. The non-ideal story is one that leaves open endings and where the plot follows a chaotic sequence of events. In comparison, digital interactive stories which involve computational components and go beyond the traditional narratology theories as Koenitz (2015a) explains, can be ideal even if they

[1] https://www.cyoa.com

are not linear or sequential. An interactive plot can have multiple paths and endings, a reader may miss portions of text in a traversal governed by their choices and be transported to another section of the story thus breaking the linear progression. That does not mean however that the story cannot be *whole.* It means that when the form is mastered to a well-designed story, a reader is allowed to experience it via their own personal choices on how the plot should either proceed, or end. It offers a sense of agency that ideal and non-interactive stories can never offer. In a non-interactive story, there is no choice but to let events happen but in a non-interactive story one takes responsibility. That is the main difference between the interactive and the non-interactive.

Research in the field of Interactive Digital Narratives (IDN) needs the study of written work. If Campbell (1949) had not studied and compared different myths he would not be able to identify that all of them were similar in telling the story of one hero through multiple variances, and identify the steps in a protagonist's journey. If Aristotle (2008) had not witnessed the theatrical performances and the myths fellow philosophers and other authors at the time had written, he would not be able to justify his poetics. If Propp (1968) had not studied and analysed a series of folk tales in his time he would not be able to identify their common structural narrative elements. To allow this form to spread its wings and show the narrative possibilities that many mediums such as films and books have done so before, digital interactive stories must be written, studied, and analysed. For this to happen the tools necessary to author a digital interactive story and the process of authoring must be better understood. There is no lack of interested authors out there to create the form. There is no lack of tools out there to help them create the form. There is only lack of communication between the two that makes authoring a complicated process to follow.

The work presented in this report is the outcome of research conducted to identify, understand, and analyse reasons behind the difficulty of authoring digital interactive narratives. It looks at the authoring experience and the problem that has been following it for the past thirty years as it is often discussed when experts in the field meet to exchange ideas (Green et al., 2018a; Spierling and Szilas, 2009). This work is concerned

with textual forms of interactive narratives and while the work will be applicable to other interactive forms such as interactive games and perhaps interactive television, interactive drama, and other experimental interactive forms it does not include unique aspects that are involved in the processes of those forms that are not literary hypertext or otherwise literary text-based forms.

1.3 Thesis contribution

Authoring, as a process is not properly understood. It is perceived as a monolithic process that seems to contain one sole step, writing. However, there is more to it than that. Before an author finishes their work, they must first think about the story, plan it, create the characters, think about how everything will connect, write, edit, proof-read, revise and release. This is what distinguishes writing from authoring. Writing is but a step in the authoring pipeline. Authoring is the whole process. For stories that are digital and interactive, authoring tools are required to make interactivity possible. For some authors this is surmountable, but for many authors interested in the form, it means falling into the depths of a tool that must by its nature be restrictive, as it cannot allow the same freedom of writing as a word processor does.

Understanding the reasoning behind interactive narrative development is a step towards understanding the reasoning behind authoring them. Understanding the reasoning behind the constraints of a tool is a step towards understanding how to use them. It is not as easy to understand from a narrative perspective all the structures these tools offer, and it is also not easy to understand how to make these tools more accessible. It stands to reason that it will be less simple to author with a digital interactive authoring tool, than it would be to author with a simple word processor. Lynch et al. (2017) explains this by saying that when using a software system to author a story *"the influence the technical side has on the creative side is unavoidable"*. It must be considered that the engineering of a product will potentially affect the creativity of that product.

Currently, content creation in itself is troublesome (Kriegel et al., 2007). The authoring tools while there to make it possible, are software systems that require familiarisation, perhaps coding skills, and come with restrictions in story creation that may contradict what the author wishes to achieve. Having to abdicate intent to an authoring tool that is built to assist in authoring something interactive, is an agreement between the creative mind and the machine that the latter will be restrictive. Digital interactive authoring is therefore problematic. Every effort to make it easier has also brought to surface more concerns. The work presented in this report is an attempt to address those concerns and understand how the authoring problem can be reduced. The experience of an author is the key objective of this research as it is believed that to improve on the use and works of digital interactive writing tools priority must be with the authorial perspective. This study is designed to investigate the authoring problem, to discover why authoring digital interactive narratives is difficult, and explore how current authors are trying to overcome the problem. The questions raised are the following:

1. *What are the conceptual difficulties authors face with digital interactive authoring tools, what are their attempts to overcome them and how are their actions affecting their stories?*

2. *What is the process of authoring digital interactive narratives and how do the authoring issues identified over the years match that process?*

1.4 Methodology

The study uses a set of qualitative research methods that help answer the research questions. Having authors and their experience in creating digital interactive narratives as the focus, the study has been designed to enable a deep understanding of the way authors use digital interactive authoring tools. For this reason, a qualitative methodological approach was a suitable fit. The methods used are autoethnographic story adaptations that contribute to answering question 1; a systematic literature review on targeted conference proceedings for data gathering to answer part of question 2; and interviews to verify the findings obtained for research question 1 and answer the

remaining part of question 2. The story adaptations were necessary to test and evaluate the use of the technically oriented authoring tools, the systematic literature review was necessary to draw knowledge from an interdisciplinary community of researchers that are studying digital interactive narratives, and the interviews were the most effective way to interact and listen to the experience of interactive narrative authors and their input on how the process reflects their purpose and how they cope with the use of technical tools to achieve that. Each of the methods selected are further elaborated as to their specific suitability and use for this study in each of the Chapters 4 through to 6.

1.5 Report structure

Chapter 2 will introduce digital interactive storytelling and give an account of how the form was created and how it is utilised today.

Chapter 3 will follow with an introduction to digital interactive authoring tools and explain how those have been making it possible to create digital interactive stories as well as giving examples of works written with these tools.

Chapter 4 presents two autoethnographic story adaptations where two interactive stories have been adapted with a set of authoring tools to gather observations on the authoring process and on how it differs in different tools and forms.

Chapter 5 presents a systematic literature review performed to identify an authoring process for digital interactive narratives, as represented in the research published over the years by experts in the field of hypertext and interactive storytelling.

Chapter 6 presents information gathered and codified from a set of interviews by digital interactive storytelling authors on their personal experience with authoring, the process they follow and the issues they encounter.

Chapter 7 provides a holistic discussion on the three research methods presented in Chapters 4, 5 and 6. It explains how each contributed to answering the research questions and provides insights on the state of authoring.

Finally, Chapter 8 concludes the report with some final remarks based on the findings and some suggestions on the state and future of the authoring pipeline of digital interactive narratives.

Chapter 2 Digital Interactive Narratives

2.1 History

Interactive storytelling owes most of its original popularity and recognition to the 1970s publication of the *Choose your own Adventure* children's books. The beginnings of *digital* interactive storytelling surfaced during the 1960s, when several technological developments taking place at the same time, slowly formed two distinct communities creating digital fiction mostly referred to as *interactive fiction*. Those communities derived from scholars in hypertext who were working on *hypertext fiction* and scholars in computing sciences and other programmers who were working on *parser-based fiction*. Works from both these communities contributed to the formation of digital interactive storytelling as a discipline and belong in the set of works now broadly referred to as *Interactive Digital Narratives* (IDN).

Before the generic term interactive digital narratives was established in scholarship, interactive fiction was heavily used as the term to describe a form of digital fiction that relied predominantly on a parser to translate natural language into computer code by accepting, responding and displaying text/media according to user input (Montfort, 2005). The term interactive fiction remains a common term which is more predominantly used by people outside of academia. The functionality of parser-based stories has been compared to riddles by Montfort (2005). Like a reader explores a space to complete a narrative, so does an enigmatologist[2] tries to solve a riddle. In both circumstances one must go through a process of solving to reach a conclusion or an answer. Parser-based fiction is like solving a riddle or a puzzle. The reader does not

[2] Will Short coined the term "enigmatologist" to mean the person who is studying or solving riddles or puzzles.

have the full picture in front of them, but they are offered pieces that once put together, start to make the story whole, and then complete.

One of the earliest interactive programs implemented during the 1960s was *ELIZA*[3], an artificial intelligence computer program that posed as a female psychologist and was able to interact with a user via textual commands (Weizenbaum, 1966). The program, developed by Roger Weizenbaum at the MIT (Massachusetts Institute of Technology) artificial intelligence laboratory and released in 1966 was a conversational style narrative, the first of its kind. *ELIZA* was so convincing, that people interacting with it were under the impression a real person was on the opposite end (Montfort, 2005). The program officially considered as the first descendant of parser-based fiction was William Crowther and Don Woods's computer game known as *Adventure* (originally called ADVENT, then Colossal Cave Adventure) (Moulthrop and Kaplan, 1991). Crowther, a computer programmer, developed the first version of the game in the late 1970s with the premise of a player exploring a cave by interacting with the plot through textual navigational commands such as 'go in'. Crowther released the game in 1976. Woods, who was working in the Stanford artificial intelligence lab at the time, came across the game and asked permission to work and improve on the code that Crowther initially developed. When Woods was granted permission, he worked on the game and released the improved version in 1977 to worldwide recognition. The game became the first of many similar text adventure games (Montfort, 2005; Norman, n.d.). Based on the table game *Dungeons and Dragons* and with influence by Crowther's *Adventure*, *Zork*[4] developed by Tim Anderson, Marc Blank, Dave Lebling, and Bruce Daniels at MIT, was the next piece of parser-based fiction released to gain attraction from the public. Their interest in keeping the team together led its authors to establish an interactive fiction publishing company called *Infocom,* which for some time during the 1980s was successful in selling text adventure games until it lost traction and went bankrupt (Maher, 2006; Montfort, 2005). Other companies around the world attempted to

[3] http://psych.fullerton.edu/mbirnbaum/psych101/Eliza.htm

[4] http://textadventures.co.uk/games/view/5zyoqrsugeopel3ffhz_vq/zork

establish what *Infocom* did, but none had succeeded as much as *Infocom* (Montfort, 2013). Despite the unfortunate end of *Infocom*, the parser-based form managed to survive through an established community[5] of fans who continued to create interactive stories. The community remains active and alive through online competitions and their work is no longer limited to parser-based stories (Montfort, 2005).

An example of parser-based fiction is the story *Bronze*[6] by Emily Short written with Inform 7 an interactive fiction authoring tool that is used to write stories similar to text adventures. Figures 1 to 3 show a short traversal of the story. The reader here depends on the guidance of the narrative in order to progress. It contains clear indicative sentences that help the reader type the right command on the interface and traverse a virtual world by moving from room to room and asserting text to imitate game like actions. In this instance, the reader traverses through rooms in a castle and it is possible to go back and forth according to which rooms are connected.

Bronze
A fractured fairy tale by Emily Short
Release 11 / Serial number 060503 / Inform 7 build 3K27 (I6/v6.30 lib 6/10N)

Have you played interactive fiction before? >yes

If you have not played Bronze before, you may still want to type HELP to learn about special commands unique to this game.

Drawbridge
Even in your short absence, the castle has come to look strange to you again. When you came here first, you stood a long while on the drawbridge, unready to cross the moat, for fear of the spells that might bind you if you did. This time it is too late to worry about such things.

An iron-barred gate leads north.

>go north
(first opening the iron-barred gate)
You shouldn't be able to open it, heavy as it is, but it swings aside lightly at your touch. The Beast said that it knows friend from enemy; and the castle, at least, still regards you as friend.

Entrance Hall
There is no fire in the big fireplace, and no one is waiting for you here; the air is very cold. Over the gate, the old familiar warning sign is painted.

Various passages lead deeper into the castle: north towards the central courtyard, southwest to the guard tower, east and west into the libraries, the offices, the galleries. Somewhere in this maze, he waits; and he should be told as soon as possible that you did return.

An iron-barred gate leads south to the drawbridge.

>go south

Figure 1 - Bronze traversal 1

[5] https://ifcomp.org
[6] https://ifdb.tads.org/viewgame?id=9p8kh3im2j9h2881

Drawbridge
There is little enough purpose in loitering outside: He and his servants never come out here, and whatever you must do, you will have to do within.

An iron-barred gate leads north to the entrance hall.

>south
From here, you can head north.

>north

Entrance Hall
There is no fire in the big fireplace; the air is very cold. Over the gate, the old familiar warning sign is painted.

Various passages lead deeper into the castle: north towards the central courtyard, southwest to the guard tower, east and west into the libraries, the offices, the galleries. Somewhere in this maze, he waits; and he should be told as soon as possible that you did return.

An iron-barred gate leads south to the drawbridge.

>west

Figure 2 - Bronze traversal 2

Great Dining Hall
Such a long hall that the soup might get cold between one end and the other. You and he used only the far west end, nearest the kitchen. Once you took to dining together at all, that is; the first few months he brought trays to your room, while you hid.

But then you took to eating here; and at the end of every meal he would stand up formally and ask his question.

"You can leave at any time," he said, when he first spoke to you. You stared at him, surprised that someone with his face and teeth was capable of human communication. "Would you like to go?"

There are other memories, more recent, of course. Every glance around the room reminds you of a different one.

>west

Enormous Kitchen
Haunted with the spirits of chefs past, generations and generations of culinary geniuses; one can never predict its whimsies. Unless he has moved everything, the bell to summon them into action should be in one of the rooms upstairs.

>west
From here, you can head north and east.

>north

Servant Quarters
You've never come here before, and now you see why. Not a room friendly to visitors, it has the air of resentful, martyred suffering. Even His most unpleasant ancestors would not have grudged this place more paint, surely, and more straw for the beds.

A decaying ladder leads down.

>down

Darkness
Though a dim light filters down from the servant quarters, you can see almost nothing of the contents of your current location. You find yourself concentrating all the more alertly on your hearing, as though the slightest echo might offer a clue.

You hear some dry sifting from the northeast.

>

Figure 3 - Bronze traversal 3

During the same time that *Adventure* and *Zork* were gaining traction, in the discipline of Hypertext, scholars began experimenting with another interactive storytelling form called hypertext fiction. Hypertext fiction is a form of fiction in where a narrative will contain hyperlinks within the text which when evoked will replace the current passage with another passage elsewhere in the narrative (Moulthrop and Kaplan, 1991; Nelson, 1965). The closest to a hypertext fiction work is the functionality of a website on the web which contains several hyperlinks connecting different pages within the website or to another place on the web. The term *hypertext* was coined by philosopher and Information Technology pioneer Ted Nelson in 1965 as *"a body of written or pictorial material interconnected in such a complex way that it could not conveniently be presented or represented on paper"* (Nelson, 1965, p.96). The first piece of literary work accredited as hypertext fiction, is author Michael Joyce's *Afternoon, a story*[7] presented in 1987 at the first ACM (Association for Computing Machinery) Hypertext conference as part of a demonstration for *Storyspace*[8], a hypertext authoring tool specifically designed for hypertext fiction (Bolter and Joyce, 1987). *Afternoon* is a story where interaction is achieved through hyperlinks embedded in the text, while the narrators describe their account and what may have happened with an accident which the main protagonist has witnessed (Moulthrop and Kaplan, 1991). The story is published and maintained by *Eastgate Systems*[9], one of the few known publishers of hypertext fiction today. *Afternoon* was followed by similar pieces of work, some of them very well-known, Shelley Jackson's *Patchwork Girl*[10], Stuart Moulthrop's *Victory Garden*[11], and Mark Bernstein's *Those Trojan Girls*[12], all published and maintained by *Eastgate Systems*.

An example of a hypertext fiction story is, among the early hypertext fictions, *Victory Garden* by Stuart Moulthrop. The story is purely text based and contains hyperlinks within the passage that can transport the reader to a different passage depending on

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[7] http://eastgate.com/catalog/Afternoon.html
[8] http://www.eastgate.com/storyspace/index.html
[9] http://www.eastgate.com
[10] http://www.eastgate.com/catalog/PatchworkGirl.html
[11] http://www.eastgate.com/catalog/VictoryGarden.html
[12] http://www.eastgate.com/catalog/ThoseTrojanGirls.html

their choices. Evidence of the links are shown in the figures below. Figure 4 shows the traversal of *Victory Garden*, situated at a node titled *Now Here This.* The outline to the left is indicative of which node is currently read and at which chapter that node belongs to. Figure 5 shows the passage that the reader arrives after clicking on the word *Slacktown* shown at the final sentences in Figure 4. This was a shift in nodes belonging to the same chapter however it is possible to shift from a node in one chapter to a node in another chapter and carry on reading an entirely different part of the narrative. As such one cannot predict here where in the narrative they can land while reading as well as when the end of the narrative is due.

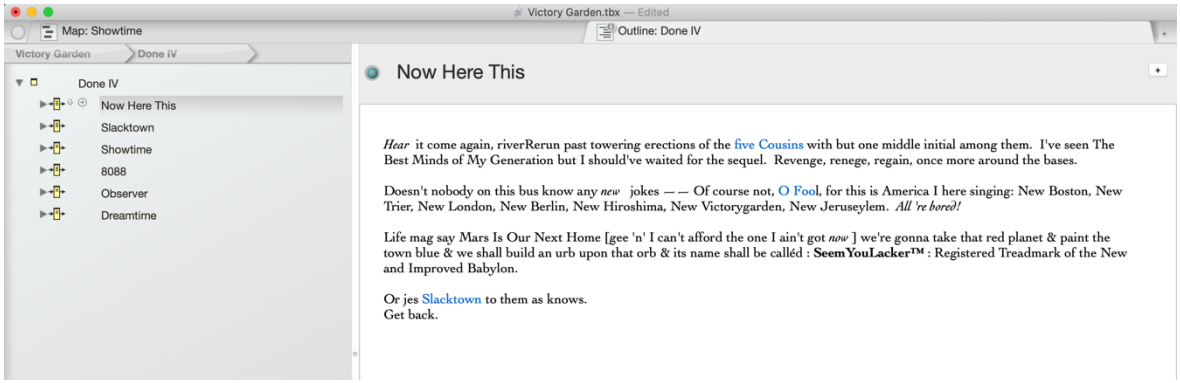


Figure 4 - Victory Garden traversal 1

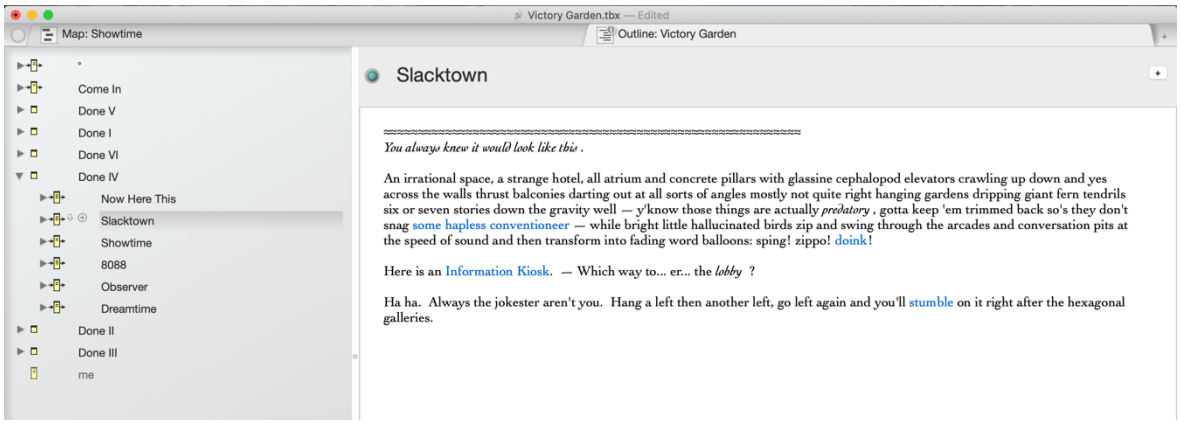


Figure 5 - Victory Garden traversal 2

As soon as hypertext writing was established, hypertext storytelling and narratives were discussed (Bernstein, 2015). Links and branching, the main elements of hypertext, have set the basis for many digital narrative forms that exist today (Rettberg, 2015). Before the web was created and before the world discovered websites and hyperlinks, hypertext

systems were making hypertext writing possible, and programmers were creating digital interactive literature. Sometimes with the aid of artificial intelligence. Interactivity has been the crucial element for these kinds of fiction since the beginning, and has remained so today, however elaborated. Other forms of interactive digital narratives include interactive cinema, interactive performances, video game narratives, virtual and alternate reality applications and other experimental forms (Koenitz et al., 2015b). All of these forms are defined by Koenitz (2015) as narrative forms implemented via a computational system and experienced via a participatory process that results in instantiated narrative products. This research is looking into the narrative forms that are predominantly text-based and are concerned with literature. An appropriate term given by Aarseth (1997, p.1) in his exploration of cyber text is *ergodic literature*, where "*nontrivial effort is required to allow the reader to traverse the text*".

2.2 The interactive element

In conventional narratives, when people experience a story, they allow themselves to be imaginatively immersed in a space that falls outside of the physical environment. A door is shut to their surroundings and their minds create pictures of what the story world imagined by the author looks like. Everyone experiences the same story differently, in that each reader creates their own story world and imagines the characters via their own eyes. One hundred people can read the same story and reach the same ending, but the pictures of the setting, the characters, and the props will have been materialised differently in each of their minds. This is as far as interaction goes between person and story. Visualising a perception of a world another person has created. The plot, some will hate while some will like. All have no choice but to stand by and watch where the story will begin and end. A story may be revised, re-written, reproduced, but perceivers are always bound to accept it as it will be told to them. Whether they like it or not, is not up to them and there is nothing they can do about it. The medium that contains the story offers one form of interaction. To turn a page and carry on. In case of a visual story, one may do nothing. Every reader sees, reads and experiences the same words, the same events, the same plot and reaches the same

ending. Depending on the reader there may be an emotional stimulation if the narrative matches their personal experiences or succeeds to invoke their emotions somehow. When the story ends, it ends. If the story is re-read, the story will end the same way. There are no alternatives, the reader is a captive of the story and its author from beginning to end. When an author writes, they write their ideal plot and their ideal ending, and that is what the reader encounters.

In interactive narratives the reader becomes an active participant (Maher, 2006). They may be provided with the ability to decide how the plot will progress. To be considered digital interactive there must be a digitally generated narrative, a simulation of an environment and a set of rules to control the interaction between narrative and reader (Hayes-Roth et al., 1998; Montfort, 2005). There must be a point to the story where the reader will have to stop and think about the path they want to follow. There must be choices for the reader to think over and make a decision between them (Bernstein, 2011). The medium that contains the story must offer more than just the mechanics of navigating from one page to another. Readers might be questioned for an appropriate textual input for narrative progression. They might be faced with a set of choices to decide which one suits their preferences best according to the situation in the plot. When the story ends, it may begin again, and end differently. There can be two or more different endings. The experience of a narrative becomes personal. The author still has the reader captive, but there is no way to know how the reader will decide to traverse the story and in case of more than one ending, which one they reached. In case of one ending and multiple paths, the author cannot know which path the reader followed. In interactive storytelling readers may be required to steer the plot, and if their hand is on the wheel the destination is their own doing (Bernstein, 2019). The author controls the narrative as far as plotting the possible routes and endings. Some control is passed on to the reader when they decide the sequence which the narrative is read (Pope, 2007). Readers are given a choice, and while choices are eminent even when reading a book, as they can choose when to pause or stop reading, whether they want to skip some parts and move on to others, those are choices of free will. The choices readers have with interactive narratives are a must (Bernstein, 2015). Readers must

make a choice via a link or a textual command for example, in order to proceed. Otherwise, the narrative is inherently half-finished. If a choice is not made then a story will be half untold and in the words of Mitchell (2004, p.65), *"a half-read book is a half-finished love affair"*.

In addition to enforcing choice, interactivity offers the possibility of embracing a story from different perspectives, almost like looking into a story from a kaleidoscopic view, and the ability to immerse oneself in the narrative on a deeper level (Murray, 2018). Murray (2018) describes the conventional storytelling methods of print-based novels, film and TV shows *unisequential*. The non-linear storytelling methods that represent branching narratives and procedural scenarios she and Landow (2009) call *multisequential*. The term refers to coherence of paths in a story with variable parts or multiple readings that take the form of a sequence. The common element between the two terms, whether a story is *unisequential* or *multisequential* is their ability to offer a sense of anticipation (Murray, 2011). When one experiences any kind of narrative no matter the outcome, if not the satisfactory element of feeding their anticipation to an ideal conclusion one wants to at least feel a sense of closure. When one looks at a book, they know roughly how close the end is by looking at how thick the collection of pages left is. One can suspect it is almost time for closure because it is viewably anticipated. The same happens when one watches a film or a show. One always knows or can roughly estimate how close the end is. Closure is different when compared to interactive narratives because with most of them there is no knowing when the closure will be encountered. The reader cannot be sure whether they will encounter an endless traversal of hyperlinks or whether the story will finish sooner than anticipated (Bernstein, 2015). The same applies for the author, as well as how a reader cannot be sure when they are finished, without a definite beginning or end, when everything is middle, the author may not be sure either (Coover, 1992). There is also the case that with multiple paths to the ending, there may not be a balance in size for each path and a reader may come to an end through a short path wondering whether the reading was worth it. That stresses authors who risk their work being badly criticised if the best part of their story is missed by poor content traversal.

On the other hand, closure in interactive narratives means that if the author gives the reader seven different endings and the reader knows they can reach seven different conclusions, they can choose to hate one ending but they will not be compelled to go away with it because they can re-visit the story and reach another ending that will satisfy them. According to Smith (1996), this personalised pursuit of narrative paths compensates the loss of coherence, hierarchy and reading tradition, because readers make the traversal their own.

The 2016 Chinese film *Irresistible Love,* based on a novel by Lan Lin, tells the story of a boy adopted and raised by a wealthy family as an obedient companion to the family's son. Growing up, the heir had been overly protective and possessive of the orphan who despite having to obey every demand from the heir no matter obscenity, lived a full and wealthy life beside him. As their relationship matured, the orphan began to have romantic feelings towards his adoptee who was appalled by the idea of homosexuality. Yet his actions towards the orphan always indicated otherwise. Following a series of dramatic events, leading to the heir's realisation that despite a primitive hatred towards the truth in the feelings of his adopted friend, his feelings were reciprocated. The movie was filmed in two parts, the second part with two different endings. The first ending leaves the audience with a traffic accident and the death of the orphan which meant that the two protagonists' love was left undone and in sorrow. The second ending leaves the audience with the same traffic accident, but where the orphan gets badly injured, disappears for three years to protect his lover's reputation as a businessman before the heir finds and reconnects with him. There the movie ended in good spirits and a love complete. The two different endings take roughly fifteen minutes from the end of the whole film and they are the only parts that differ. Even though it was a matter of personal choice and not so much interactivity, the chance to end up with the desired ending, exemplars one of the default possibilities that interactive narratives offer. The author has chosen to release two endings, and the audience was free to watch whichever satisfied them. Precisely, with interactive narratives, it is possible to offer a set of endings to closely reflect the preferences of many readers and give them their closure of preference. Even if it means revisiting the same words as before to make a different

choice, the new reading will provoke new thoughts (Bernstein, 2015). Readers can keep re-reading until they are happy that the ending reached makes sense or reasons with them. With a non-interactive film such as *Irresistible Love* the experience is not personalised to the individual and the element of interaction is absent. Had the film been interactive, the experience would be adapted to the individual spectator and the spectator would feel immersed in a journey stirred by their own guidance. Interactivity offers personalised narrative experiences (Murray, 2017).

Mulholland and Collins (2002) tell us that the potential of interactive digital narratives lies in the immersion of a reader in a story, which can be as deep as protruding feelings of belonging within the space of the story or as attaching themselves to characters in the story. Immersion by interaction is losing sense of the real to become part of a story world by engaging in actions within that world (Mateas, 2001). Immersion in a story changes because participation in the narrative feels more real. The reader is no longer merely a viewer. Adjoined with immersion is also transformation, which is present by allowing the reader to transform in one of the story characters, through the different variations of the plot, and through the personal journey to the end of the story (Mateas, 2001). By interacting with the story, immersion comes natural depending on the role a reader holds. If the reader is enacting the protagonist or another character in the story, then they are transformed into another person other than their own self. As a character in a story world, the outside world is transformed into that of the story, and with each action defining the plot, the narrative transforms into the reader's personal journey.

Assisting in this deeper feeling of immersion and allowing the sense of transformation is the amount of authority the author decides to grant the reader, otherwise known as the agency. Readers can witness the effects of their actions on the plot and the more active a reader is within a story world the more enhanced the immersion in the environment is (Murray, 2017). Agency is what grants power and a sense of responsibility over the narrative to the reader because as Bernstein (2019, p.35) wrote: *"In the theatre, Ophelia dies nightly and twice on Sunday, but it's not our fault: the tragedy will unfold whether we go to the theatre or stay home. If we have agency…it is precisely our fault: Ophelia*

drowns if we fail to prevent it". Wood (2017) explains that the sense of agency will depend on how the author will create the narrative's *fabula* (raw material of the story in chronological events) and *syuzet* (how the events are arranged and conceived through the narrative). When the author provides agency via interactive elements such as hyperlinks, non-sequential reading, text assertions etc. on story events, the *syuzet* becomes dynamic in a fixed fabula which creates a personalised experience of the narrative for the reader. She also mentions the possibility of an author providing a fixed *syuzet* by using the interactive elements to grant control on the raw material thus allowing readers to form their own variations of what becomes a dynamic *fabula*. However this may be more prevalent in improvised interactive forms such as interactive theatre rather than any of the interactive digital narrative forms (Wood, 2017). Granting a reader such power in agency and free will to make their own interpretations or variations of the narrative has raised discussions on whether they should own the role of an author as well (Murray, 2017). Crediting them with co-authorship. Being able to determine where the plot is going and which ending to resort to in an interactive digital narrative for the interactor or the reader holds an amount of power not relevant to authoring. A reader might be complicit to what happens in a transitive story according to Bernstein (2019) i.e. if there is a choice on whether the wolf will eat Red Riding Hood's grandmother or not, but the choice is set by the author. Whatever the reader chooses will still be a predesigned path set out by the author as an alternative to another path. It is all going to be the plan of the author no matter how many endings or plot traversals a story shall entail. Readers or interactors as Murray (2017) calls them and as she states *"can only act within the possibilities established by the writing"* (Murray, 2017, p.187). A reader is no more an author in interactive digital narratives as they are in non-interactive narratives. The control they are offered in the digital space is predetermined and pre-established. The author may not be aware which events in the plot will be witnessed or experienced, but they will know all the possible routes and endings available. In conclusion, readers are not automatically co-authoring. They are readers with agency.

2.3 The interactive author

Aristotle (2008, p.7) said "*the poet is a poet because they create myths, and not so because they make lyrics".* Being an author, is more than being a writer (Foucault, 1969). Scholars have speculated what it means to be an author, and similarly here the role of the author is examined with regards to the specificity of authoring in the interactive narrative field. Here the author is referred to as interactive author for the purposes of the study however future studies in the field may prove that the term needs changing, enhancement or segregation depending on the interactive product the author is attempting to create. For simplicity, in this study the term interactive author is used for all the creators of interactive digital narratives. As opposed to the aforementioned speculations about what it means to be an author by the referenced scholars, the role of the interactive author is investigated here not as what the role means in society but as per the practises authors do in the authoring process specific to the interactive narrative field.

Writing is part of authoring, but it is not all there is to it. There is a process between and after the step of writing that can be considered as part of authoring. Forming an idea, planning how to arrange the events in a story, writing the content, editing the content are all things that contribute to the process of authoring. They stand as the whole process of creation. Interactive authoring is the same, with additional characteristics to the role of the interactive author. For the interactive author there is a new medium of storytelling built to accommodate interactivity making the author also a designer of a digital space (Coover, 1999). The systems used to author interactive narratives are built with complex mechanisms especially designed to do the things other mediums are not capable of. When those systems are also space-based, which means they allow for the creation of locative narratives - an example found in Hargood et al. (2018) - where the events unfold while a reader navigates the physical environment, the immersive and interactive feeling extends to the environment. This means that the interactive author has to consider not only characters and plot but also space and objects (Meyer, 2016). Designing this form of narrative requires the combination of an

author, content, a storytelling system, a reader and a means by which all these actors will communicate (Ben-Arie, 2009).

An author is presented with a new way of thinking and a new way of writing. There is no longer only the possibility of inventing a story and exposing it with an assortment of scenes and events, and the tool for writing is not just made to assist in writing the text. To be able to write an interactive narrative an author needs an appropriate authoring tool, and an open mind to new narrative implementations. Authoring, Murray (2017) tells us, becomes procedural, which makes writing involve not only text, but rules that will govern what the text will do. The text takes a life of its own because it can be replaced, revisited, or get lost. Everything that happens in the process of authoring a linear story is adjoined by the necessity to learn how to use an authoring tool, as well as comprehend how to create branching structures that will make a meaningful experience for the reader such that it exploits the possibilities of interactivity (Millard et al., 2018). The mind has to be prepared to combine a set of anticipated actions by the reader and provide a set of appropriate responses to those actions (Riedl, 2009). Interactive authors need to allow themselves to think in an asymmetrical, chaotic and non-sequential way. They need to master thinking about many plots in the space of one story or imagine a story that aligns with the environment and use that as the space of the narrative. There can be not one end to the story, not one possible path for navigating the narrative, and possibly not one way to begin reading. Interactive authors must be conscious that traversal will be controlled by the reader, and need to make sure that the control they give is enough to make sense for the reader while exploring the narrative, rather than encountering dead ends or losing interest in random choices (Kolb, 2009). They need to trust that their work will pierce through the emotional response of the audience and they need to do so in a way that the audience will open up and let their trust in the hands of the author (Glassner, 2001). The interactive author needs to be able to understand that the authoring tool of their choice gives them possibilities to create something extraordinary and ideally match their thoughts with an authoring tool built to guide them through the process of creating that story. A story is

no longer a sequence of events, it becomes a series of events interconnected with each other, predetermined by the author and influenced by the reader (Spierling, 2009).

Finally, interactive authors should be conscious that a tool might have an immediate impact on the narrative and that the better the tool is understood, the better the quality of the narrative is likely to be. The more extensively the tool and its affordances are exploited the more novel and complex the end product can be. If either the author is not aligning their thoughts with what the tool can offer and can only imagine a predetermined plot or outcome or the authoring tool is designed as such that it restricts the authors' attempt to imagine anything beyond the nonlinear novel then the possibilities of digital interactive storytelling are automatically restricted (Dang et al., 2011; Louchart et al., 2008). This might be considered as a form of technological determinism (Dafoe, 2015). In this thesis a partial view of this theory will be relevant where it is discussed how the authoring tools inform the creative mind and process of an author. The view is only partial here because it is argued that the existence and furthermore quality of the tools is predominantly an enabler in the existence and quality of digital interactive stories as new types of digital technology enable new types of interactive art.

2.4 Summary

This chapter has introduced the field of digital interactive storytelling through an account of the history of how the digital literary form was inspired, it has explained what makes this discipline different from the traditional and non-interactive storytelling forms and it has also discussed the role of the author in the interactive narrative as to the additional actions the authoring process includes for them.

The following chapter will explain what enabled this form to initially exist and what helped in its progression and survival in recent times by introducing and giving an account on the tools that make the creation of relevant stories possible.

Chapter 3 Authoring Tools

3.1 Early authoring systems

Twenty years after Ted Nelson coined the term *hypertext,* in 1987 at the University of North Carolina (UNC) Chapel Hill, experts from around the world had gathered to discuss all things hypertext (Barnet, 2013). The highlight of that conference was a series of demonstrations on hypertext systems developed across the globe by a variety of professionals and academics. All these systems were derivatives of visionary systems whose purpose was articulated by Vannevar Bush, Douglas Englebart and Ted Nelson. Bush and his vision *Memex* (Memory Extender), Englebart and his system *NLS* (oN-Line System), and Nelson's vision *XANADU* have been perhaps the three most significant contributions into developing an understanding on creating, interconnecting, and retrieving human knowledge long before the web was created (Barnet, 2013). *Memex* and *XANADU* never became a reality, their plans for development remain on paper through essays and academic papers (Bush, 1945; Nelson, 1965). Yet their reputation survived the test of time to inspire almost every hypertext system presented in that first hypertext conference. They all wanted to create systems that would provide easy access to information instantly and interpret human knowledge. Systems that would be of aid to the human mind, pertaining human memory in one place. Bush's *Memex* being ahead of hypertext time during the 1940s, was envisioned as an electro-optical device system that would store information on microfilm (Barnet, 2013). Engelbart's *NLS* developed in the 1960s had the philosophy that you can link anything anywhere. It was a computer system with a screen and a mouse that aided in content exploration and manipulation. Engelbart demonstrated the system in 1968 at a combined ACM/IEEE (Association for Computing Machinery/Institute of Electrical and Electronics Engineers) Computer Conference, thus introducing the computer mouse

for the first time. Until today his ground breaking demo is referred to "*the mother of all demonstrations*[13]" (Barnet, 2013).

Meanwhile, Nelson had already a clear vision of *XANADU* but after several attempts to create it with a variety of collaborators, none stood still as the ideal implementation Nelson had in mind and so *XANADU* was never created. Nelson wanted a system to store and retrieve information in all its versions with necessary metadata attached to it such as authorship, quotation, and linkage to other information that would be available worldwide. Nelson's vision for *XANADU* has been passed around and discussed with many researchers, one of them Andries Van Dam who was inspired to build his own hypertext system called *HES* (Hypertext Editing System), a system that was close to what Nelson envisioned but not close enough to satisfy his vision (Barnet, 2013). Van Dam would also go on to build *FRESS* (File Retrieval and Editing System), a better or improved version of Engelbart's *NLS* and an advanced version of *HES*. Finally, Van Dam would go on to build *Intermedia*, a system that was meant to allow multiple users to access the same content mainly targeted for use in teaching environments (Barnet, 2013).

All the aforementioned systems with the exception of *Intermedia*, were meant for single use to extend knowledge, write content, link content and retrieve information, each built based on a different model. Some were implemented, while some remain as fundamental visions that contributed knowledge to those who were built. Barnet (2013, p.116) summarizes *"early hypertext systems were built to embody particular visions about how the human mind and memory work, to represent the 'complex interconnections' that hold between ideas*". When demonstrations of systems begun in the first Hypertext conference in 1987, most of the aforementioned visionaries were there to present them. Their ideas were adjoined by systems such as the *WE* (Writing Environment), a hypertext writing system developed in UNC's Textlab (Smith et al., 1987), and Apple's *HyperCard* a hypertext and hypermedia system (Eck, 1989). Among

[13] https://www.youtube.com/watch?v=yJDv-zdhzMY

the pool of hypertext systems presented that day was also *Storyspace* (Bolter and Joyce, 1987). *Storyspace* is the first hypertext system designed specifically for hypertext literature and the only system presented in that conference that survived after Tim Burners Lee overtook the world with the largest and most widely used hypertext system, the World Wide Web (Barnet, 2013; Coover, 1992).

Professor and author Michael Joyce in the mid-1980s wanted to be able to write something that would narrate a possibility of ideas and their interconnections. A novel that changed with every reading. He told Barnet in 1998 *"I wanted, quite simply, to write a novel that would change in successive readings and to make those changing versions according to the connections that I had for some time naturally discovered in the process of writing and that I wanted my readers to share"* (Barnet, 2013; The Literary Platform, 2014). Joyce had an idea for a novel but needed a system to help him construct that idea. Professor Jay David Bolter had similar thoughts on the association of ideas and what infrastructure of system would be suitable for writing them. The two met, shared their visions, exchanged their ideas and a collaboration began for the envisioning of a hypertext tool, meant to be used for writing a novel (Barnet, 2013). Their idea was based on the hypertext infrastructure as the combination of natural language text accessed through a digital medium, branched together via electronic links.

Following discussions with one of Bolter's colleagues at UNC, Professor John B. Smith, Bolter and Joyce set out to create their authoring system. Professor Smith had at the time been involved with the development of another writing tool which he also presented at the Hypertext conference in 1987, however he was not so interested in writing hypertext when that was fiction. On the other hand in their approach to bring creative writing into hypertext Bolter and Joyce (1987) created and presented *Storyspace*, according to them, a hypertext system they created for authoring and reading flexible interactive fiction. While they mention interactive fiction in their paper, neither Bolter nor Joyce considered at the time that it was a term many were using to refer to text adventure games. In their mind, they had a branching structure of passages that constituted hypertext fiction. In fact, their introduction to *Storyspace*

stated *"Storyspace, then, is a simple system for hypertextual fiction"* (Bolter and Joyce, 1987, p.44). Distinguishing thus what *Storyspace* was made for, from text adventure and other parser-based interactive fiction works. To demonstrate what *Storyspace* could do, Bolter and Joyce made available the story Joyce was working on at the time (*afternoon, a story*) as a prime example, subsequently making both system and story the first of their kind in hypertext literature.

Storyspace, has a hypertext structural editor that represents textual episodes as boxes and connections between them as arrows (hyperlinks). With an interface split into two modes: one for the author who can use the editing mode to create episodes and link them together; and one for the reader who can use the reading mode to see the structure of the story and traverse it, *Storyspace* implements hypertext structures to create its own kind of interactive story. Figure 6 below is an example of how the visual structure of authoring an interactive story in *Storyspace* looked when the system was first introduced, and Figure 7 shows the interface of *Storyspace* today:

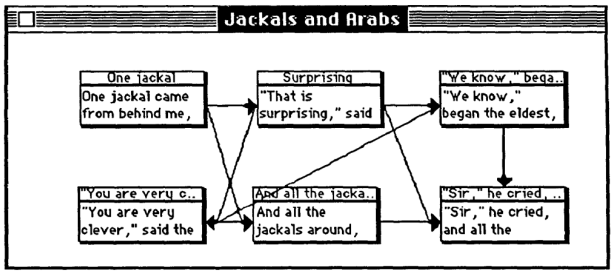


Figure 6 - Storyspace 1 user interface (taken from (Bolter and Joyce, 1987))

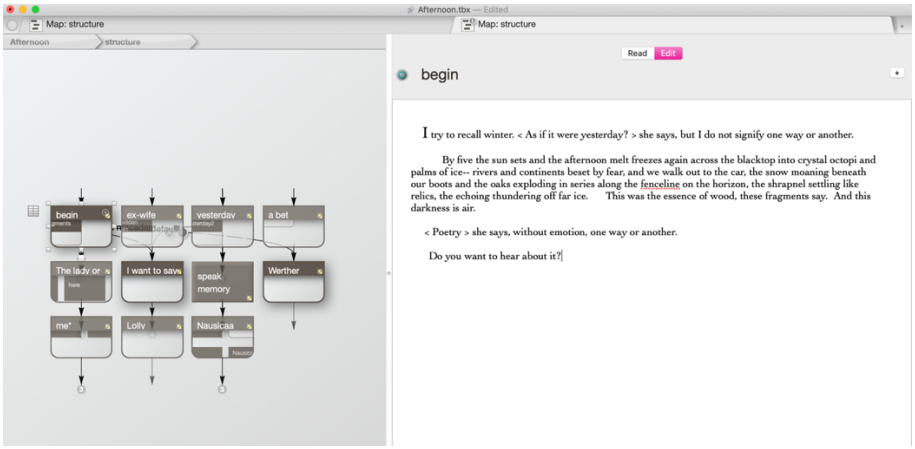


Figure 7 - Storyspace 3 authoring editor (2020)

The first version of *Storyspace* in Figure 6 was the one used by Joyce to author *afternoon, a story* in 1986. The story was published in 1994 by *Eastgate systems* who have obtained the rights to *Storyspace. afternoon* can still be purchased today. The story is a tangle of textual nodes that narrate from perspectives of different protagonists and incidents what happened in the life of Peter who begins the narrative thinking he may have witnessed a road incident involving his ex-wife and son. A reader is faced with several hyperlinks while traversing the text in the story and is transferred from one point in the narrative to another, sometimes half-way through a page. There is no knowing where the reader will end up in the narrative. Many hypertext authoring tools followed *Storyspace* and many hypertext stories followed *afternoon, a story.*

When William Crowther's first interactive fiction game *Adventure* was re-released by Don Woods of the Stanford AI (Artificial Intelligence) laboratory, a couple of students in the MIT computer science laboratory came across the game and quickly got infatuated with the idea. The students having felt that they wanted more from the game, set out to develop their own similar version of a text adventure game which in 1980 would be deemed the successor of *Adventure* in the text adventure games called *Zork* (Lebling et al., 1979). David Lebling, Marc Blanc and Timothy Anderson who wrote the game would become part of *Infocom*, the company that developed and published digital text adventure games. The company, founded in 1979, developed their own game interpreter called *Z-machine* to compile their games in files, playable on personal computers. With time the company started making a substantial amount of money through the adventure games and progressed to also develop non-game products before their sales started to decrease significantly around 1985. Ultimately *Infocom* went bankrupt and was purchased by *Activision*[14] a computer game company (Briceno et al., 2000).

[14] https://www.activision.com

The digital text adventures era could have come to an end with the primary developer and publisher of the work disappearing along with the source code of their *Z-machine*. However, a community of people fascinated by the art had already invested in the discipline and were keen to carry on playing as well as developing with whatever means possible text adventure games similar to the ones *Infocom* had developed. Having to create a game through writing computer code, during the late 80s and early 90s was less approachable for anyone without the skills to develop a game. This changed when a number of developers started creating specialised interactive fiction authoring tools that would require no programming skills and would be easy in use by any individual. Some of the first such authoring systems would be: *The Quill Adventure System* (later called *Professional Adventure Writer*) written by Graeme Yeandle and published by *Gilsoft* (company founded by Tim Gilberts whom Yeandle joined) in 1983, *TADS*[15] (Text Adventure Development System) written and released by Mike Roberts in 1987, and *Inform*[16] written and released by Graham Nelson in 1993 (Montfort, 2013). The latter two are widely used today by many interactive fiction authors and have been joined by an array of interactive fiction authoring tools used to create a variety of works, with *Inform* being perhaps the most popular.

Figure 8 below shows the authoring environment of *Inform*. *Inform* is a natural language authoring tool which uses a parser to compile its own natural language vocabulary into a virtual story world. Stories developed with *Inform* are exported into story files and can be accessed either via a browser or an interpreter that can translate the story file into a playable format. *Inform's* interactive element, being a text-based interactive fiction tool for readers, is evoked through the user interface by an exchange of textual commands.

[15] https://www.tads.org/

[16] http://inform7.com/

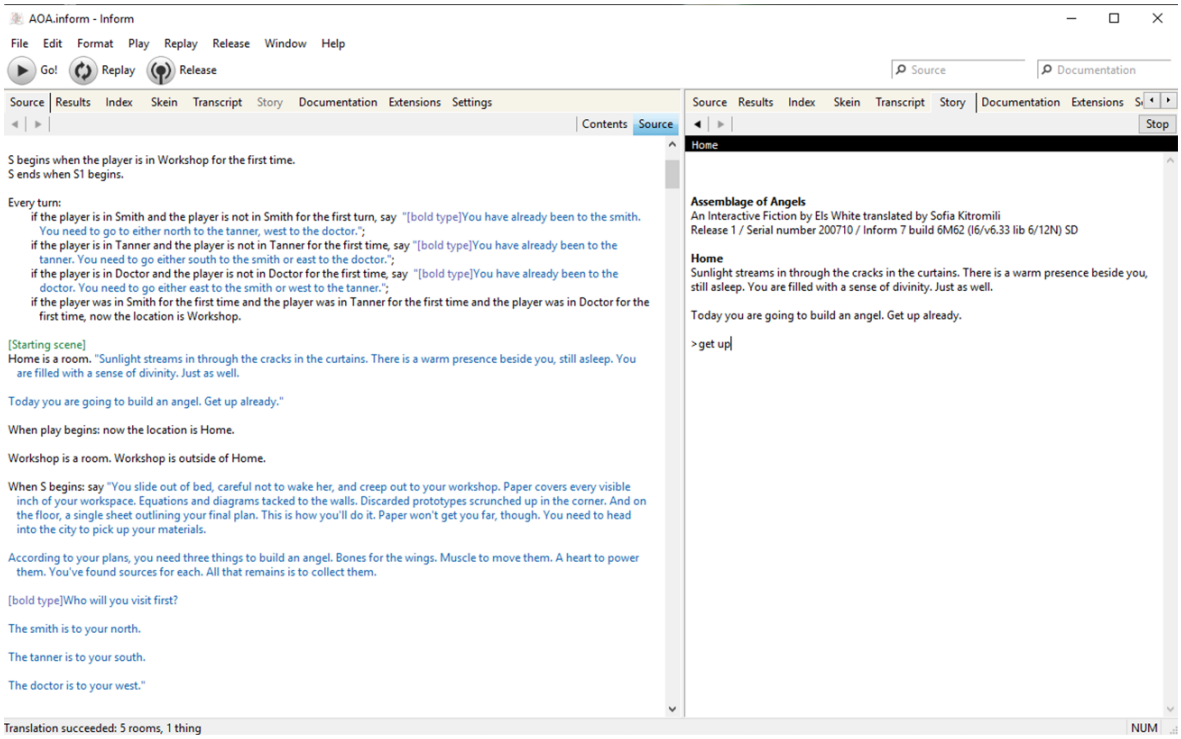


Figure 8 - Inform 7 authoring editor

A repository of stories exists in an Interactive Fiction archive[17], and community members can engage with one another through the Interactive Fiction forum[18] that discusses all things interactive fiction.

3.2 Modern authoring tools

When Tim Burners Lee created the Web in 1994 he gave a worldwide accessible home to hyperlinks (Connoly, 2000). Since then, their use expanded exponentially and so hypertext fiction, alongside parser-based fiction started becoming something everyone could get their hands on. Previously, authoring text-based digital narratives was a matter of research in an established academic laboratory or the brainchild of a skilled programmer. The Web was not the defining contribution that led to authoring tools, but it played a major contribution in their distribution and discovery by people around

[17] https://ifdb.tads.org/

[18] https://intfiction.org/

the world. Thus, authoring became accessible to a wider audience. Considering how technology has advanced since the 60s, 70s, and 80s, and what the World Wide Web has made possible while also affordable, the ability to write and publish stories has grown exponentially. From hypertext and hypermedia authoring systems to websites and blogs, and interactive authoring tools, the possibilities to author have escaped the barriers of the print medium and grew through the digital medium. When the digital medium arrived, it offered portability, a different form of navigation and freedom of writing against the print medium. Now the more recent digital interactive medium offers complexity in the exposition of the narrative, choices in the narrative traversal, kaleidoscopic views of the narrative structures not limited to sketching on a piece of paper, alternative plots through various interactive means, and the control to create a form of narrative which previous mediums were not able to do so (Bolter and Joyce, 1987; Knoller, 2012; Murray, 2018).

For a medium to be considered a narrative medium it must, according to Lowe (2009), satisfy two events. First it must be able to represent events as concrete experiences. Second it must be linear, as in stories written with them must be processed or read in a linear sequence. Digital interactive authoring tools are such a narrative medium however, the narratives produced with them are not necessarily subjected to only being read in a linear sequence. The art of authoring interactive narratives is mediated by the writing tool being used. Modern tools offer different patterns of narration, writing vocabularies and functionalities, all components influencing the authoring procedure. The shaping of a story depends on the material incorporated in the narrative, which may be text, images, sounds or any other digital media. The approach of authoring interactive narratives is that nodes act as content and links between nodes as the means to give context (Marshall and Shipman, 1995). Context can be represented by more than just hyperlinks or textual assertions as introduced in the early systems (Petrelli and Wright, 2009). Tools now allow multimedia, graphics, gameplay or locations embedded in the stories to enhance narration, navigation, content presentation and

reading. An example of a modern tool is *Storyplaces*[19], seen in Figure 9, a sculptural hypertext tool that uses GPS technologies to map location with passages of text (Hargood et al., 2016). Readers traverse a narrative by walking around the physical environment and unlock content when they step onto specific locations set by the author of the text.

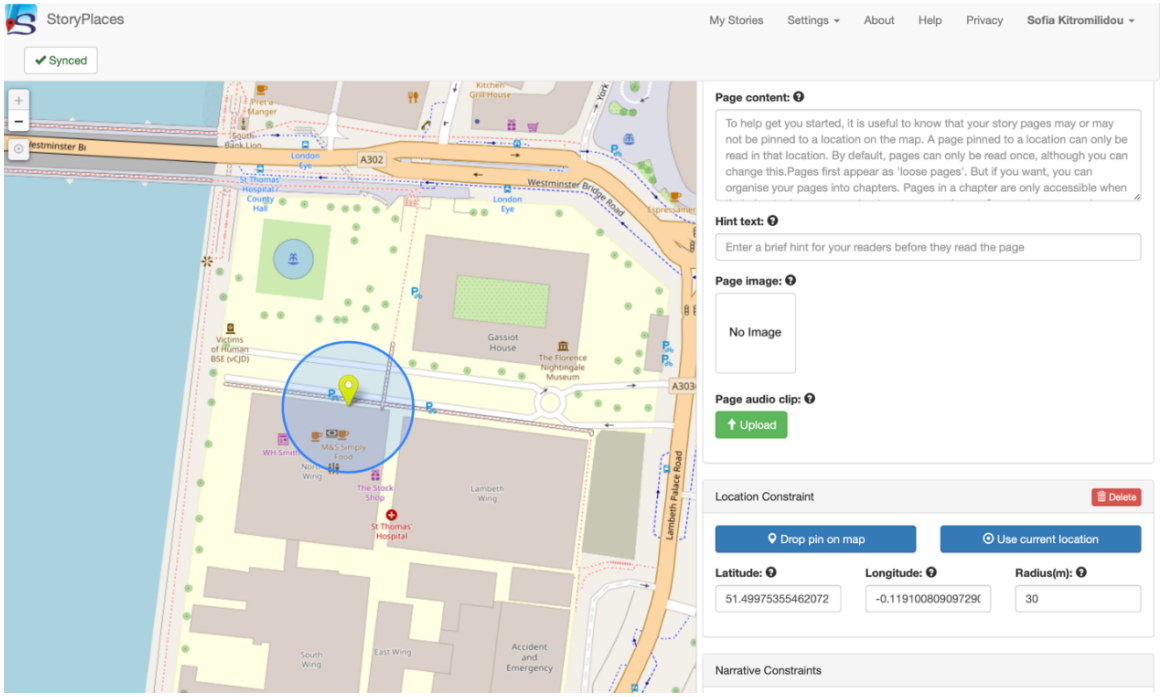


Figure 9 - Storyplaces authoring editor

Storyplaces is considered a hypertext tool like *Storyspace*. Unlike *Storyspace* which is tagged *calligraphic*, a term by Bernstein (1999) because it uses hyperlinks to connect nodes of text, *Storyplaces* is tagged as a *sculptural* hypertext tool an additional term by Bernstein et al. (2002) because nodes are already placed in the environment and connections between them are removed while a reader traverses a story (Packer et al., 2017).

A tool similar to *Storyspace,* and a favourite amongst the interactive authoring community is *Twine*[20]. *Twine* is a tool that resembles *Storyspace* in a simplest form. Twine is considered a *calligraphic* hypertext tool that works by connecting nodes of text

[19] http://Storyplaces.soton.ac.uk
[20] https://twinery.org

via links. Twine has three forms of story development (Harlowe, Snowman, Sugarcube) each one more advanced than the next to accommodate story building for people with different levels of programming knowledge. It has a simple user interface, and the authoring environment is hidden behind a spatial diagram of the connections between nodes. Figures 10 and 11 show the user interface of Twine.

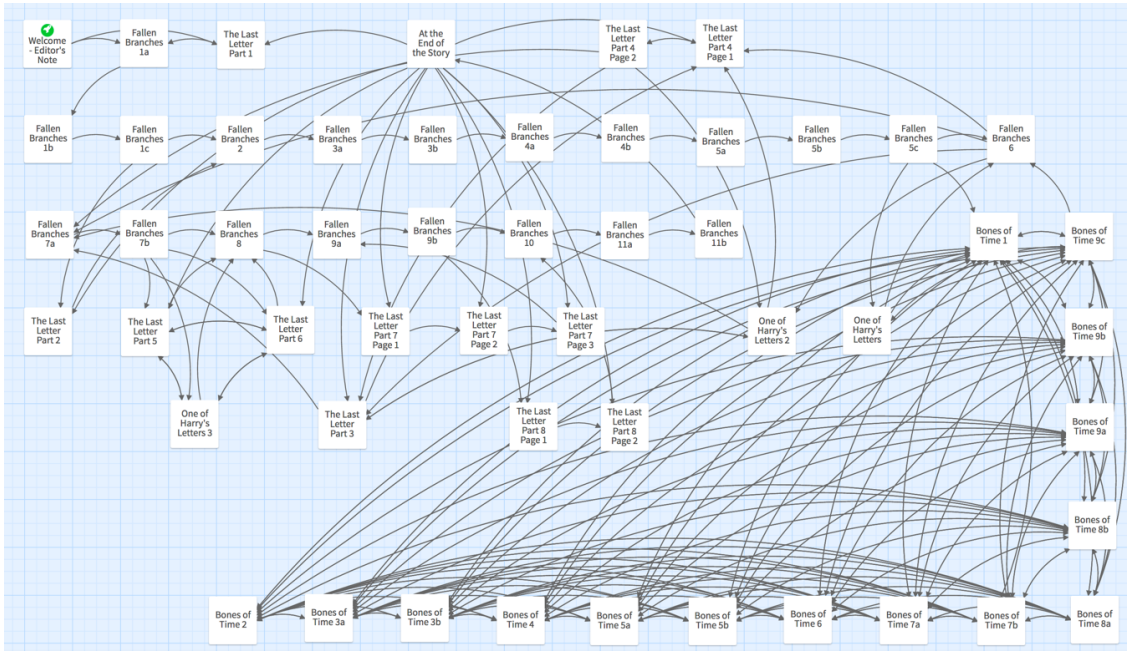


Figure 10 - Twine Map Screen

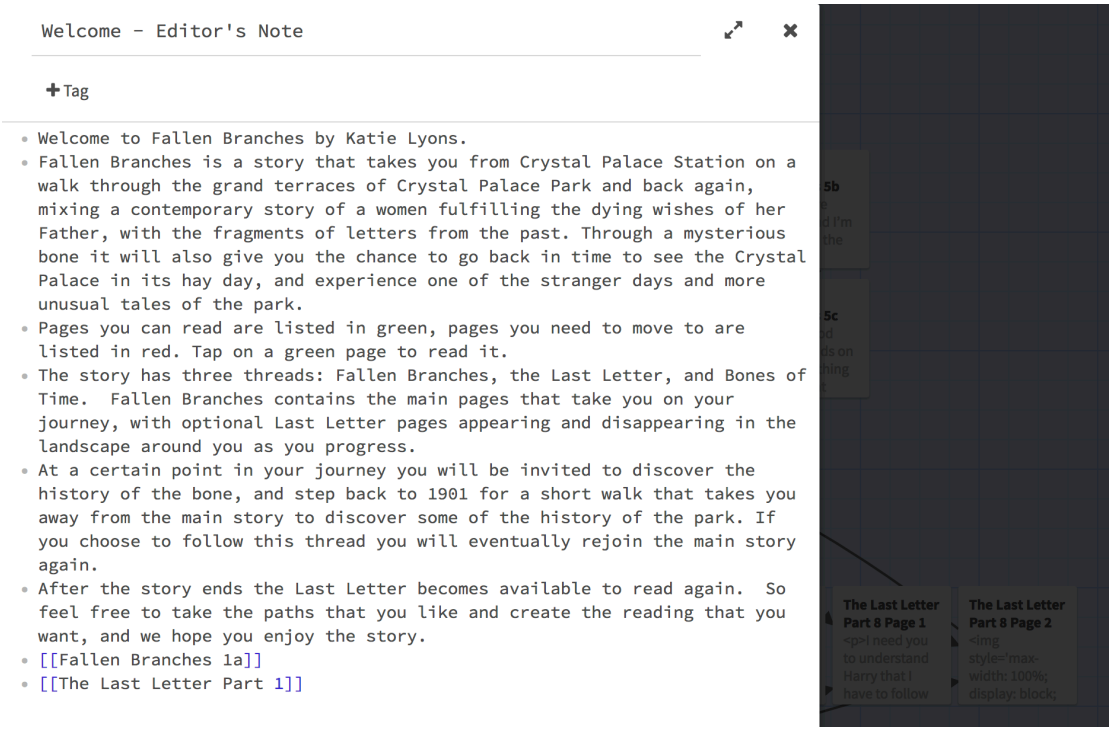


Figure 11 - Twine text editor

3.3 The need for authoring tools

Koenitz (2017) during a private communication with Jay David Bolter, one of *Storyspace's* developers, in 2010 quoted Bolter's saying: *"It is a common joke in the field that everybody wants to have their own authoring system".* A lot of people want to engage with a certain type of authoring tool that evidently has not been invented yet, and if it has, it does not suit exactly what they are looking for. Bernstein (2001, p.41) tells us that *"The customary reason for building a new system is to build a better system"* and Koenitz (2014) further supports that the reason behind various tools being developed is the difference in necessities that interactive digital narrative scholars face with their research direction, aesthetics and funding among others. That may well serve scholars in developing the perfect authoring tool for the work that they do, however as Koenitz (2014) also mentions the use of authoring tools extends as far as their own personal use. The reason being that they take on multiple roles and serve as their own content creators. Considering the increase in authoring tools over the past thirty years, it is a valid consideration to assume that authoring tools are constantly being developed to improve or serve specific needs. However, when those are not tested against the necessities of people who are going to use them in the long term, then usability issues are bound to arise, given the literacy of each user. On this occasion, each prospective author.

There are many digital interactive authoring tools out there and there are many people working towards the development of new ones. The development of new tools is a debate among scholars whether those are unnecessary and could do well into being part of general purpose authoring systems or whether those are indeed necessary to be developed (Koenitz, 2017). Green et al. (2018b) have done a survey to cluster into categories a set of authoring tools to begin work on defining the term *authoring tool*. They have sampled a set of 29 tools and based on a set of features they were able to create four clusters that represented what those tools can and cannot do. Similarly Shibolet and Knoller (2018) have set out to create a more comprehensive list of a meta-analysis on authoring tools where they present a framework for categorising and

describing tools. Among the interim conclusions of their work they suggested that *"More study is needed on how tools are actually used by authors - on the author's experience of the creative process"* and that *"Future tools should therefore pay specific and distinct attention to storyworld and interactive narrative structure, as well as to interaction model design, for example by creating distinct but interconnected design spaces for each of these aspects"* (Shibolet and Knoller, 2018, p.2). Evidence of tools developed in academia as well as a list of commercially available tools is provided in Appendix A. Reasons stated for the development of new authoring tools include:

- to re-develop similar authoring tools to improve on functionalities previous tools were either not offering or did not consider (De Bra et al., 2016; Göbel et al., 2008),
- to experiment with patterns of hypertext in narratives (Bernstein, 2001),
- to explore new story development tools (Hooper and Weal, 2005),
- to simplify the authoring process (De Bra et al., 2016; Foss and Cristea, 2010),
- to improve on authoring issues discovered on previous tools (Smits and De Bra, 2011).

Most tools developed are targeted for writers/authors. Some researchers specify non-technical authors (Cheong et al., 2008; Dade-Robertson, 2007; De Bra et al., 2016; Foss and Cristea, 2010; Göbel et al., 2008; Koenitz and Chen, 2012; Mitchell and McGee, 2012). A fraction of tools are targeted for a broad range of people or people that are not authors by profession but could exploit a digital interactive authoring tool to benefit their work (Díaz et al., 2015; Lynch et al., 2017). A frequent example are curators that could use them to create digital interactive experiences in museums (Iurgel, 2004; Wolff et al., 2013, 2012). With great transparency, over the years the purpose and technologies of authoring tools are increasing in variety. All the more researchers are experimenting with tools, more ideas arise to be incorporated into authoring tools. The main derivative is this - there is clearly no shortage of tools, yet there is an obvious shortage in understanding the authoring process accompanied by them.

3.4 The authoring concerns

Marshall and Irish (1989) have noted that similar to how readers used to find it hard to work through hypermedia presentations authors found it hard to create them. This was written when authoring tools had just begun to make an appearance and only a handful had been developed. Nearly twenty years later through a significant technological advancement in hypertext systems and generally authoring tools, Foss and Cristea (2010, p.83) noted that an adaptive hypermedia system is still complex to use as *"the authoring process for adaptive content is new and alien to most authors"*. Spierling and Szilas (2009) mentioned that there are more authoring tools' suggestions out there than there are solutions or work towards resolving general authoring problems. It is clear that while authoring tools have been increasing in number, the authoring issues have been increasing alongside them, and while the tools may be improving the range of narrative capabilities the issues remain unharmed. It was not entirely easy to create digital interactive narratives when they were first introduced, and precisely thirty years into the future, it still isn't.

Issues with authoring tools	***Reference***
"Creating hypertexts is complex because of the richness of interconnectivity that exists among nodes and links in hypertexts. As such, the demands placed on hypertext authors in authoring hypertexts cannot be underestimated."	(Theng et al., 1995)
"Link traversal requires design of coherence, transitions and context provided as traditional written forms" *"Screen layout requires graphical design skills"* *"Interactivity requires knowledge of human computer interactive practises"* *"Confinement from the authoring system"*	(Marshall and Irish, 1989)
"Storytelling models are usually constrained to the applications they are implemented in because of the particular characteristics of the data used to define story events and the way those events are linked"	(Nakasone and Ishizuka, 2006)
"Hard to clearly define what steps of creation fall within the scope of authoring and where the boundaries of so-called authoring tools are located" *"Formatted and constrained writing, potentials of engines underused, time consuming task for entering content, understanding of tool engine and storyworld"* *"Interaction design and deliberation of user experience"*	(Spierling and Szilas, 2009)
"Authoring process is very complex" *"Authoring process for adaptive content is new and alien to most authors"*	(Foss and Cristea, 2010)
"Content production for a graphical narrative is unlikely to be a one-man job. Writing and animating skills are different" *"Input of content depends on architecture of run time system"*	(Aylett et al., 2011)
"Lack of user-friendly interfaces" *"Conceptual difficulties in handling computational data for producing interactive drama"*	(Szilas et al., 2012)

Table 1 - List of authoring issues

This called for attention to some of the issues. Table 1 above lists some authoring issues recorded by several researchers during the development or evaluation of an authoring tool they have worked on.

Some of the authoring tools addressed on Table 1 above were presented as hypertext authoring tools and not specifically storytelling tools. Their issues are however interchangeable because as explained in Chapter 1, storytelling authoring tools are descendants of hypertext systems. Szilas et al. (2012) describes an issue of unfamiliarity when interacting with a system, that carries with it a certain set of computational modelling functionalities for non-linear and interactive narratology, is something foreign to the linear plots of narratives most authors are used to (Réty et al., 2008). Due to the computational models most of these authoring tools bear, there often exists a possibility that an author will be required to write code. Coding is also foreign to non-technical authors (Lynch et al., 2017). Many people are intimidated by code and if a tool is presented as a 'fits all hands' tool, it fails in this sense to invite authors who only wish to deal with natural language. Currently the need to learn how to script, code, or model are some of the basic abilities an author should have if they want to write an interactive digital narrative. That does not extend invitations to all sorts of authors, and this discipline is in desperate need of more creative authors.

A couple of issues discussed by Spierling and Szilas (2009) and Szilas et al. (2012) describe the lack of good and user-friendly interfaces. Medler and Magerko (2006) suggested that the user interface of an authoring tool should be intuitive and easy to use. Foss and Cristea (2010) supported that a tool must be consistent with existing tools and also interoperable with familiar story creation modes. These suggestions would improve the familiarity of an author with an authoring tool, but it raises the question on whether it is necessary to have more than one. If tools are to be consistent with existing applications in terms of the interface it makes sense that these tools offer a common authoring pattern. This way there would be no need to have more than one authoring tool offering a common authoring pattern. On the other hand, a 'one tool fits all types' approach in digital interactive storytelling would not be impossible in theory. Nonetheless, not every narrative pattern and storytelling engine can be combined into

one tool without it being overly complicated. Authoring tools are already deemed complicated for some authors. If more are to be created, as they have been so far, researchers must identify, record and share possible authoring issues they encounter. In addition to this, issues need to be identified not only by those actively involved in the development of a tool but from people who are blindly engaging with the tool with the sole conception of creating a new form of narrative.

Issues mentioned by Aylett et al. (2011) and Spierling and Szilas (2009) describe the difficulty of adding content in the tools. When developing a new authoring tool considering the author's demand, an author needs to be an active participant in either the development of the system's requirements or interface design. The most important aspect for an author and one that should always be an important consideration in every tool is the content creation. If the author can create an exceptional interactive piece of work with a well-designed narrative structure, the work shall fail as a narrative without exceptional content. The content should be the easiest thing to embed in any type of narrative. Spierling and Szilas (2009) mentioned that one of the problems authors faced when working with the selection of tools they developed was the time-consuming task of entering content into the system. A story without content is like a film without actors. There is nothing to relay the narrative therefore perhaps the most important feature all the tools should be concerned with is the input of content into their engines.

Finally, many issues discuss the general complexity of the author's work by the confinement and complex structures of linking and mapping the content within the tools (Aylett et al., 2011; Foss and Cristea, 2010; Marshall and Irish, 1989; Nakasone and Ishizuka, 2006; Spierling and Szilas, 2009; Theng et al., 1995). In simple terms *'*authoring is a complicated process*'*. Murray (2011, p.17) mentioned *"the measure of success is the experience of the interactor"* and she was addressing the interactor as the reader and the experience as the reading experience of an interactive digital narrative. Given that on the reading end of interactive digital narratives, the measure of success lies with the experience of the interactor, it may be implied that the measure of success on the authoring end, also lies with the experience of the interactor. More specifically, the author. If authors wish to engage with interactive digital narratives and they are

burdened to accept that the tool of their choice will affect their narrative, it is less likely that they will be encouraged to use it. The tool should be a positive enabler in the author's experience.

Digital interactive storytelling if utilised appropriately is set to open doors for fascinating experiences that will involve disciplines beyond literature, ludology or computing. While a lot of people are engaged in this discipline and have been committed in creating a good amount of work, digital interactive storytelling is still a relatively young and underfunded field with not enough advocates to help it expand. Koenitz et al. (2015c) explains that this is partly because there is a lot about the authoring process left to be understood. Authoring tools have been developed with the premise to simplify the authoring process and while on some level they succeed by being free and in most cases simple to use, they are still not as inviting to creative writers as they are to people interested in game development and coding. Traditional authors tend to think in a linear way that doesn't require linking and multidirectional plots (Coover, 1992). The possibilities for narrative design with the set of digital interactive writing tools available today on the other hand is not limited to that. They offer endless possibilities because they are programmed to follow a set of rules and constraints built for creative digital interactive storytelling.

On the other hand, the technicalities of being a restrictive system means that there is an additional hurdle to overcome. One of getting to know a tool and being able to use it without losing inspiration. An authoring tool should be an author's right hand. It should offer them space to be creative and the ability to write freely. Unavoidably the nature of these authoring tools makes them more difficult to handle, therefore restrictions on user intention, are to be expected. Authors need not only master the narrative by defining characters, plot, locations etc. but also the tool used for writing the narrative. Authors need to be re-educated in using these tools to write, and occupy their minds with additional thoughts when writing is itself a mind-consuming act (Coover, 1999).

Most of the modern tools are built to craft and accommodate a specific narrative design with constraints and structural components that influence the author into thinking in a particular manner, prior to engaging with creating a story. Aylett et al. (2011) explain that the solutions the tools offer to reconcile structure and interaction for the craft of interactive digital narratives is influential, however the main issue is that what is to be authored depends on the system architecture. The process in itself becomes contradictory to the creativity of crafting a story. When the tool limits the imagination, it naturally limits the artistry. On the other hand, when the artist is left to handle the tool with limited knowledge, imagination might not go past the possibilities the tool can provide. For example, in hypertext writing, simply creating links between passages does not make for an author understanding the possibilities of the medium (Landow, 2009). Yet trying to understand all these linking, labyrinthic networks with no fixed beginning, middle and ends, with no certain timeline is something that authors need to be taught as it falls outside of the traditional narrative pace (Coover, 1992; Smith, 1996).

Authors with a linear mindset are likely to stick to that process even if they desire to create an interactive narrative because that is the only way they have been taught. If they are forced to step outside of the traditional narrative boundaries, they will, but without an understanding of what they can do, they are likely to get lost in a maze of their own words (Coover, 1992). That unfortunately means that unless an author is programmatically skilled or has an advanced level of technical background, it is less likely that they will wish to engage with writing an interactive story (Kriegel et al., 2007). Whereas if they do, they will not exploit the form as expected. It is as if there is a locked door yearning to be opened by more creative minds such as creative writers and literary professionals, with authoring tools being their keys to opening those doors, however they do not know how to use them properly.

Szilas et al. (2012) pointed out that an authoring tool should allow authors to express their creativity. Ideally each and every one of these tools should not limit the purpose of an author rather inspire them when they are stuck and be visually clear on what extremities it can offer to their stories. This has not been possible for quite some years now (Spierling, 2009). However, if the author becomes a central agent into the

development of authoring tools, in the future there might be a way to bridge the communication gap between authors and digital interactive authoring tools. Systems should help authors project the same expressivity they would when writing a traditional narrative for an interactive narrative, without worrying about how the system works (Louchart et al., 2015; Stefnisson and Thue, 2017; Szilas, 2015).

This discipline needs systems that will make authors want to spend their time and effort in creating procedural stories (Aarseth, 1997; Murray, 2017). Murray (2017, p.287) states it best: *"If we are to reach the point where we can create complex computer-based characters with the same expressiveness that is true of the characters we now create with word masses and shots of film, then we must start by building authoring systems that will put the abstraction expertise of the precise computer scientist into the interpretive hands of the quirky artist".*

3.5 Summary

This chapter has introduced the early systems that made the digital literary form of interactive storytelling possible and discussed how modern systems allow the form to survive today. Then the chapter supported why the authoring tools are vital to the development of the form and raised some concerns that have been prevalent during the authoring process given their restrictive and technological influence on creative writing.

The following chapter is the first chapter that stands part of the study's overarching methodological approach and will describe two autoethnographic story adaptations with a set of modern digital interactive authoring tools - some of which were introduced in this chapter - that were conducted to examine the authoring process, record observations on the practise and issues of authoring and compare the different approaches of authoring.

Chapter 4 Autoethnographic story adaptations

4.1 Introduction

In 1987 when *Storyspace* was introduced, its creators demonstrated it as a simple system for hypertext fiction (Bolter and Joyce, 1987). The inclusion of authors to structural experiments of the tool's use has been an important factor into the development of *Storyspace* 3, the version of the system currently available (Bernstein, 2016). In many other cases, authors do not seem to be heavily involved in the development of an authoring tool or able to share their views on the computational and structural functionalities (Szilas, 2015). Experimenting with a system and performing user acceptance tests is one way to test and discover how well it functions and whether the interface is responsive and intuitive. With digital interactive authoring tools, testing the interface is only one hurdle to surpass. The greatest hurdle is the one that requires the content to be structured, linked and tested. This involves engaging not any type of user, but the only user who will possess the power to test the tool for how well it functions and how easy it is to use and author a story. In testing the tools, one must consider that with every other medium of storytelling, authors are able to produce content without having to concern themselves with how they will arrange the events and display the narrative. But with digital interactive storytelling mediums, they are concerned with this. Ideally how they are going to manipulate such tools in order to achieve what they intend to achieve. Authorial intent, Riedl (2009) indicates, should be manifested through a system that will allow an author to achieve their goals. Authoring experiments with the involvement of authors is essential during development, after completion, and during upgrades of tools since authors can provide as valuable input while designing a system as when they are testing it. Ultimately, they will be the users of the software in question and if they find it even the slightest complex or constraining, they will be inclined to give up on it.

4.2 Method of approach

Theng et al. (1995) while researching the potential difficulties authors experience when writing with hypertext systems, suggested a small list of functionalities that design systems such as writing tools should provide. They did a comparison on authoring tools assessing the ability of vendors to modify tools and the ability of users to use the tools. Pohl and Purgathofer (2000) compared linear authoring with hypertext authoring and set out to discover activities that authors of hypertext documents were mostly concentrating on. They achieved that by engaging students in authoring hypertext documents with *Dark Star* an authoring environment developed in the Vienna University of Technology by recording the students' actions as they wrote along. Via a granularity analysis where they measured the relative importance of each recorded action on a graph, they identified five classes of action: editing text and node titles, creating and deleting nodes, moving nodes, linking actions, other actions and the relative importance to an author. In doing so they were able to deduce information with regards to the authorial processes of hypertext documents. Spierling and Szilas (2009) performed authoring experiments to test the effects of creating story worlds based on the tools they developed. Their experiments enabled them to discover a number of issues encountered when trying to introduce their systems to authors and the difficulties the authors faced while using the systems. Swartjes and Theune (2009) performed two adaptation case studies with a multi-agent story generation tool while exploring the impact of story generation on the design process of authoring. One of their case studies was the reproduction of the *Little Red Riding Hood* story which they needed to alter if it were to be properly adapted with the authoring progression phases of their tool and to transform it into a non-linear narrative.

The need to understand how these tools work and what their impact on narratives is, comes from a practical and experimental point of view, and in order to understand how an author wishing to engage with a digital interactive authoring tool would be influenced, how the interaction with the tool would affect the story, and how an author would

approach design patterns, it was appropriate to compare adapting a story between a small set of authoring tools. A combined comparative (similar to Theng et al. (1995)), and adaptive (similar to Swartjes and Theune (2009)) approach was taken here with a set of three digital interactive authoring tools in the form of autoethnographic story adaptations. While Swartjes and Theune (2009) called their adaptations case studies here the story adaptations are referred to as autoethnographic story adaptations to reflect better that the adaptation approach is based on and influenced by the researcher's personal experience. While autoethnography is used more commonly to examine cultural settings according to (Adams et al., 2017) here it is used in the context of examining the personal process of authoring in interactive digital narratives as a series of actions rather than form knowledge of its relation to any parts of society and culture.

The study features *Twine* a hypertext tool similar to *Storyspace*, *Inform 7* a natural language interactive fiction tool, and *Storyplaces* a locative literature tool. Two adaptations have been conducted over two stories written with *Storyplaces* and *Twine*. *Storyplaces* and *Twine* are both hypertext-based authoring tools, however one is specifically designed to accommodate locative story elements while the other is purely designed for branching story elements. Both story adaptations consist of a story taken from one tool and adapted to two other tools. The adaptations were an attempt to grasp the design approaches of a story using a set of different tools and the impact on the narrative of trying to fit it within the constructs of a specific tool. First, a story originally written with *Storyplaces* was adapted to *Twine* and *Inform 7*. This first adaptation deduced some observations on the impact of authoring a locative story to non-locative specific tools thus influencing an expansion to the experiment of repeating the adaptation using a non-locative story and trying to author it with a location aware tool. Given that three tools were involved, this would mean repeating the adaptation process thrice. However, due to *Inform 7's* locative constructs of creating and navigating a story world and the similarities in story mechanics with *Storyplaces,* minus the physical environment, it was assumed that repeating the adaptation with this tool as an originator would most

likely deduct similar observations as those obtained with the first adaptation. *Twine* on the other hand, completely omits the necessary use of locations making it ideal for repeating the adaptation in reverse by taking a non-locative story on this occasion and turning it into a locative story. Thus, the tools would be strained for functionality per the author's demands and allow for a newly formed perspective of what the authoring process entails either way.

4.3 Story adaptation 1: Fallen Branches

4.3.1 The story

The first story selected for adaptation is called *Fallen Branches* by author Katie Lyons, published on the *Storyplaces* platform in 2017. As a story of around ten thousand words, it was of manageable size and complexity for this project.

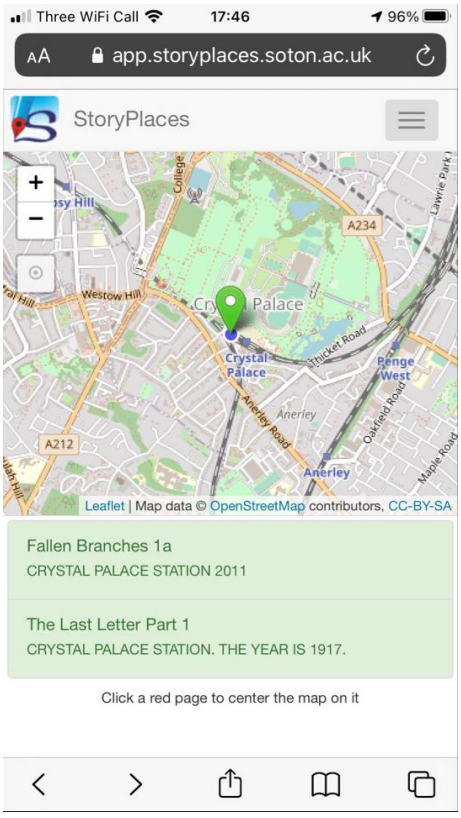


Figure 12 - Screenshot of reading Fallen Branches

A reading of a story with *Storyplaces* requires a portable device with GPS enabled and connected to the web. The story is accessed through a website and works by demonstrating a map of the locations the story took place. Locations to be visited for content to be unlocked are marked on the map and the story unfolds when the content is revealed.

Fallen branches is a story about a young woman named Sandy who was tasked by her late father to take a bundle of letters to an old woman in Crystal Palace Park and an old artefact (an elephant bone) to a museum curator at the park. Upon arrival Sandy begins a day's journey throughout Crystal Palace Park to meet with those people, and also to her surprise, learn more about her family's heritage. The story is well spread in Crystal Palace Park and takes roughly 90 minutes to read uninterrupted.

The intention of the author when authoring with *Storyplaces* was to create three story threads: one for the main story called *Fallen Branches*; one where story events are described in the form of letters between two lovers called *The Last Letters* and *Harry's Letters*, and one where an old tale of two elephants from the past is described called *Bones of Times*. The only path readers need to read to complete the story is the *Fallen Branches* thread. Anything else in the story is subjected to the choices and course of reading readers follow. The *Last Letters* and *Harry's Letters* are revealed in the landscape and unlocked at specific locations as well as the initial page of the *Bones of Time* thread. If any of the letters is not read and the reader moves on to another location, the letter disappears from the landscape. When reaching and if entering the *Bones of Time* node, readers must complete reading the entire sequence before returning back to the main story.

4.3.2 Drawing story maps

To be able to develop a story usually some planning precedes the authoring stage and that may involve charts, diagrams, background research, personal notes etc. Planning can be a

way to ensure that an author will end up with a story where narrative and outcome correspond to their intentions (Riedl and Young, 2006). A good way to plan any story that requires linking between nodes is to create a graphical representation of the connections between passages of text hidden behind nodes. Some writing tools available, offer the option to generate such visual maps or create them automatically when a story is compiled.

For each writing tool used in this adaptation, a story structure was created by drawing a map that aligns with the original story's progressive paths and according to connectivity between locations. Researchers who previously wrote about the story *Fallen Branches* had already drawn a diagram of the story structure (Packer et al., 2017). The story structure in *Storyplaces* is composed of 11 chapters. Each chapter has one or more non-consecutive locative nodes attached to it. Each node corresponds to a specific location and belongs to either one of the three story threads (*Fallen Branches, Last Letters, Bones of Time*) created by the author to narrate the story.

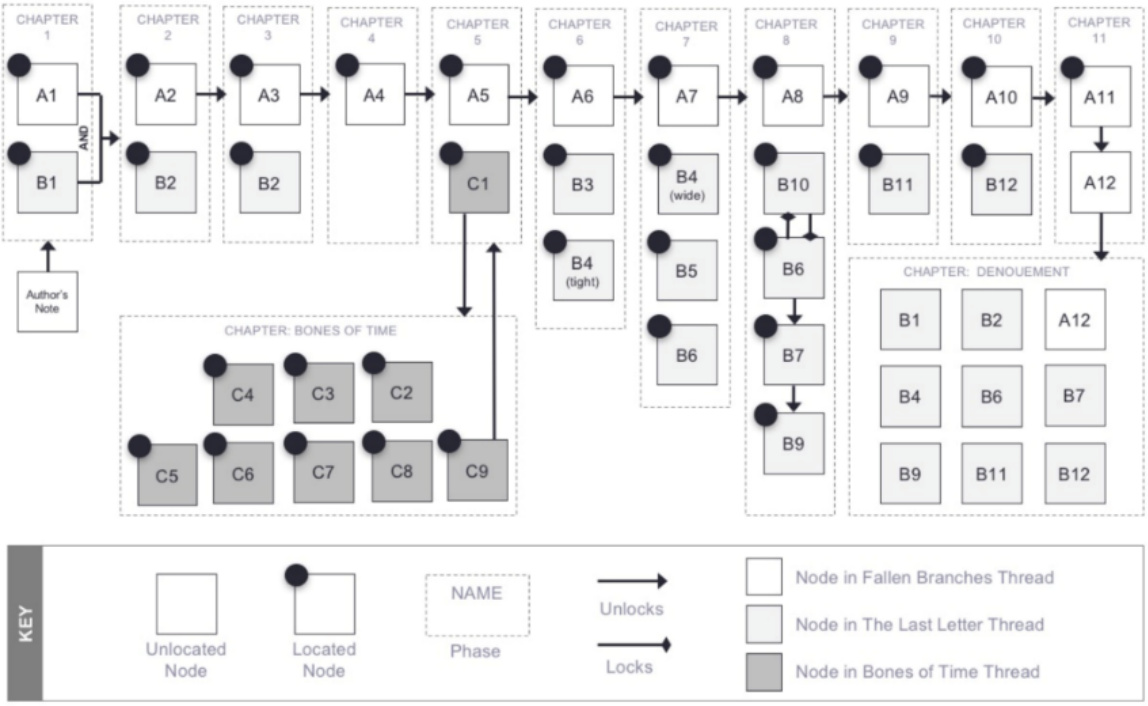


Figure 13 - Fallen Branches story map (taken from (Packer et al., 2017))

Figure 13 above shows the structure of *Fallen Branches*. Each node is part of either the *Fallen Branches*, *Last Letter* or *Bones of Time* thread. A potential reader moves through Crystal Palace Park following Sandy the main character of the story, while nodes appear in the landscape around them. Nodes from the *Fallen Branches* and *Last Letters* threads appear on the landscape on specific locations. The *Bones of Time* thread becomes available half-way through the main story and temporarily switches the narration back to an incident that happened in Crystal Palace around 1900.

The diagram in Figure 13 above was adapted firstly for *Twine*, and then for *Inform 7*. In both cases a similar diagram was created to represent the structure of the story based on each tool's constructs. *Storyplaces* is a sculptural system which means that all nodes are available until read (Bernstein et al., 2002; Hargood et al., 2016). Modelling the story required drawing a manual diagram to enable better conceptualisation of how locations would be connected and how content would be attached to each location. On the contrary *Twine* is a calligraphic system where modelling results in a complex tangle of links (Bernstein, 1999). *Twine* by default enforces the creation of visual nodes to represent passages and allows for those nodes to be connected through a hyperlink embedded in the text behind each node. Chapters in the *Storyplaces* diagram in Figure 13 above are classified under alphabetical A, B or C nodes. To adapt this in *Twine*, nodes were classified by the corresponding titles of nodes as they were found while reading *Fallen Branches* in *Storyplaces*. For example, node A1 as shown in Figure 13 above under CHAPTER 1 was encountered as *Fallen branches 1a* in the reader of the tool (Fig. 12). In making it easier to visualise the story in *Twine* it made more sense to title each node using the chapter titles as allocated in *Storyplaces* rather than the alphabetical classifications. Figure 14 below, shows the diagram of the story structure as created with *Twine*. Behind each white node lies the story content and each grey arrow connects the content of the narrative. *Twine* does not contain explicit representation of locations; therefore, they do not appear in the story map, relying instead on the text to orientate the reader.

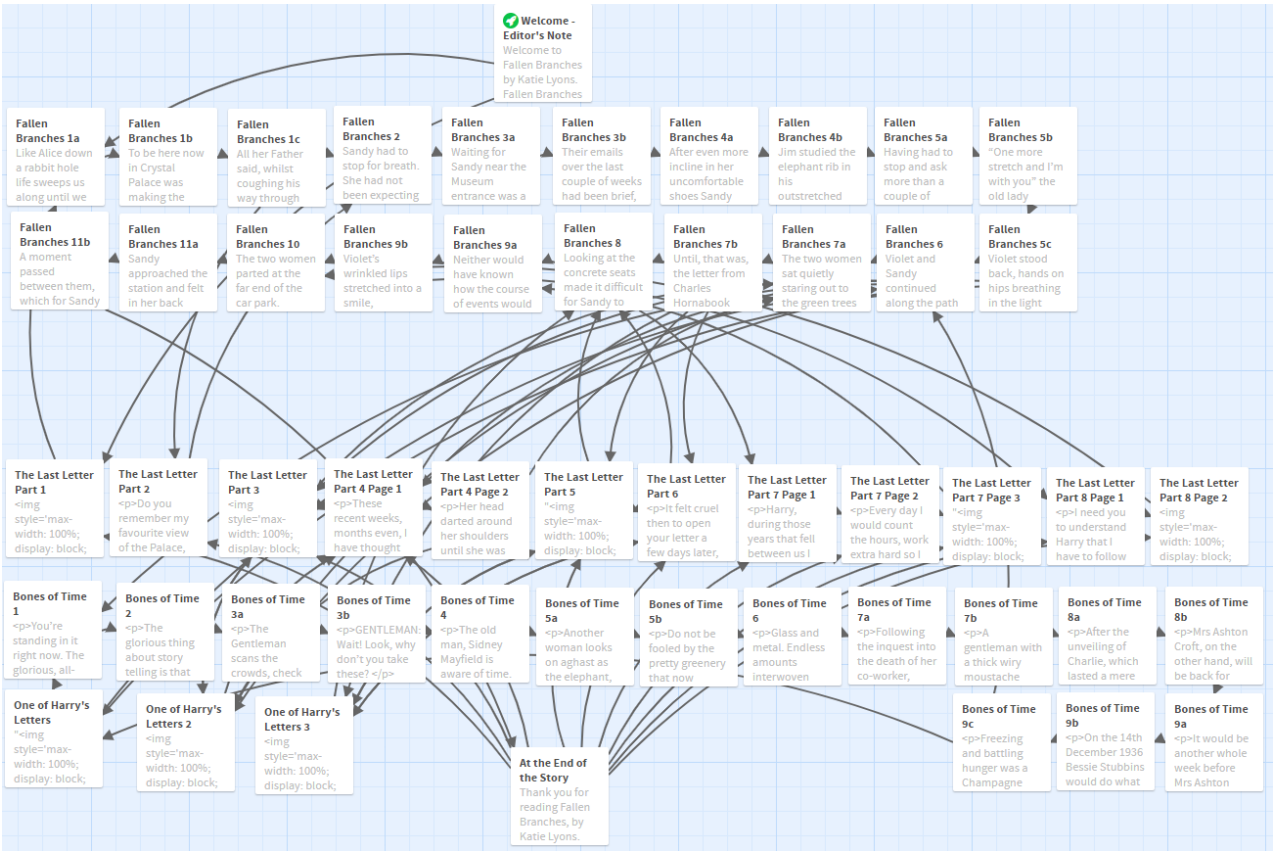


Figure 14 - Fallen Branches story map in Twine

With *Inform 7* the process of modelling a structure was significantly different from both *Storyplaces* and *Twine* because the tool's structure focuses on building a world model. Readers explore a story by navigating through textual assertions (i.e., go west or go south) in different locations. This means that although the reader is free to move around the locations (as they are in *Storyplaces*), albeit not physically, the story itself plays out in a more sequential manner dictated by where the scenes are set. Specific locations in Crystal Palace Park had to be recreated in *Inform 7* as a series of *rooms*, with navigational routes between them to reflect their positions in the real world. The tool allows for a construct called *scenes*, which represents logical parts of a story to be sequenced together (for example, *acts* of a story). Based on this, the chapters from *Storyplaces* were adapted into *scenes* to enable mapping of the diagram for the story structure in *Inform 7*. Finally, *Inform 7* has the notion of *objects* that exist within the story world and can be picked up and moved around. *Objects* were used to represent the

Last Letters & Harry's Letters, and these are revealed and added to the reader's inventory when first arriving in the correct *room* in the correct *scene*. Figure 15 below shows the diagram drawn for *Inform 7*. Chapters are represented by *scenes* and respective locations are represented by *rooms* assigned to each *scene*. Numbers assigned on each *scene*, as seen in Figure 15 below, are matched against the alphabetical A, B, C classification of nodes as seen on the *Storyplaces* diagram in Figure 13 above. Additionally, each *scene* is assigned a location based on the name of location assigned in *Storyplaces* for each chapter.

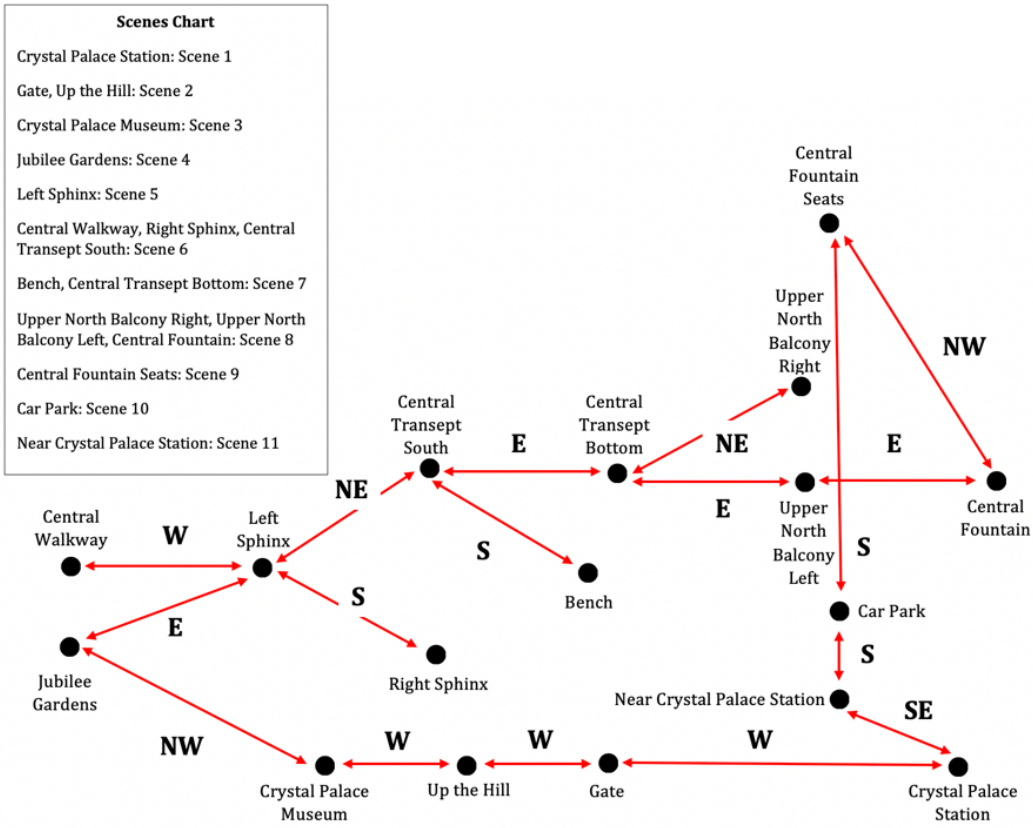


Figure 15 - Fallen Branches story map in Inform 7

4.3.3 Adding the content

Following the design of story structures, in order to have complete readable narratives, the text of the story had to be embedded via the authoring interface of each tool. The

entire story content as found in *Storyplaces* was copied in *Twine* and *Inform 7*. In *Twine* the text was placed in a text editor that appears when clicking on the white nodes seen in Figure 14 above. In *Inform 7* text was copied in a programmable text editor that appears upon programme initiation. Figures 16 and 17 below show the editors respectively.

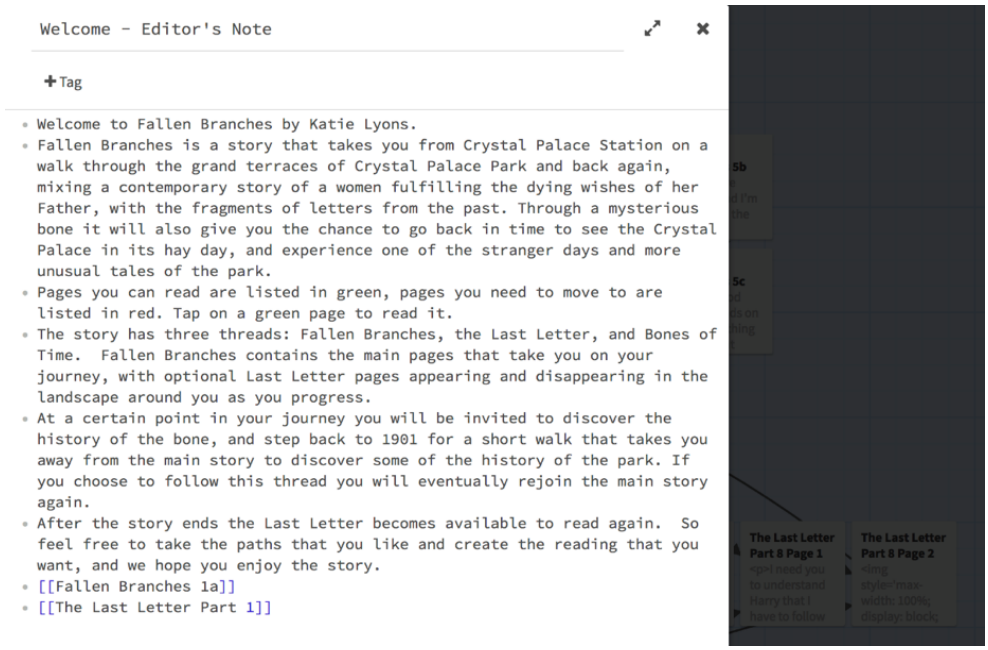


Figure 16 – Authoring Fallen Branches in Twine

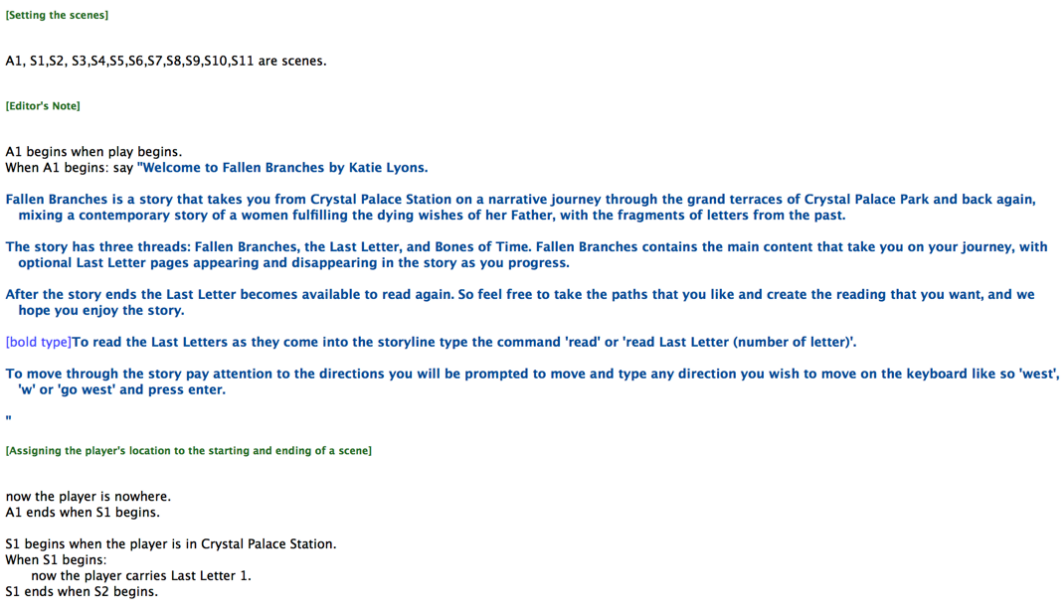


Figure 17 - Authoring Fallen Branches in Inform 7

4.3.4 Design observations

While the structure and content were put into place in both tools concerned with this authoring adaptation, a number of key observations arose while attempting to imitate the story behaviour as originally authored and intended by Katie Lyons in *Storyplaces*.

O1.1 Story structures

Three story structures are described in this report, each representing the *Fallen Branches* story for *Storyplaces*, *Twine* and *Inform 7*. The story structures for *Twine* and *Inform 7* were created based on the story structure of *Storyplaces* seen in Figure 13 above copied from Packer et al (2017). What was evident after completing the diagrams of all the story structures was that each and every one was entirely different, even though all three of them describe the same story. Similar to *Storyplaces*, the story structures were created manually for *Inform 7* and *Twine* although with *Twine* the structure was graphically created within the tool.

Figure 13 above describes the *Storyplaces* story structure using an alphabetical classification to represent chapter headings and locations. Figure 14 above describes the *Twine* story structure using the chapter headings that correspond to the alphabetical classification seen in Figure 13 above. A sample of those headings can be seen in Figure 12 above. Figure 15 above describes the *Inform 7* story structure using the names of locations that correspond to the alphabetical classification seen in Figure 13 above. The reasoning behind the creation of the structures in such a different manner, is purely based on the nature of each tool. Each structure was created to follow the narrative as the author of the story had originally indented. A great deal of why the story structures where built a certain way, has a lot to do with how the story content had to be incorporated in each tool. To set some examples let *Twine* be considered, the hypertext tool that works by connecting events with hyperlinks. Each hyperlink acts as a visual guide for the reader to know how to proceed with the story, similar to how the map acts in *Storyplaces*. While in

Storyplaces both chapter headings and locations are visible, in *Twine* mentioning both would be unnecessary. The reader experiences the story in *Twine* through a computer screen where the only action necessary is to traverse from one page on the screen to another. Therefore, hyperlinks in *Twine* only show the chapter headings. This can be verified by looking at Figure 18 below.

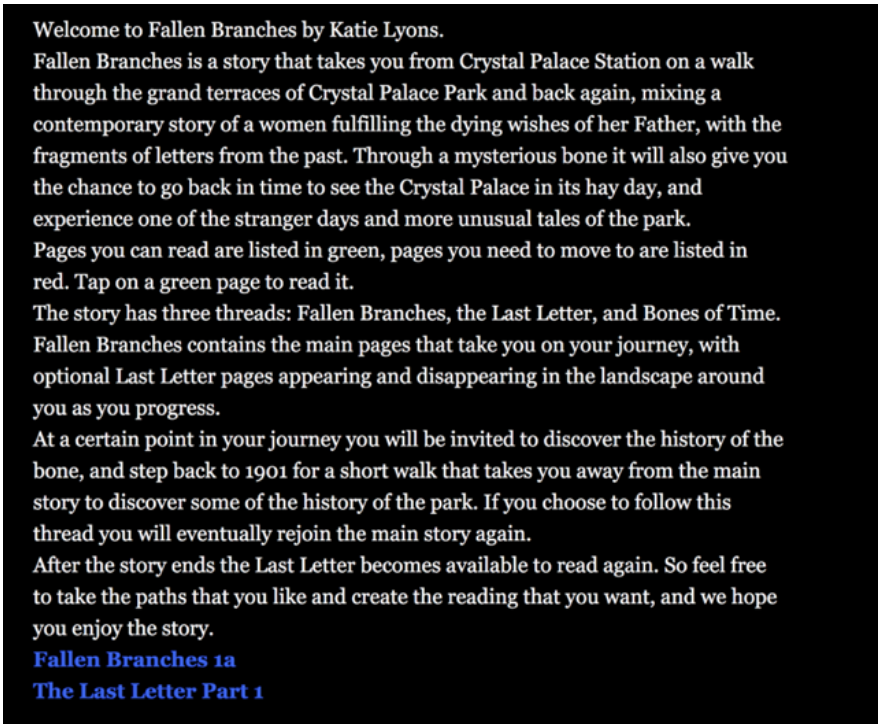
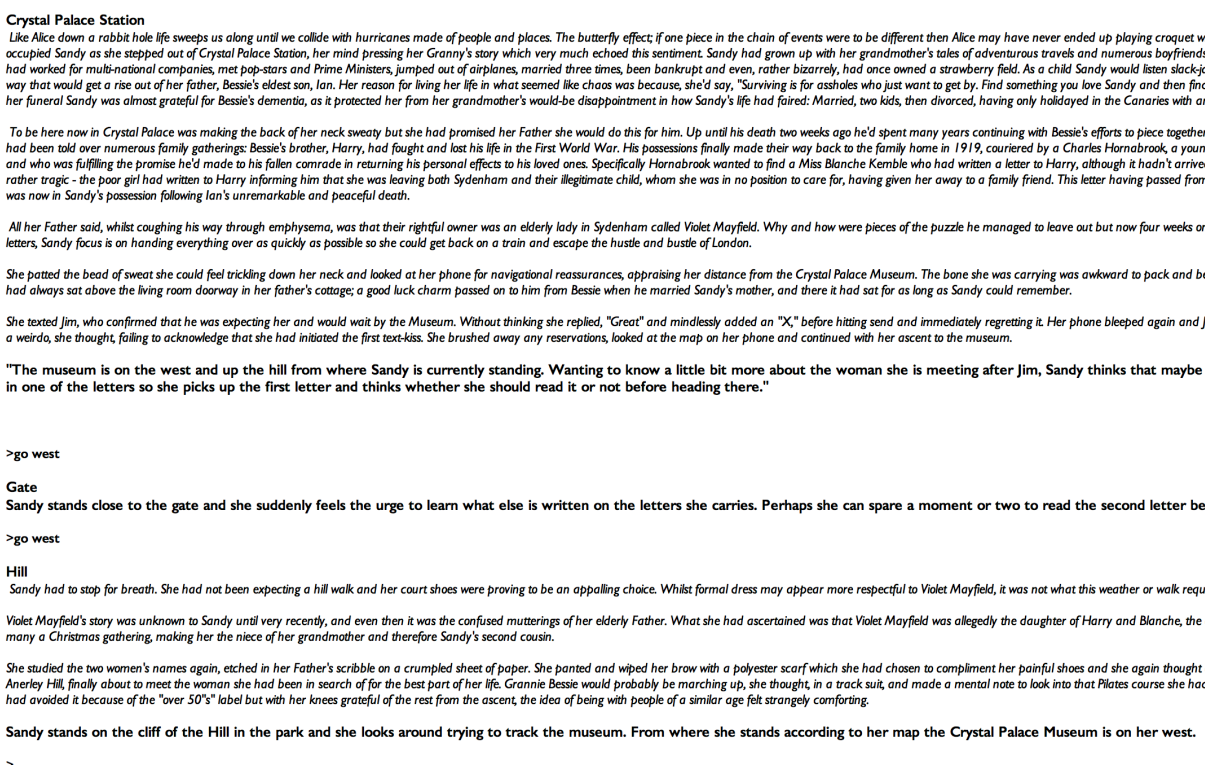


Figure 18 - Reading of Fallen Branches in Twine, showing the hyperlinks

Inform 7 on the contrary, shows only locations. One common element *Inform 7* bears with *Twine*, is that readers in both cases traverse the story using a computer screen. Instead of hyperlinks, in *Inform 7* readers encounter directional text assertions that need to be responded to in order to move from one *scene* to another. Each *scene* corresponds to a physical location. When readers begin reading the story, they enter *scene* number 1 which is attached to the location *Crystal Palace Station*. Since locations are key elements, there was no necessity to include more information other than location names and the attached story content for a reader to navigate through. Figure 19 below shows this circumstance.



Crystal Palace Station
Like Alice down a rabbit hole life sweeps us along until we collide with hurricanes made of people and places. The butterfly effect; if one piece in the chain of events were to be different then Alice may have never ended up playing croquet w occupied Sandy as she stepped out of Crystal Palace Station, her mind pressing her Granny's story which very much echoed this sentiment. Sandy had grown up with her grandmother's tales of adventurous travels and numerous boyfriends had worked for multi-national companies, met pop-stars and Prime Ministers, jumped out of airplanes, married three times, been bankrupt and even, rather bizarrely, had once owned a strawberry field. As a child Sandy would listen slack-j way that would get a rise out of her father, Bessie's eldest son, Ian. Her reason for living her life in what seemed like chaos was because, she'd say, "Surviving is for assholes who just want to get by. Find something you love Sandy and then finc her funeral Sandy was almost grateful for Bessie's dementia, as it protected her from her grandmother's would-be disappointment in how Sandy's life had faired: Married, two kids, then divorced, having only holidayed in the Canaries with a

To be here now in Crystal Palace was making the back of her neck sweaty but she had promised her Father she would do this for him. Up until his death two weeks ago he'd spent many years continuing with Bessie's efforts to piece togethe had been told over numerous family gatherings: Bessie's brother, Harry, had fought and lost his life in the First World War. His possessions finally made their way back to the family home in 1919, couriered by a Charles Hornabrook, a youn and who was fulfilling the promise he'd made to his fallen comrade in returning his personal effects to his loved ones. Specifically Hornabrook wanted to find a Miss Blanche Kemble who had written a letter to Harry, although it hadn't arrive rather tragic - the poor girl had written to Harry informing him that she was leaving both Sydenham and their illegitimate child, whom she was in no position to care for, having given her away to a family friend. This letter having passed fron was now in Sandy's possession following Ian's unremarkable and peaceful death.

All her Father said, whilst coughing his way through emphysema, was that their rightful owner was an elderly lady in Sydenham called Violet Mayfield. Why and how were pieces of the puzzle he managed to leave out but now four weeks or letters, Sandy focus is on handing everything over as quickly as possible so she could get back on a train and escape the hustle and bustle of London.

She patted the bead of sweat she could feel trickling down her neck and looked at her phone for navigational reassurances, appraising her distance from the Crystal Palace Museum. The bone she was carrying was awkward to pack and b had always sat above the living room doorway in her father's cottage; a good luck charm passed on to him from Bessie when he married Sandy's mother, and there it had sat for as long as Sandy could remember.

She texted Jim, who confirmed that he was expecting her and would wait by the Museum. Without thinking she replied, "Great" and mindlessly added an "X," before hitting send and immediately regretting it. Her phone bleeped again and J a weirdo, she thought, failing to acknowledge that she had initiated the first text-kiss. She brushed away any reservations, looked at the map on her phone and continued with her ascent to the museum.

"The museum is on the west and up the hill from where Sandy is currently standing. Wanting to know a little bit more about the woman she is meeting after Jim, Sandy thinks that maybe in one of the letters so she picks up the first letter and thinks whether she should read it or not before heading there."

>go west

Gate
Sandy stands close to the gate and she suddenly feels the urge to learn what else is written on the letters she carries. Perhaps she can spare a moment or two to read the second letter be

>go west

Hill
Sandy had to stop for breath. She had not been expecting a hill walk and her court shoes were proving to be an appalling choice. Whilst formal dress may appear more respectful to Violet Mayfield, it was not what this weather or walk requ

Violet Mayfield's story was unknown to Sandy until very recently, and even then it was the confused mutterings of her elderly Father. What she had ascertained was that Violet Mayfield was allegedly the daughter of Harry and Blanche, the many a Christmas gathering, making her the niece of her grandmother and therefore Sandy's second cousin.

She studied the two women's names again, etched in her Father's scribble on a crumpled sheet of paper. She panted and wiped her brow with a polyester scarf which she had chosen to compliment her painful shoes and she again thought Anerley Hill, finally about to meet the woman she had been in search of for the best part of her life. Grannie Bessie would probably be marching up, she thought, in a track suit, and made a mental note to look into that Pilates course she hac had avoided it because of the "over 50"s" label but with her knees grateful of the rest from the ascent, the idea of being with people of a similar age felt strangely comforting.

Sandy stands on the cliff of the Hill in the park and she looks around trying to track the museum. From where she stands according to her map the Crystal Palace Museum is on her west.

`

Figure 19 – Reading of Fallen Branches in Inform 7, showing locations, story content and textual assertions

01.2 Rewinding and Revisiting Nodes

The thread *Last Letters* was implemented in *Storyplaces* to make nodes disappear if readers miss them while navigating through the story. For example, if the reader fails to read a letter, that letter disappears from the map and cannot be accessed again even if its location is revisited. Similarly, if the *Bones of Time* sequence is visited, the remaining unvisited nodes disappear and do not reappear until the reader completes *Bones of Time*. If the *Bones of Time* thread is missed, then it is removed from the story entirely.

By adapting this in *Twine* using explicit hyperlinks, it was derived that the coordinates for locations defined in *Storyplaces* acted similarly to how links acted in *Twine*. Where a node was made available in *Storyplaces* similarly a hyperlink was made available in *Twine*, and when a visited node disappeared so did a hyperlink. However, *Twine* by

default includes a *back* button in all the stories so the reader can easily go back to any state in the story, revisit missed nodes and rewind the content. There is a way in *Twine* to remove the back button but that would require using an advanced story mode that allows for more complex programmable components in a story, something that fell outside of the study's scope. This in a way defeated the author's intent when creating the story in *Storyplaces*, which permits revisiting a location but restricts rewinding the content.

With *Inform 7* readers can navigate themselves in any location they want at any time with prompts on each location acting as their navigational cues. Similar to *Storyplaces* here, revisiting a location is possible since the reader can navigate any direction they choose virtually. A mechanism in *Inform 7* allows to include restrictions for not rewinding content therefore recreating this was possible.

O1.3 Definition and Description of Locations

All the locations mentioned in *Fallen Branches* are physical locations, identified via GPS co-ordinates and communicated to readers through a map interface. As a result, locations need to be defined, but not described, and there is no need to define the connections between them. The map makes all of the above possible visually. Neither *Twine* nor *Inform 7* use real world locations, so definition, description, and connection between locations becomes a manual task.

Since *Twine* does not use real world locations like *Storyplaces* or is based on a story world like *Inform* 7, *Twine* does not mention any locations. Location, unless an author purposefully uses it to title a node, is not prevalent and as such when authoring *Fallen Branches* in *Twine*, none of the locations were included. This is another component outside of authorial intent since locations are vital elements in the original story that end up losing context in *Twine*.

With *Inform 7*, stories resemble a virtual version of the physical world, therefore locations remain essential in setting the storyline. When adapting *Fallen Branches*, *Inform 7's*

scene, *room* and *object* constructs were utilised to define locations and story content. Chapters were defined as *scenes*, locations were defined as *rooms,* and story content was added as the description of a *room*. In the case were content was part of a *letter*, that *letter* was defined as an *object* and the content of the *letter* was added as the description of an *object*. Both *objects* and *rooms* were assigned to a *scene*. Traversing between locations to read the story with *Inform 7* is theoretically like walking around locations as one physically does while reading the story with *Storyplaces*.

O1.4 Distance between locations

Traversing through the story in *Storyplaces*, requires physical movement from one location to another, thus taking a certain amount of time to reach nodes and unlock the story content. *Twine* and *Inform 7* do not require such movement because with either one of those tools the story is situated and maintained on the computer screen. Interaction involves either clicking hyperlinks or inputting textual assertions on the user interface. This means that authors who use a locative tool must consider the amount of time it will take for a reader to navigate between the locations that unlock chapters and make sure that the experience is not diminished by long pauses in between.

O1.5 Navigational cues

For a reader to be made aware of how to proceed with the story, *Storyplaces* prompts the reader via an embedded map with pinned locations hiding available story content. The map acts as a navigational cue.

In *Twine* navigation is possible through hyperlinks made available at appropriate positions within the text which when clicked, progress the story accordingly. The links act as navigational cues.

In *Inform 7* there are no explicit navigational cues to indicate which location when visited will progress the story. When a reader visits a *room* (location), a description of that *room* is displayed on the screen. On this occasion that description is the story content. To

enable the author to traverse the story and know where to go next, supplementary text was added to the story with appropriate cues to help with the story continuation. This means that original creative content was necessary to supplement the original storyline with *Inform 7*, creating thus a sense of co-authoring between author and researcher.

O1.6 Text delivery

Text in *Storyplaces* is input in pages that tie to physical locations. These are unlocked when a reader visits their location. The text can be of any form, and in *Fallen Branches* it appears as either a page describing the contemporary visit to the park, a page from a historical account of an incident in the park, or the text of a letter. Text is directly linked to navigational cues being what readers look for to progress with the story.

This translates well into *Twine*, where individual nodes also take different forms. With *Inform 7,* there is a different case because its construct is tied to a world model. For the reader to encounter the text, they must interact in some way with that model. *Room* or *object* descriptions convey the text so when a reader visits a *room*, the description of the *room* is triggered and displayed on the screen. In the case readers attempted to revisit a *room* there was a need to add supplementary replacement text and prompt readers to continue progressing with the story rather than revisiting content already read. This means that text was a necessary addition to the *Fallen Branches* main story in *Inform 7*, creating again the sense of co-authoring between author and researcher.

4.4 Story adaptation 2: Assemblage of Angels

4.4.1 The story

Assemblage of Angels[21] is a story written by Els White for the interactive fiction competition *Spring Thing Festival of Interactive Fiction*[22]. In research for an appropriate story, that would be short and similar to size as *Fallen Branches*, written in *Twine* and preferably with good reviews or accolade attached, *Assemblage of Angels* was deemed to be fit for the purpose. It comes with two awards from the competition for being the most heart-warming and evocative story, it is written with *Twine* and is no bigger than sixty nodes. The plot follows a young woman's journey into gathering elements from different specialists to build her own angel. As the woman traverses through places such as the town's tanner, smith and doctor, the story tells about her life through the interactions of familiar faces she comes across while gathering materials to assemble the angel. The story has one main thread and three consecutive threads that represent the material providers which the protagonist must visit (the smith, the tanner, the doctor) in order for the story to be completed. Throughout the narrative the author has included choices within the text that may alter slightly the content a reader may be presented with depending on their choice. No matter the choices if all necessary nodes are visited the story results in the same aftermath. The story file was accessed through the competition's website, and the author has been contacted and notified about the use of their story for research purposes to which they happily agreed.

[21] https://www.springthing.net/2020/play_online/AssemblageOfAngels/index.html

[22] https://www.springthing.net/2020/play.html

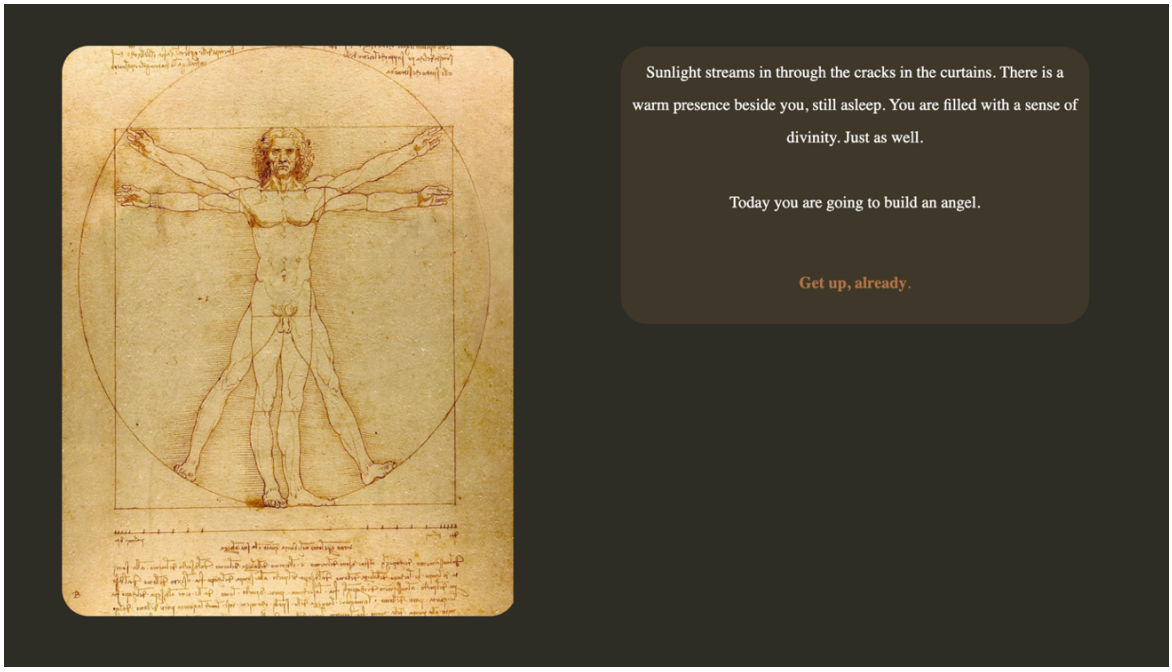


Figure 20 - Assemblage of Angels story read from a browser

4.4.2 Drawing story maps

One benefit of the *Twine* authoring environment is that it prompts the author to create a map of the story by default as part of the user interface when branching nodes together via links. Figure 21 below shows the story structure of *Assemblage of Angels* as the author has designed it in *Twine*. The title of each white node reflects the name of a hyperlink embedded in the story content, or another verbal indication that the author could point to and recognise what content is hiding behind the node.

To be able to conceptualise connections between nodes for *Storyplaces* and *Inform 7*, new maps were developed for each instance to use as a guide on the development of the story. The maps can be seen in Figures 22 and 23 below for each tool respectively. The story maps shown in the figures below may resemble each other, however there are minor differences in the node titles that enabled the adaptation of the story to be approached more comfortably and also to be better understood.

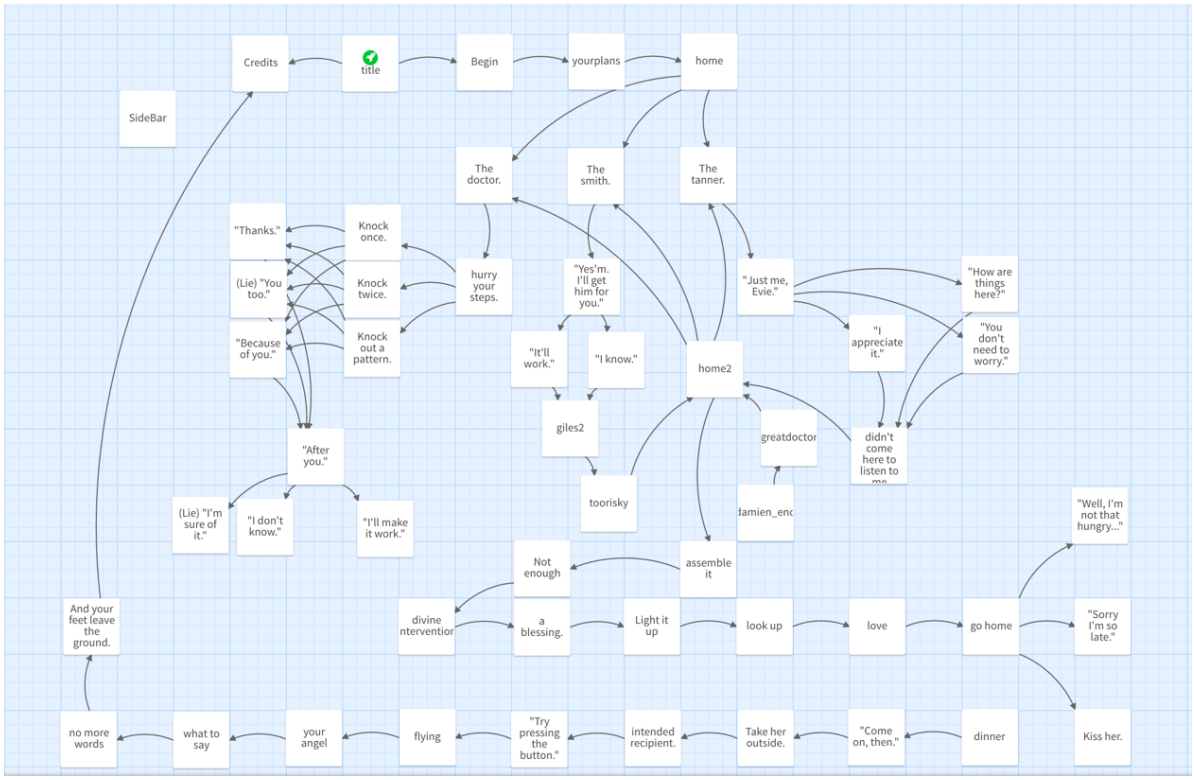


Figure 21 - Story map of Assemblage of Angels in Twine

Since *Storyplaces* is a locative tool where the story is traversed by navigating the physical environment it was necessary to simulate any locations in the story somewhere in the environment. The town of Winchester has been selected as the generic location where the story takes place because of its proximity to the site of research and the geographical locations of many sites around the small town that are easily accessed from a central starting point such as the train station. As a starting point of the story the main station has been set. Nearby shops and banks within close proximity were chosen as additional locations where content would be attached to. In Figure 22 below nodes that appear to be locative mean that in order for the content to be unlocked the reader must physically visit the attached location. For example, the node *Begin* is a locative node which requires the reader to be physically positioned near the Winchester train station. Once read, *Begin* unlocks the following page and once the whole chapter is completed the following chapter is visible. Once all the necessary nodes are completed the final node is unlocked and the story may be completed.

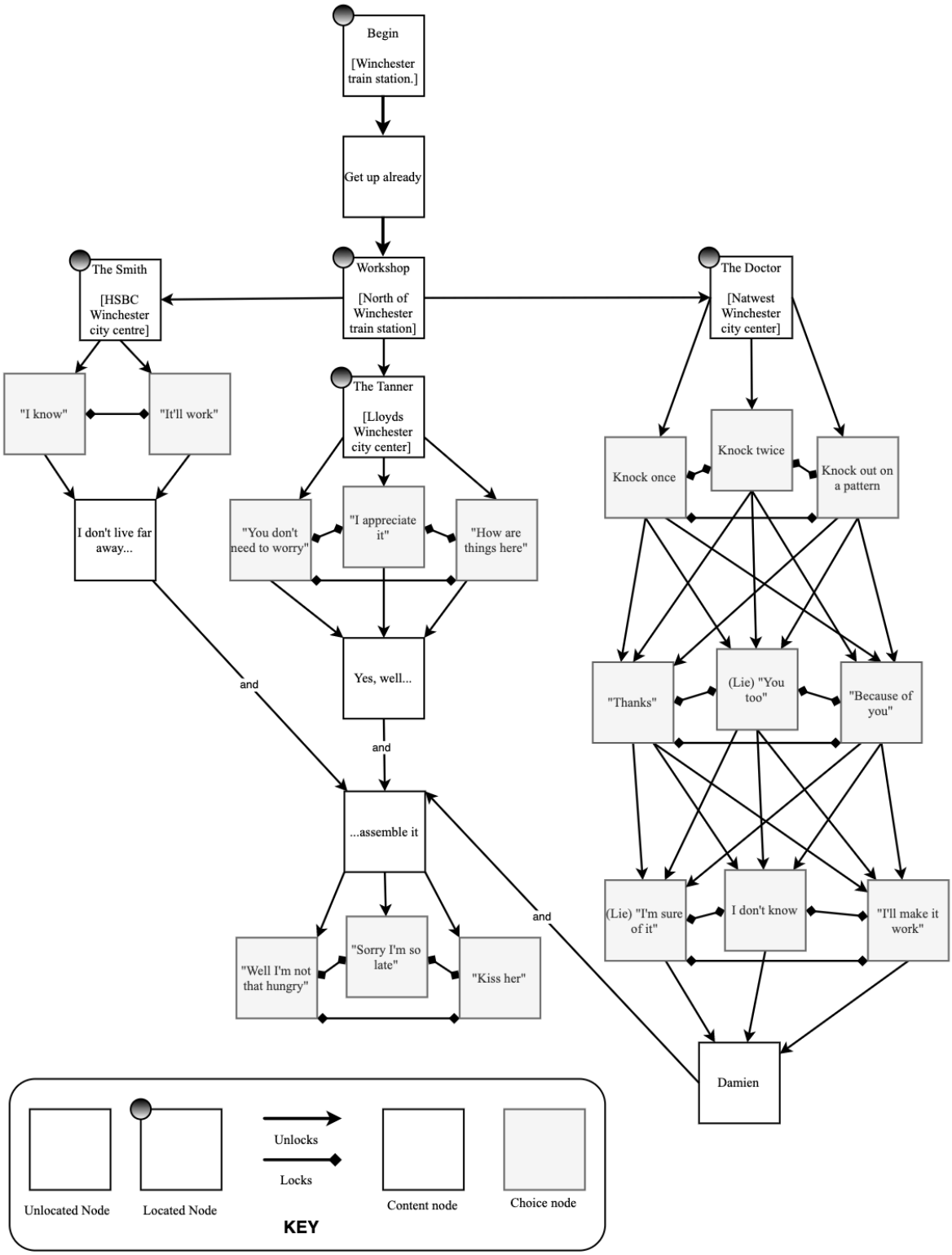


Figure 22 - Story map of Assemblage of Angels for Storyplaces

Some nodes in the story are nodes of choice, which means that when encountered the reader will be presented with a set of pages connected to each other so that once one of them is chosen the rest disappear. This reflects choices that were made available as hyperlinks in the reading of the story in *Twine*. Examples are found under the threads of nodes *The Smith, The Tanner* or *The Doctor*. An example is under the node *The Smith* which reaches a point where the reader must decide whether to read the page behind the choice 'I know' or the page behind the choice 'It'll work'. When the reader is encountered with a choice, they can only select to follow one of them as the selection will lock the remaining choice or choices and make them unavailable throughout the rest of the reading. This behaviour is demonstrated in Figure 22 above where diamond edged arrows reflect that nodes connected through them are nodes that once accessed can lock the other end or ends for the remaining of the story. Locations *Begin* and *Workshop* were not originally specified exclusively by the author however they were assumed here as locative starting points to accommodate the reading in *Storyplaces*.

The same additional locations have been included when adapting the story in *Inform 7* given the common locative elements it shares with *Storyplaces*. Figure 23 below shows the story map as it was drawn for *Inform 7*. Each location belongs to a different *scene* and each *scene* is attached to the necessary content. The map shows how locations are connected directionally as they were defined within *Inform 7's* environment. Each location needs to be defined and linked to another location via the means of a compass direction, left and right or such as the case of the *Begin* node inside or outside. *Begin* as shown on the map has been defined as a location inside the *Workshop* location so that when the reader writes the first verb to interact with the story they are automatically moved to the *Workshop*. The story in Twine begins with the hyperlink 'Get up already' (Fig. 20) which is a prompt that takes the protagonist from bed into their workshop. As such the instruction 'get up' has been used as the first verb a reader should use to begin the story in *Inform 7*. Coincidentally the verbal proposition 'get up' is programmed with a default functionality and behaviour controlled by *Inform 7*. Amending or changing this behaviour

proved a complex procedure that fell outside of the study's scope therefore adjustments have been made to align with the tool's behaviour. In this case 'get up' means that a reader when using that verb will be transported outside of their current location. Since the beginning location in the story was *Begin* and it was defined as being inside the location *Workshop*, the verb 'get up' moves the reader from *Begin* to *Workshop*.

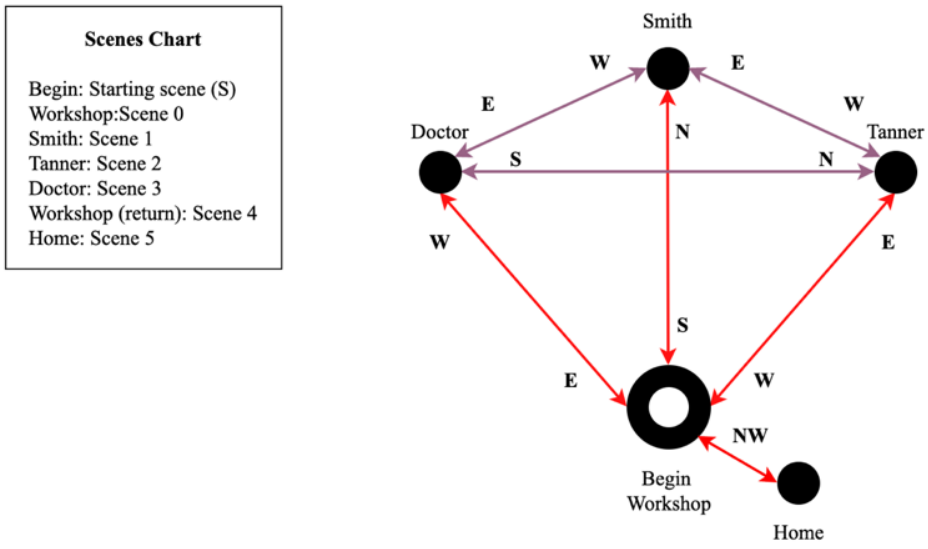


Figure 23 - Story map of Assemblage of Angels for Inform 7

From the *Workshop* the reader can go into any direction (S: South, E: East, W: West etc.) to visit the *Smith, Tanner or Doctor*, return to *Workshop* for the assembly of the angel and finally visit *Home* to complete the story. The node *Home* was an additional node exclusive to *Inform 7* to carry out the final narrative strand which comprised a *scene* between the protagonist and her partner after the assembly of the angel. This *scene* was not originally attached to a location as with *Begin* and *Workshop* however in order to access it with *Inform 7* it had to be attached to a virtual location. This was a necessary addition to reveal the content that would complete the story as *Inform 7* dictates that to access content a reader must be in a defined location. This was avoided in *Storyplaces* because while a locative tool it allows for content to appear without it being mandatorily

attached to a location therefore while the node *Home* could also be included it was decided that the story worked well without it.

4.4.3 Adding the content

The content was accessible via the original story file, which was openly available to the public via the competition's website. When imported into *Twine* the story becomes accessible and implementable. All of the story content was copied and pasted in the necessary nodes in both *Storyplaces* and *Inform 7*. Figures 24-26 below show the same sample of text as it was added in each authoring environment of the tools. In the case of *Twine* shown in Figure 24 at the end of the page, the scripting code for creating links is merged with the natural language text.

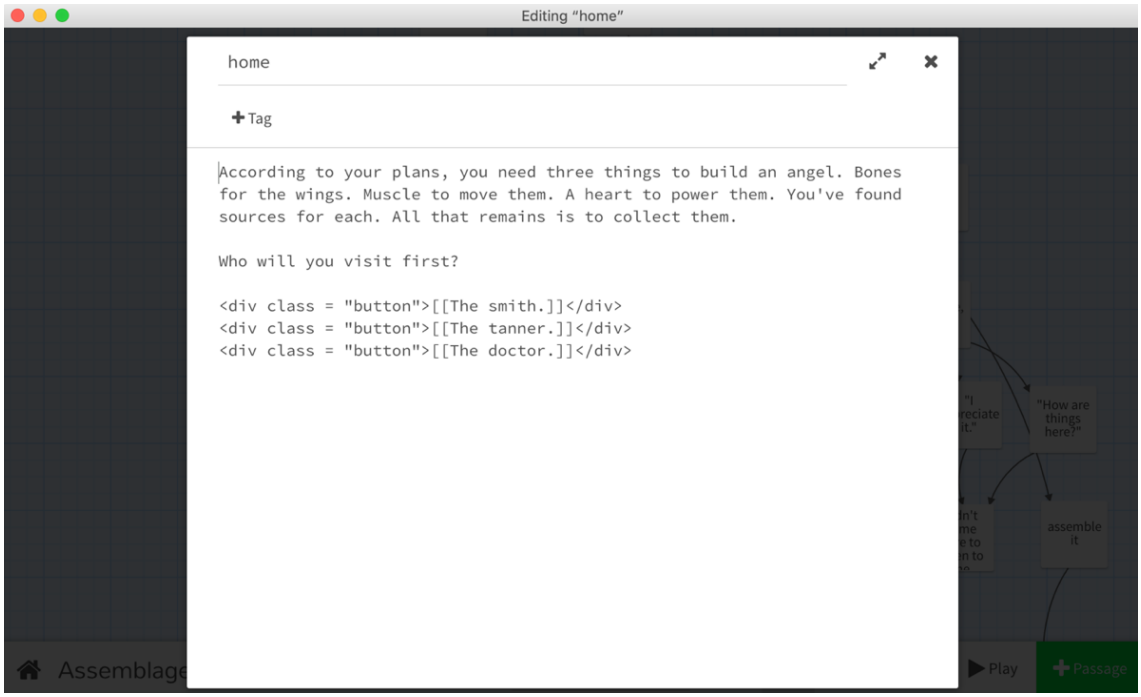


Figure 24 - Sample of story content in the Twine authoring environment

Figure 25 below shows the authoring environment of *Storyplaces.* With *Storyplaces* connections between nodes are accomplished by invoking the attached map while editing a page and toggling the built-in page elements all manageable via the user interface.

Locations can be attached to content by either manually adding the coordinates in the necessary input fields or by pointing the desired location on the map which fills out the coordinates automatically. To make the connections there are provisions that allow the author to set controls on when a page should be unlocked and that may be defined either by the location a reader is at any given moment, the page that preceded it or a combination of both.

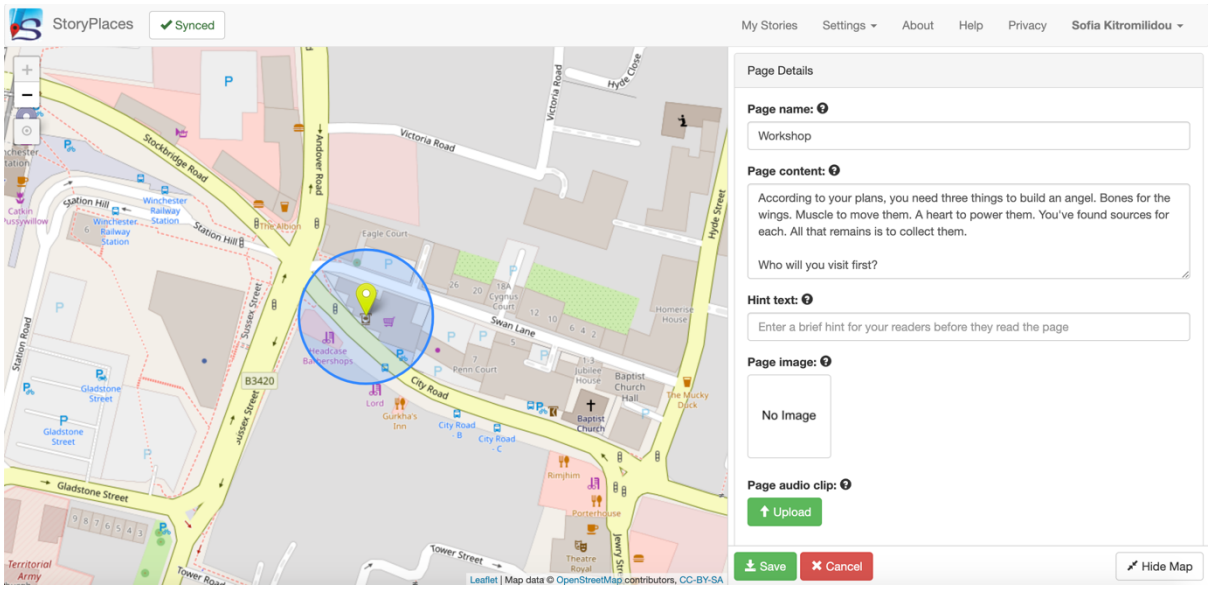


Figure 25 - Sample of story content in the Storyplaces authoring environment

In *Inform 7* where links are not viable and things are connected via virtual locations, things become slightly more complicated as every location must be declared as a *room* and the content of the story must be added as a description of that *room*. *Rooms* in *Inform 7* were introduced in adaptation 1 as constructs in the tool used to define a particular location which a reader can access or navigate through. The description of each *room* is presented as story content when a reader visits a particular *room*. In this case while a *room* was created for each location in the narrative the content was not attached as their description to avoid it being repeated in the reading if and when the reader needed to visit a location twice. Instead, new creative content had to be added as a replacement prompt depending on whether the reader had visited a location for the first or second time and so

on. Such content was regulated by controlling its appearance in *scenes*, another of *Inform 7's* constructs previously introduced that regulates the chapters into different scenes in a story as they would be acts in a play. By controlling the *scene*, *location* and *turn* a reader was located, it made it possible to control the appearance of appropriate content. A sample of how *scenes* work is displayed in Figure 26 below where 'S0' was declared as a *scene*. As with *Twine* content and scripting language are merged in the *Inform 7* authoring environment.

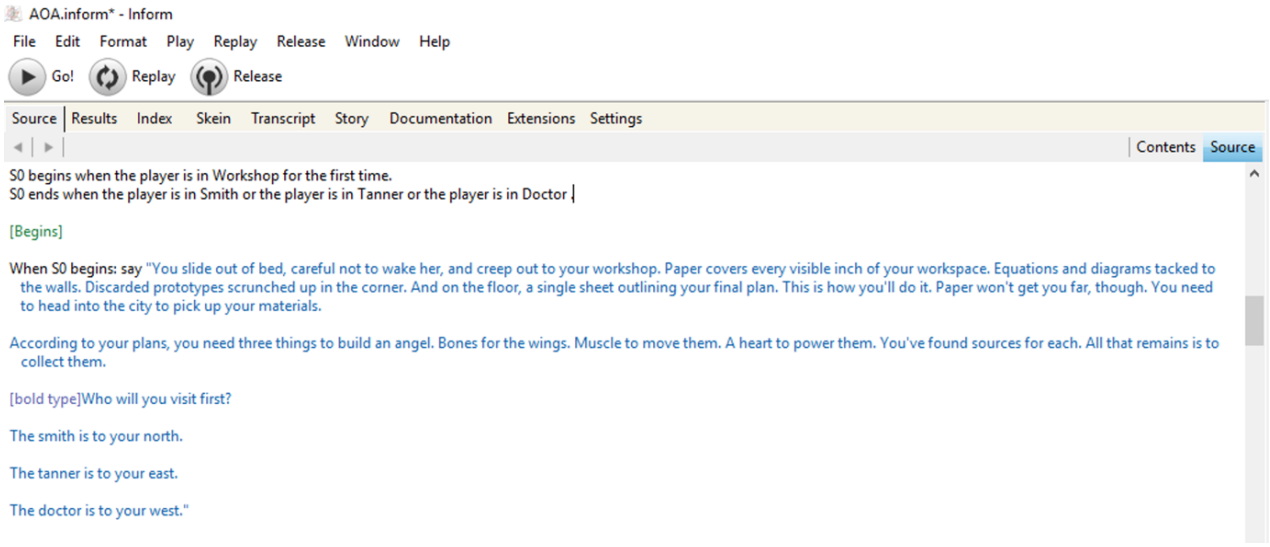


Figure 26 - Sample of story content in the Inform 7 authoring environment

4.4.4 Design observations

O2.1 Narrative labour

Depending on the agency of reading a story and the mechanics of a tool, the content was accordingly adjusted to reflect the best reading experience. The experience of reading a narrative depends on the structure and environment of the tool it originates. *Assemblage of Angels* was written in *Twine* thus part of the reading experience is the action of clicking on hyperlinks which in turn inform what content will appear. Figure 27 below shows a page in the *Assemblage of Angels* story where the author has opted to include three options for what the reader would wish to happen in the story. The narrative is at a stage

where the reader is standing outside of someone's door and they need to knock for entry. The author has offered the choices 'Knock once', 'Knock twice', and 'Knock out a pattern'. The reader can only choose one choice and depending on their preference different text will appear in the following page to reflect the reader's selection.

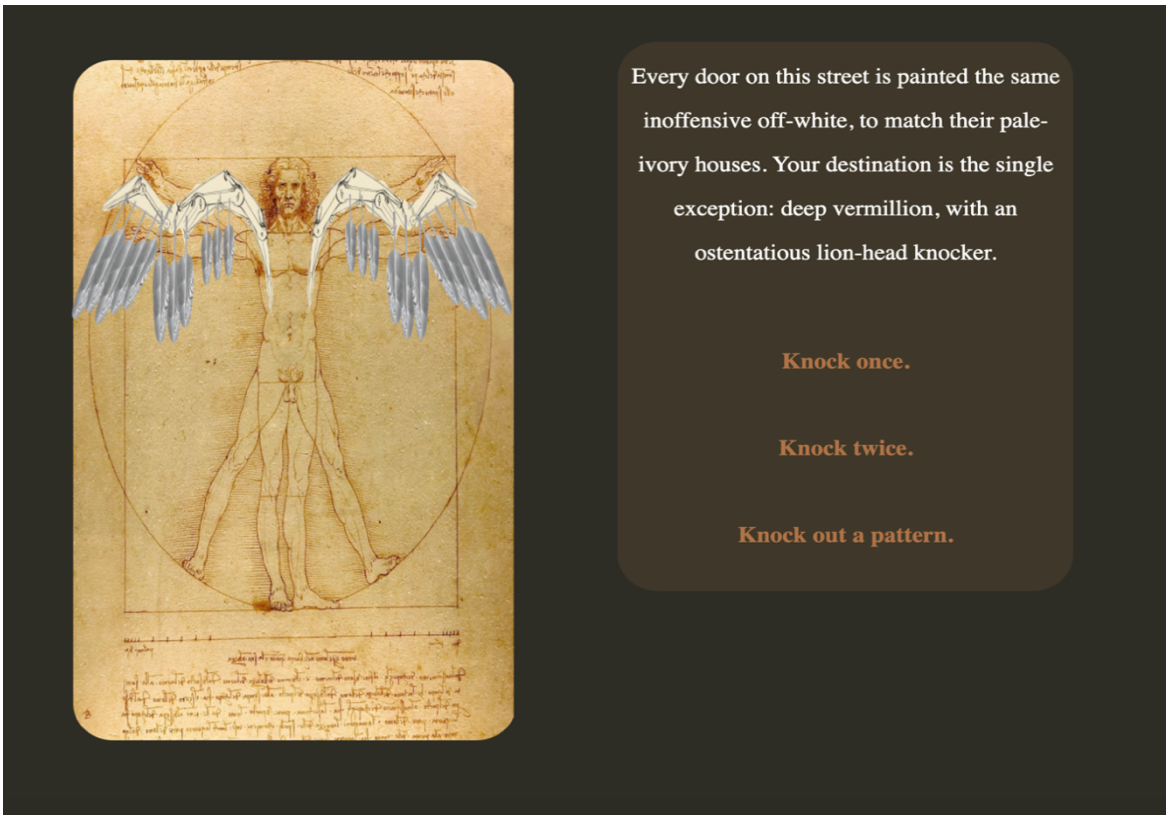


Figure 27 - Assemblage of Angels page with narrative choices [Twine]

This behaviour was simple to mimic when adapting the story into *Storyplaces*. It was achieved by offering these choices to appear as a set of distinct pages and making them available for preview at the appropriate stage in the narrative as they were made available with *Twine*. By invoking the mechanics of Storyplaces and setting constraints on the pages it was possible once the reader selected one of the pages to make the rest in a set of choices, disappear. Figure 28 below shows how a set of choices would appear while reading *Assemblage of Angels* in *Storyplaces*. The green titles shown in Figure 28 below are the unlocked pages at the stage of the narrative the reader is situated. The red titles are those that have yet to be unlocked either because the current page or set of consecutive pages

need to be read, or because the reader has yet to physically visit the locations that unlock them. The unlocked pages shown in the figure are part of a set of pages that belong to the same chapter. There is a constraint attached to those particular pages, and pages similar to those that behaves like the following statement - if a reader visited either page in a chapter, remove the unread pages from the reading traversal.

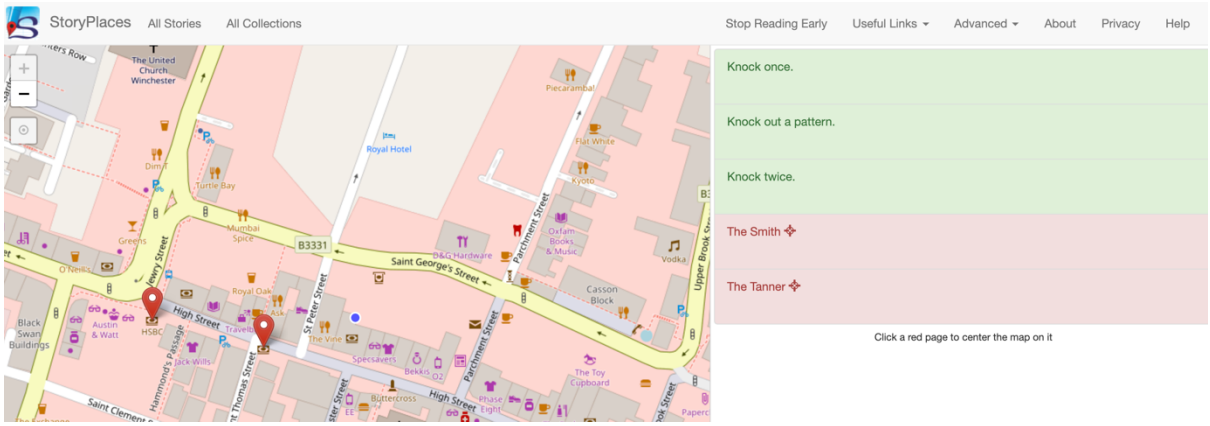


Figure 28 - Assemblage of Angels page with narrative choices [Storyplaces]

In *Inform 7* this was implemented using the construct of *actions*. *Actions* are a construct in *Inform 7* that allows the creation of verbs not already specified in the tool's vocabulary. Verbs such as 'go', 'pick up', 'open' etc. used for traversal, have default actions attached to them within the system and can be invoked whenever necessary as deemed appropriate for use in a story. If an author wishes to use verbs not defined by the system or that carry out different to their default behaviour, it is possible to do this with the *actions* construct. As such new verbs have been implemented according to their meaning to respond by making appropriate content available. The reader sees the verbs as textual assertions to which they have to respond accordingly and enable continuation of the narrative. Figure 29 below shows the presentation of these verbs as choices in *Inform 7*. The reader is presented with the choices and they need to type on the screen which choice they prefer. The example in Figure 29 below presents the same set of choices that preceding Figures 28 and 27 above have demonstrated. On this occasion the reader is expected to type on the screen which choice matches their preference the best. For simplicity issues the verbs were

codified to be invoked by typing alphabetical and numerical classifiers such as ‘a1’, ‘b1’, ‘c1’ instead of their corresponding textual sentences.

Other links found in the original story that did not offer a choice and were merely an agency component, were either omitted and added as part of plain text in their attached story content or were implemented similarly to the links that offered a choice.

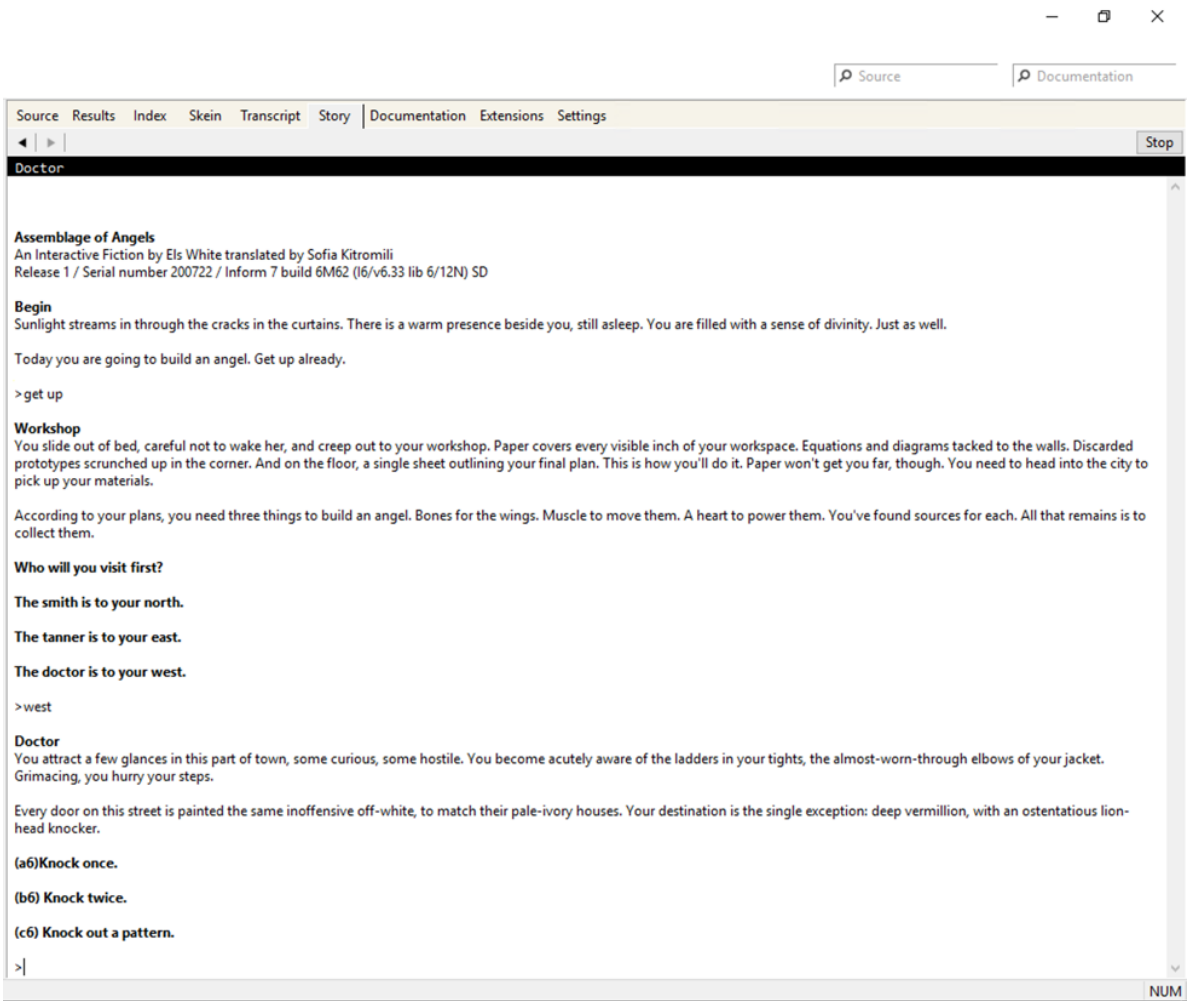


Figure 29 - Assemblage of Angels page with narrative choices [Inform 7]

In *Storyplaces* such a link would act as a page waiting to be accessed and read. In *Inform 7* that link would transform into a textual assertion expecting the reader to use a newly coded verb in order to proceed. For example, in Figure 29 above when the story begins the narrative prompts the reader to get up from bed. In order to keep the original

narrative labour as with *Twine* which included this as a hyperlink for the reader to act on a similar approach has been taken with *Inform 7*. The action verb 'get up' is by default implemented as an *action* within *Inform 7* which acts by removing the reader from one location to another location attached to it. This could easily be omitted in either adaptation given that it makes no difference in the actual narrative however to keep up with the author's original intent and given the possibility, it was implemented. Maintaining the agency as the author originally intended proved to be possible with the adaptation tools. At times their purpose ceases to offer the same effect of narrative labour which felt redundant when it would not make a significant effect, and the text might have served better as part of unresponsive content rather than part of agency constructs. An example is shown in Figures 30 and 31 below. The word 'ash' is a hyperlink that when clicked reveals additional text in the same paragraph. Since hyperlinks are not in effect in either *Storyplaces* or *Inform 7*, this functionality was not implemented in the corresponding paragraphs because it would be less of an optimal part in the agency. Instead, such content was merged with content from succeeding paragraphs. On this case authorial intent was purposefully altered.

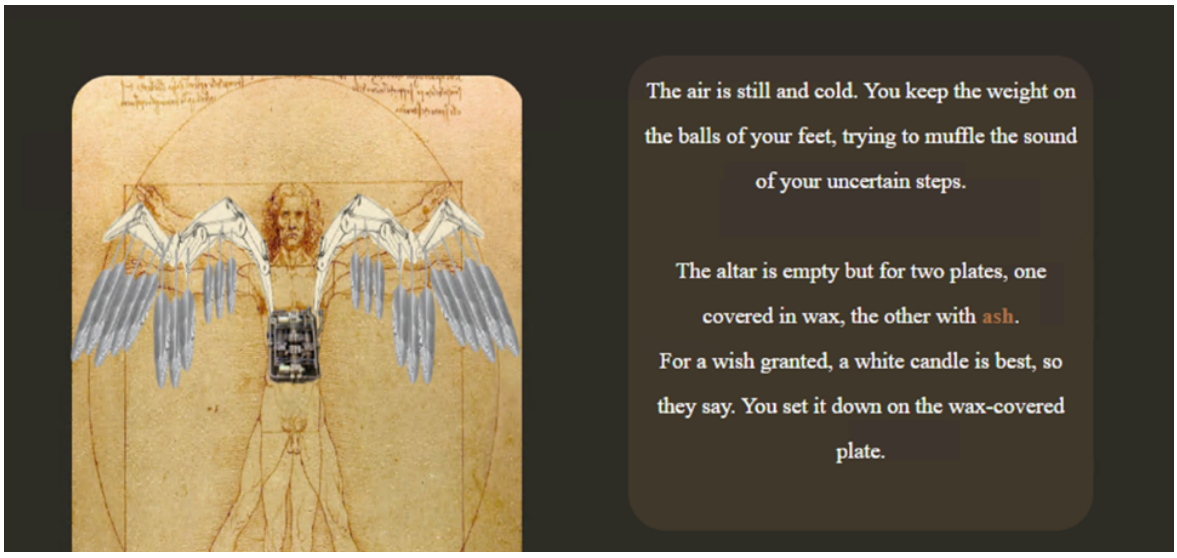


Figure 30 - Inline link that leads to expanded paragraph [Assemblage of Angels - Twine]

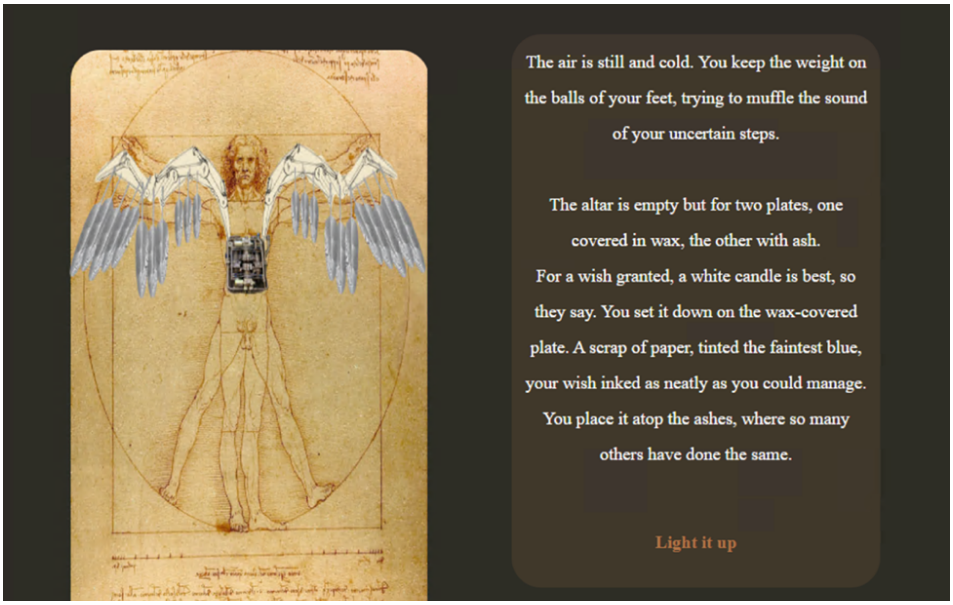


Figure 31 - Expanded paragraph that was revealed after clicking on a link [Assemblage of Angels - Twine]

O2.2 Definition and description of locations

The most distinctive locations mentioned in the original story are those that compile the three threads in *Assemblage of Angels* which when all followed eventually lead to the final *scene* that will finish the story. The locations presented as hyperlinks and shown in Figure 32 below are: *The Smith, The Tanner,* and *The Doctor.*

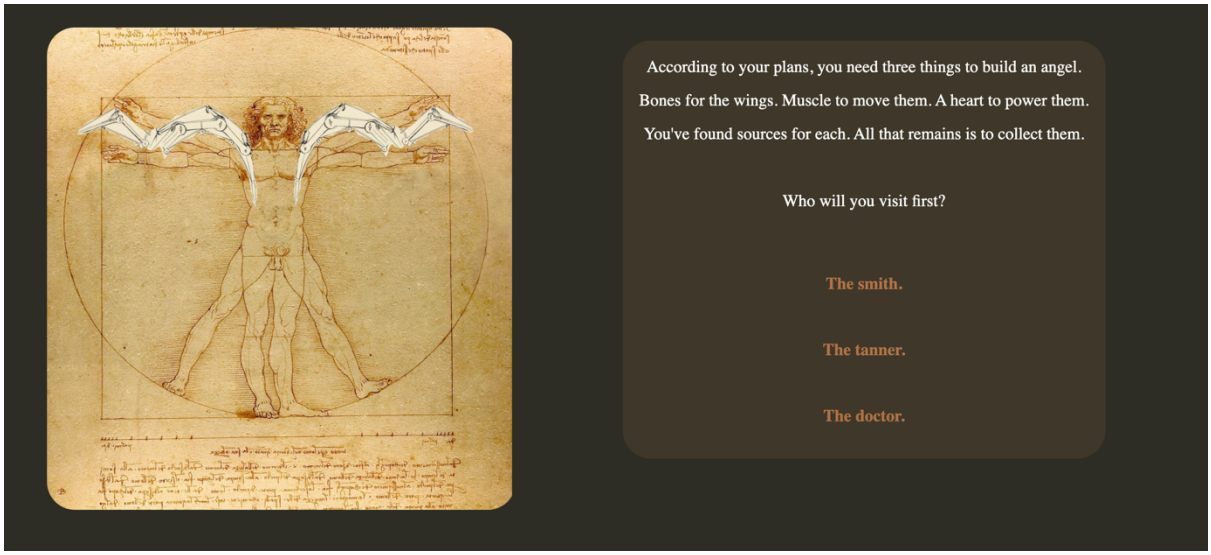


Figure 32 - Main locative links in Assemblage of Angels original story in Twine

Incorporating these locative elements in *Storyplaces* meant that physical locations had to be manually selected. This was simple to do since it is possible to pin locations on certain pages, thus allowing them to be revealed when the reader is physically located in the attached location. In order to offer a starting point for the story in *Storyplaces*, it was necessary to identify locations that were not explicitly stated in the story but were implied through the content. For example, the author mentions at the beginning of the narrative that the protagonist gets up from bed and should head to their workshop. While the workshop is only mentioned in that context, it was assumed as a location that the protagonist would visit. *Workshop* was transformed as a location in *Storyplaces* and subsequently in *Inform 7* as well. Figure 33 below shows the corresponding screen of Figure 32 above in *Storyplaces*.

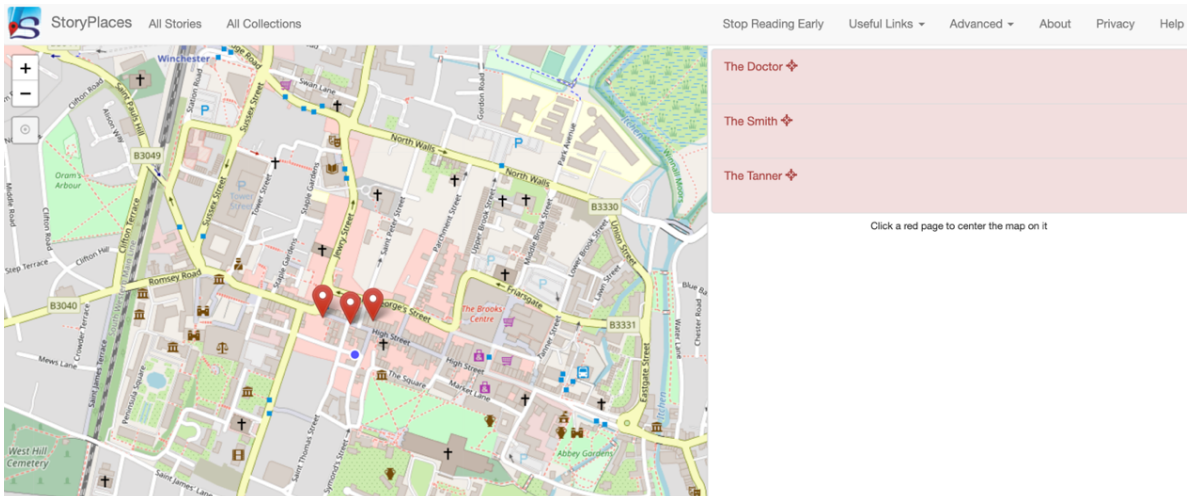


Figure 33 - Locative pages in Assemblage of Angels story in Storyplaces

In order to connect these locations and make either adaptation possible the reader needed on both occasions a starting point. One to begin navigating the environment with *Storyplaces* and one to virtually navigate the story world in *Inform 7*. Therefore, additional locations such as *Begin* and *Workshop* were created so that the reader is located somewhere as starting and follow up point, until the time when they need to visit the original designated locations (*The Smith, The Tanner, The Doctor*). Additionally, since locations are navigable in both *Storyplaces* and *Inform 7*, there had to exist a way

for the reader to know which location to steer themselves towards, in order to follow up with the narrative. This in *Storyplaces* was achieved via the embedded map in the reading environment that shows with pins the locations a reader must go to unlock content. For evaluation purposes Winchester has been selected as the location where the story will take place and locations span from the Winchester main train station to the city centre which is a five to ten-minute walk. There are five locations in total that the reader must visit in order to complete the story and those are *Begin* that follows the *Workshop* that follows either one of the *Smith*, *Tanner* and *Doctor*. Once all those locations are visited the story can be completed. The same locations were declared with *Inform 7* and those were connected manually using the tool's vocabulary with an additional location being *Home* which was necessary in *Inform 7* to situate the reader somewhere for the final act of the story. In order to inform the reader what to type on the screen and which direction to aim, additional text was added for prompt. Instead of showing a list that just states *Smith, Tanner* or *Doctor* in *Inform 7* the list includes the direction of each location attached to each place. This is visible in Figure 34 below which corresponds to the screen in *Twine* seen in Figure 32.

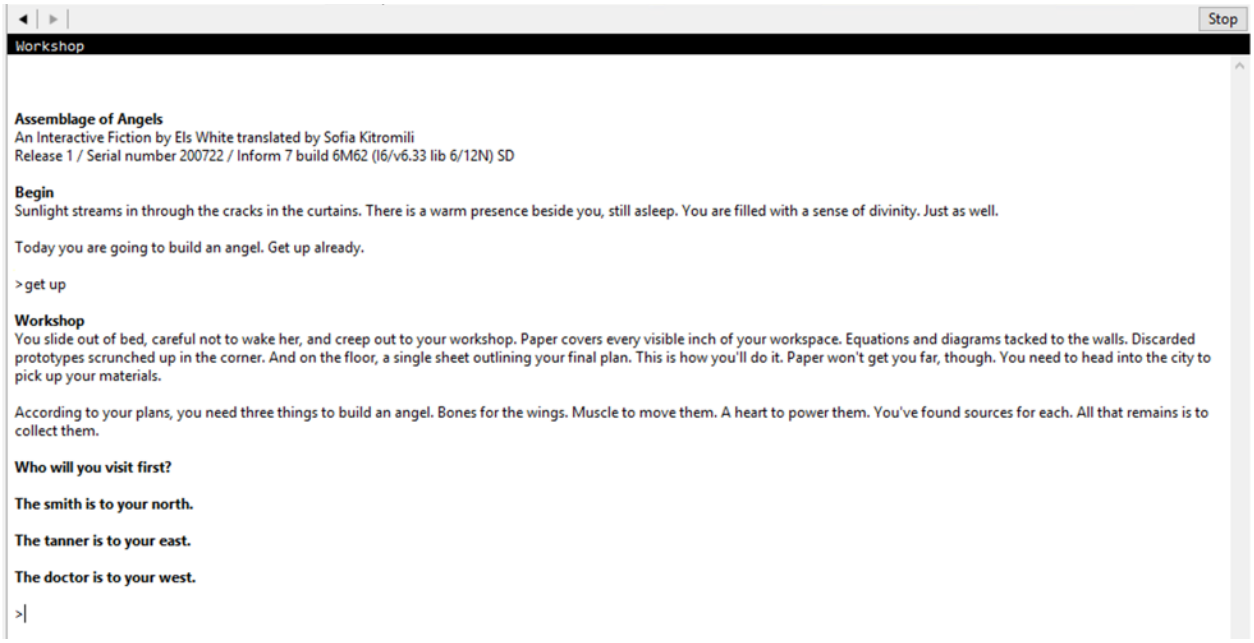


Figure 34 – Locations as presented in Assemblage of Angels story in Inform 7

O2.3 Revisiting and Rewinding nodes

The original *Assemblage of Angels* story was created so that the reader cannot go back and revisit or rewind a note. Once a choice is made there is no way for the reader to undo it or go back in any way to revisit a node unless the story is complete, and the reader starts again. This is something that was not entirely possible with the adaptation of the story in either *Storyplaces* or *Inform 7*. In *Inform 7* the reader can at all times navigate through the different locations set in the story, as it was not possible to entirely remove them once the reader had visited them. Trying to do so caused the story to run into a compilation error. This was because locations were declared as *rooms* and removing all of them after the reader had visited them meant that there would not be a default location for the reader to be located and this is against *Inform 7's* structural functionalities. This is why the additional location *Home* as mentioned previously had to be incorporated in *Inform 7* but not necessarily in *Storyplaces*. *Storyplaces* can deal with a reader accessing content if they are not situated in a particular location, *Inform 7* cannot. A reader must always be somewhere. This initially resulted in content been repeated whenever the reader visited a location more than once. To solve this a construct in *Inform 7* was utilised that made it possible to test the location and *turn* in that location the reader was at any given time. By conducting these checks, it could be determined whether a reader visited a location for the first or second time and thus adapt the content accordingly to avoid repetition. One such example is seen in Figures 35-36 below.

The example in Figure 35 below shows when the reader is already in the location *Smith* and has finished the passage looking to carry on. They are prompted to move to another location by typing the appropriate direction on the screen. Figure 36 below shows what is shown when the reader tries to go back to the location *Workshop* (set as one of the initial locations) before completing the visits to the remaining necessary nodes at least once (*Tanner, Doctor*). It prompts the reader to visit the necessary locations with a message that they have not yet completed the collection of necessary materials to build the angel. Furthermore Figure 36 below shows what happens when the reader tries to visit the

location *Smith* for a second time. Instead of allowing them to access the content already read, they are prompted to visit the remaining necessary locations, thus making sure that those are also read as per the original story's requirements.

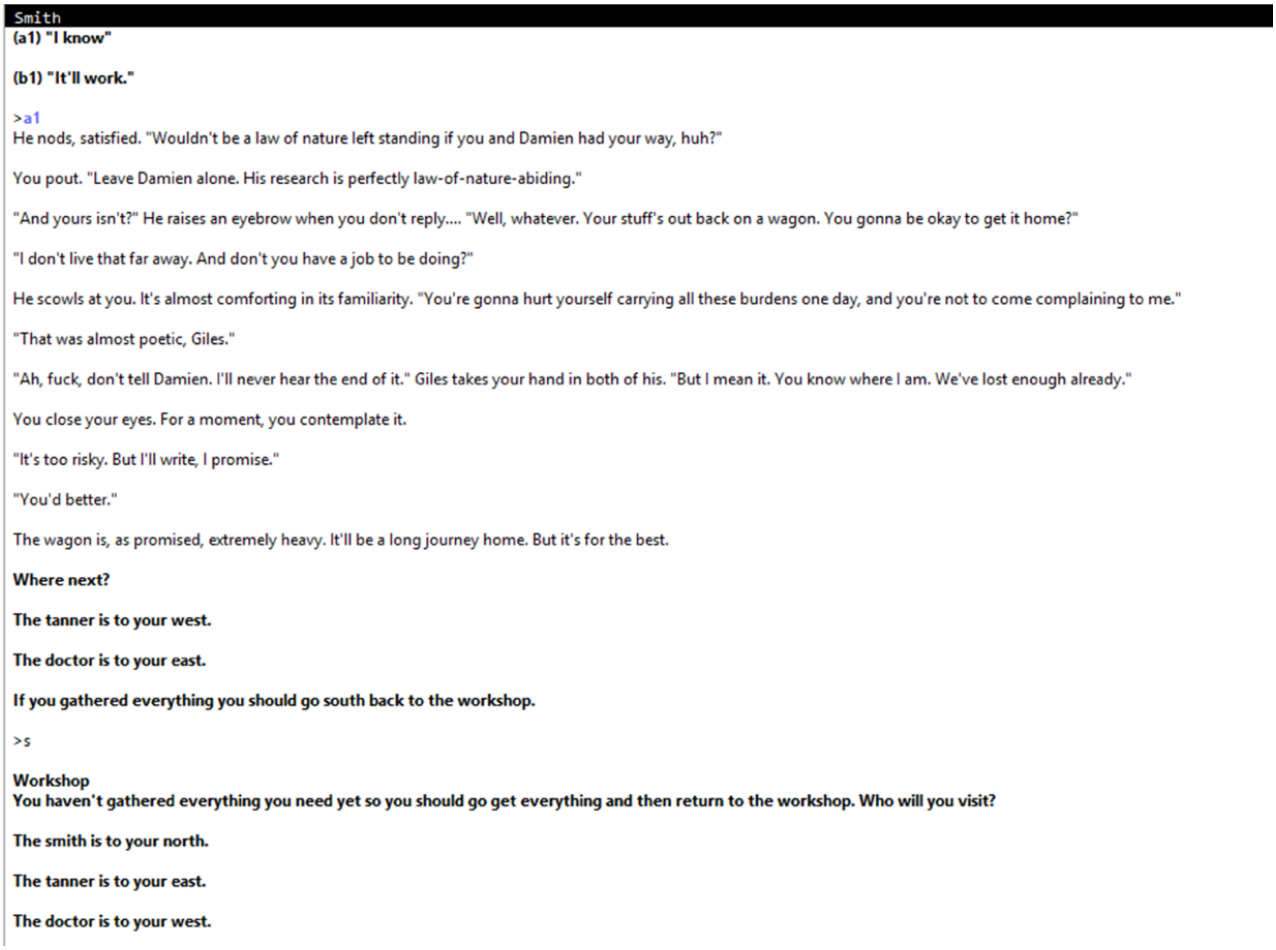


Figure 35 - Inform 7 reading screen with additional text to original story 1

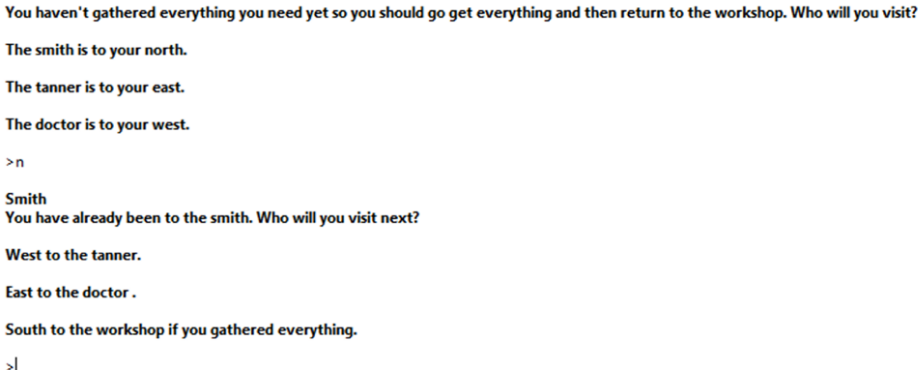


Figure 36 - Inform 7 reading screen with additional text to original story 2

Figure 37 below shows how revisiting and rewinding is prevented in the original story. Locations visited are crossed out and become inaccessible.

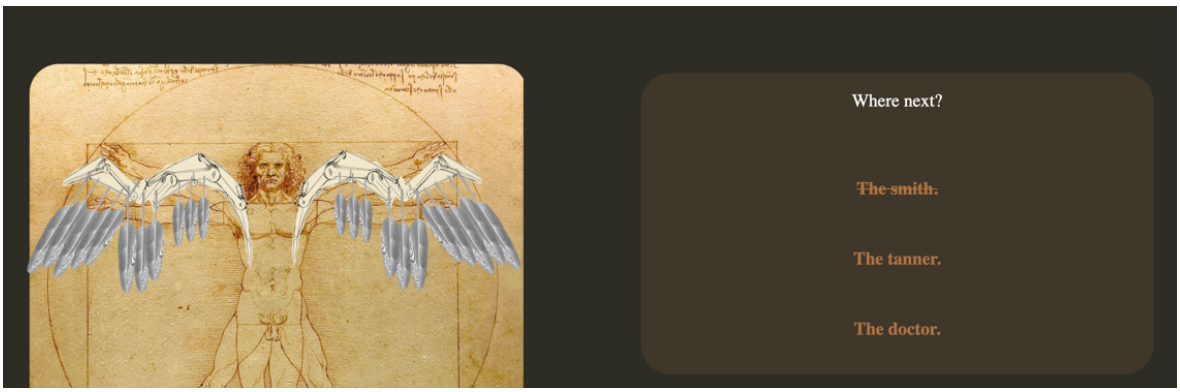


Figure 37 – Twine reading screen of preventing revisiting nodes

With Storyplaces on the other hand, removing the pages from the live reading was not an issue since they automatically disappear once read. This is something easily achieved by setting this in a page's constraints as seen in Figure 38 below when the choice to read a page multiple times is set to 'No'.

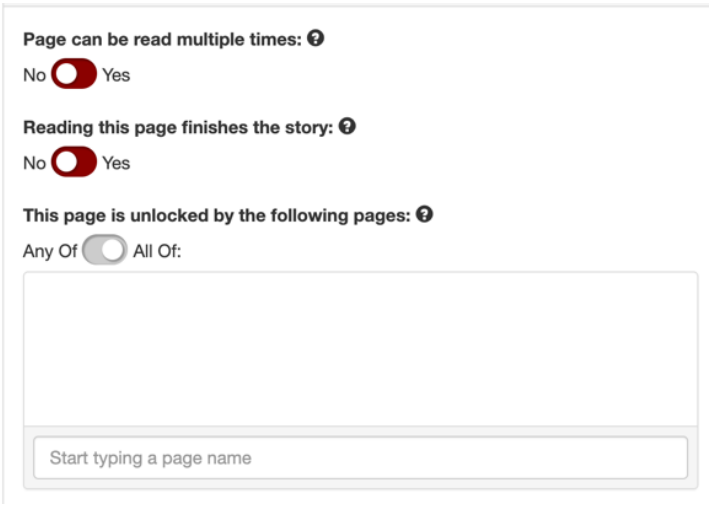


Figure 38 – Storyplaces interface constructs for preventing revisiting a node

This feature prevents the rewinding of nodes as the author intended however since pages are pinned on physical locations, revisiting their location is up to the reader. Nothing

stops the reader from physically revisiting a node where content was previously unlocked and read, but the tool ascertains that rewinding of content is prevented.

Ultimately with both *Storyplaces* and *Inform 7* locations may be revisited but the content can be managed so that it does not rewind.

O2.4 User interface conception

One aspect that has proven useful during the adaptation was the ability to accomplish the interactive elements of the story via the user interface. This was predominantly visible with *Storyplaces*, designed to include complex story constructive elements such as mapping and connecting locations, locking and unlocking chapters or pages, and removing pages that have been read by simply toggling buttons in the user interface. On the contrary *Twine* and *Inform 7* required at least a minimal account of scripting which meant that some time would need to be spent in familiarising with how to write machine code. This is not necessarily something that will affect how the way a story is shaped; however, it is something that affects how an author perceives a tool. An author that is able to easily conceive what options they have when authoring a story means that they can easily configure whether the tool can serve their needs. On the case of the second adaptation *Assemblage of Angels* the tools were already familiar from the first adaptation *Fallen Branches* and their constructs were well known. The familiarity made it easier for the second adaptation to be planned and carried out without overwhelming difficulty. With the first adaption, this task had been more difficult as there was no knowledge on how the tools worked or how they functioned, and the user interface was not diligent in communicating that. An author who is unsure of what a tool can do, can easily mismatch their tool selection with their end goal and end up using a tool that does not quite grasp the true nature of the story they would like to create. Therefore, allowing the tool to take over and influence the narrative structure.

4.5 Summary

The above story adaptations describe how two stories, one written with a locative literature digital interactive authoring tool - *Storyplaces* - and one written with a hypertext/branching authoring tool -*Twine* - were adapted into these tools vice-versa as well as into a natural language parser-based interactive fiction writing tool – *Inform 7*. These adaptations were designed to explore different ways which interactive authoring tools affect the authoring process of a story. Ten key observations were noted that involved how the story structure for each tool was created, the way locations were defined and described, effects of revisiting and rewinding nodes, the definition and distance between locations, the navigational cues for progressing with the story, the way text was delivered, the narrative labour, and finally the effects of the user interface.

A key observation was that authoring tools can affect the ways authors tell interactive stories with their ability to add or remove elements in a story which the author may not intend. Examples from the adaptations include the embedded back button in *Twine* that failed to restrict readers from rewinding nodes, the neglect of locations in *Twine* that made the story lose context, and the addition of supplementary text in *Inform 7* to enable story continuation and prevent rewinding repetitive content.

An interesting observation was O1.4 - distance between locations. When reading *Fallen Branches* in *Storyplaces*, it may require a three-minute walk to reach from one node to another and unlock the story content. When reading the story in *Twine* and *Inform 7* it takes no time at all. If an author wishes to offer a locative experience to the reader that requires travelling from London to New York, asking them to travel such great distances to access parts of a story might be discouraging. Leading to the fact that authoring a story about location with a non-locative authoring tool might be more feasible.

Another interesting observation is O2.1 - Narrative labour, shows how the agency loses or gains significance depending on which narrative structure is implemented and what the

labour of navigating that structure is. Using *Twine* as an example, there is a satisfaction behind the labour of clicking hyperlinks that when replicated in a tool like *Storyplaces* becomes mundane. With *Inform 7* the concept of hyperlinks is replaced with the exchange of text with a parser on the screen. This shows how agency in interactive narratives can take many forms and that each form has its own unique traits that may be difficult to achieve with just any authoring tool.

Finally, observation O2.4 - User interface conception, discovered when the authoring commenced in *Storyplaces* that showed how the interface plays a role in how the perception of the author on what the tool can do can be affected. The interface of *Storyplaces* made the process smooth by being easy to conceive and work with, and that has much to do with the complex functionalities that were masked and implemented as part of the user interface that did not govern the need of scripting or coding. This is quite a vital part of the authoring process as authors will often avoid choosing a tool that they do not understand or that seems to be dictating their creative purpose. Notable here is that when an author knows how the tools work, they can compare functionalities and implement the story mechanics easily as was the case when the second adaptation for this project commenced. Otherwise, it might be hard to configure things through the documentation as it was deemed quite complicated during the adaptations. Given the different backgrounds of authors it seems unlikely that everyone will come to understand the guides in the same way.

Overall, the observations indicate that stories are in significant ways influenced by authoring tools. Affordances of one tool may be a labour-intensive task in another tool, and the user interface plays a significant role in not only the experience of an author but also the authoring process. Setting *Storyplaces* as a final example, it is not to be dismissed that the ability to handle location definitions through a map, brought a set of benefits which the other authoring tools failed to provide. There is no need to define specific locations, nor create content connections manually. It is all handled by the tool similarly

to how many other user interface induced components are handled. This may discourage the ability to define fictional locations or create long-distance connections in a story but when it comes to authoring, it is a component that makes physical location definition easy. If this is true with the variety of tools out there, that each is created to accommodate simplicity when carrying out a particular authoring requirement then their continuous development over the years would be explained. With so many requirements in interactive storytelling it stands to reason that authoring tools are multiplying. The only concern with this, is whether new tools manage to resolve authoring issues found in older tools.

In the following chapter a systematic literature review to collect relevant to the study information about the authoring process and the issues of interactive digital narratives from the publications of two distinct academic communities will be presented. Chapter 5 will present the second method that stands part of the study's overarching methodological approach via an inductive approach with means to develop an authoring process model, inspired from the observations of what entailed the authoring process with each tool in the story adaptations of this chapter.

Chapter 5 Systematic Literature Review

5.1 Introduction

The previous Chapter 4 has presented an experimental approach into the process of authoring digital interactive narratives with a small sample of authoring tools. Using two interactive stories as autoethnographic story adaptations those were adapted from their tool of origin to an additional two tools. By doing this experiment it was possible to understand how the tools make authoring possible, how they influence a story and the shaping of that story and how the process of authoring a digital interactive narrative compares to the process of authoring a traditional non-interactive story. The focus of Chapter 4 was on the authoring tools and on how they respond to the needs of an author. It showed how tools can offer unique functionalities that may be hard to replicate in other tools due to the interactive format they were built for. It showed that in order to approach the development of a narrative a good amount of familiarisation with the tool may be necessary if an author is to achieve exactly what they are looking for. It also showed that during the narrative development common activities necessary to the process, such as going through documentation, creating visual structures and testing the functionality of the story to see that it conforms to the original idea, were repeated on both story adaptations. The activities that surfaced were essential to the experiment because they set a foundation for considering the identification of an underlying authoring process as well as the issues that surface during that process. This chapter will in turn describe an approach that shifts focus from the tools to the authoring practise and seeks to identify and establish how activities during authoring can establish a formal authoring process.

Kampa (2018) explains that there are two ways to approach authoring in digital interactive storytelling. One is to learn how to program and develop one's own tool with

the desirable features. A cumbersome yet effective story creation process that allows for the engine to work exactly as how it was programmed by the creator. The other is to learn how to write content for an already developed tool but accept that there will be creative limitations. Kampa (2018) here explains a project undertaken on writing a location aware story, to classify the authoring tasks followed during the process. Her results define three categories of tasks: creative (finding locations or taking pictures, creating videos etc), technical (creating technical documents and structuring the content) and scientific (historical data). She mentions that a common authoring task was an iterative process of testing and debugging the story and concludes the study by stating that the authoring process of digital interactive narratives consists of several authoring tasks (Kampa, 2018).

Several researchers have suggested design frameworks or design processes that would help with the authoring of hypertext and interactive fiction and the broader range of interactive digital narratives.

Smith et al. (1987) through cognitive theory developed a framework for written communication explaining that writing is a cognitive process that considers memory, ideas and associative relations among them, and reading and analysing text. In his framework the author uses prewriting, organising and writing as three steps directly concerned with the authoring procedure.

Trigg and Irish (1987) believe that hypertext is equipped to support the writing process when writing consists of features beyond text composition such as notetaking, organising and structuring.

Theng et al. (1995) wrote on specific requirements that authoring should contain to satisfy potential authors. Those were creation of nodes and links, generation of overall map and structure, support for capturing and representing users' needs, provision of a full range of editing facilities, support for tracking and checking, support for testing and evaluation,

and creation of external links. They used this list to study the existence of these objectives against tools such as *HyperCard*[23]. While the research was based on older hypermedia tools new ones have surpassed in functionality and story behaviour, a similar approach to modern writing tools would be ideal to identify whether some important requirements are being met.

Koenitz (2015b) suggested four design phases based on the story development approach he teaches with an authoring platform called *ASAPS* (Koenitz and Chen, 2012). Those phases are paper phase (idea to treatment to flow diagram), prototype phase (check interaction and flow without (final) assets), production phase (create (final) assets, structure and interaction), and testing phase (beta user testing, final adjustments).

With these examples in mind and the need to identify an authoring process to describe what steps it may entail, a systematic literature review was identified as an appropriate and necessary method to approach, with the aim of discovering papers from a targeted set of libraries that can offer knowledge on the authoring process.

5.2 Method of approach

Digital interactive narratives extend their scholarly routes into disciplines widely covered under two distinctive research communities; those researchers who are studying Hypertext and those that study Digital Interactive Storytelling in all its forms. The work of each community is published under the ACM Proceedings for Hypertext since 1987 and under Springer Proceedings for ICIDS (International Conference Interactive Digital Storytelling) since 2008 which followed events ICVS (International Conference on Virtual Storytelling) and TIDSE (Interactive Digital Storytelling and Entertainment) between 2001-2007 on a yearly or two-yearly basis. With every proceedings publication both communities hold a

[23] http://hypercard.org/

rich variety of papers that introduce, discuss and explain authoring tools and the authoring practises of digital interactive narratives. The conferences cover much about theoretical aspects of narratives and the transition to digital and interactivity. A summary of the topics covered in either one or both conference proceedings involve narrative theory, practises of digital interactive storytelling in games, virtual reality, cultural heritage, authoring systems, hypertext theory and infrastructure, hypertext literature and narratives, and hypertext and hypermedia authoring. Much of the literature invested in this project has benefited from work covered in both the aforementioned communities. Not limiting the knowledge, but rather extensively through investigation of the origins and upbringings of interactive digital narratives and the expansion of authoring tools, it was deemed appropriate to meticulously scan the literature published from expert researchers in the realms of digital interactive storytelling and more importantly in the limited number of those who are investigating authoring tools. Due to their direct relevance with the topic of authoring digital interactive narratives and with evidence that there are ongoing investigations on understanding an authoring process two events have been selected for review.

The process of outsourcing the most relevant papers to the inquisition of an authoring process has been to examine closely all of the publications available online for each proceeding of both conferences. Proceedings for the Hypertext and Social Media conferences are available on the ACM Digital Library[24] as a list since 1987. Proceedings for the ICIDS conferences are available on the SpringerLink[25] repository as a list since 2008. The full list of ICIDS proceedings including those that used to publish work under two other proceedings (ICVS and TIDSE) between the years 2001-2007 are available on

[24] https://dl.acm.org/action/doSearch?target=browse-proceedings-specific&ConceptID=118222&ConceptID=120301&ConceptID=118290
[25] https://link.springer.com/conference/icids

the Association for Research in Interactive Digital Narratives[26] (ARDIN) website as a list since 2001. Once these libraries were identified, they were accessed year by year and scanned through by reading titles and abstracts identifying keywords that were deemed relevant to the act of authoring interactive narratives. Those that matched the keywords were shortlisted for deeper analysis. Keywords that indicated a paper could prove fit for purpose were the following:

- authoring tools
- authoring issues
- authoring process
- narrative design
- narrative patterns

A process of inductive coding was followed while each shortlisted paper was read in depth and notes were taken from any mentions of distinct authoring processes, capturing the term used in the paper to describe the process. Similar activities were grouped together into distinct steps and those went through several iterations until the division between those steps was clear. Finally, a name for each step was chosen, drawing on the terms used by the papers themselves, or reflecting some of the names used previously in relevant literature.

Source	HT & Social Media	ICIDS	Total
Scanned	1150 papers	694 papers	1844
Shortlisted	48 papers	39 papers	87
Selected	11 papers	6 papers	17

Table 2 - Statistics on selected papers for the systematic literature review

[26] https://ardin.online/conferences/icids-interactive-storytelling/

Through a combination of both conferences a total of 1844 papers have been scanned through the online proceeding repositories of each conference and from a total of 45 proceedings (27 from Hypertext and Social Media between the years 1987-2018 and 18 from ICIDS between the years 2001-2018). A total of 87 papers were shortlisted for a full review having been deemed potential sources of knowledge on interactive authoring tools and their process of authoring and 17 have been selected to form the results.

Thus far, many researchers have had multiple roles in the investigation of authoring digital interactive narratives. Their roles varied from being the authors of a narrative as seen in Millard and Hargood (2017) to being the creators of a tool seen in Hargood et al. (2018) or the literary theorists behind a narrative approach seen in Hargood et al. (2016). This pattern is repeated by several experts in the fields and as the years progress their research builds up on their previous work to resolve the eminent problems that have been unresolved as seen in Halasz (1987); Spierling and Szilas (2009); Green et al. (2018), or adapt to modern technological advancements and improve on previous versions of an authoring system as seen in Bernstein (2002). That yields non-conclusive data on how to resolve the authoring problem and the results might on some level be biased on the needs of the researcher. In addition according to Spierling (2018), the evaluation that most researchers do seem to be acknowledging the authoring problem as something that is there as opposed to something that needs to be evaluated for resolution. Especially from an author's point of view. In order to collate and arrange all the relevant findings on the authoring process, a systematic literature review was deemed a necessary approach to collect common evidence from novel existing work, piece together information that address common issues and put them into a new perspective. The information gathered was aiming to develop a picture of how the authoring procedure is regarded by researchers, some of whom also act as tool developers, and what their findings say about the relationship behind the design of a tool and the process of authoring an interactive narrative. Papers selected for the study exhibited evidence of providing insights to the following main question of the study:

What is the process of authoring digital interactive narratives and how do the authoring issues identified over the years match that process?

The main question was addressed through the following breakdown questions:

- What do researchers assume about the authoring process?
- What are the assumptions on the authoring requirements and how are researchers looking into discovering what those are?

5.3 Configuring an authoring process

By revising the literature selected for this study, taking advice from the aforementioned frameworks or models researchers have published and by collating those with suggestions of improvement on the authoring process it was possible to identify a series of steps that contribute to what the authoring process entails in interactive storytelling. The suggestions gathered have been either critique from researchers on the use of a tool, design considerations towards future system developers or authoring suggestions from which authors would benefit during the authoring process of a digital interactive narrative. Common suggestions have been grouped together and each group of suggestions was categorised as an authoring step in the authoring process.

A total of six steps derived from the classification of suggestions as can be seen on Table 3 below and these are:

Training & Support – Guiding the author on how to use the authoring tool via documentation, examples, guides or tutorials.

Planning – Sketching out the plot(s) of a story, creating characters, drafting events, and making notes.

Visualising/Structuring – graphically creating, studying, and revising the structure of a story (relationships between events, characters, chapters or scenes) and granting an overview of the whole.

Writing – inputting content that is part of the narrative presented directly to the reader (typically the text) rather than any specialised language of the tool.

Editing – revising, augmenting, and changing the content and structure of the story, for example embedding media in the text, changing stylesheets, keeping a revision record, or updating the structures or relationships between nodes.

Compiling/Testing – checking that the design is complete and error free, for example without any loose ends or empty nodes. Also, in the case of using a tool with its own vocabulary that the language was used without syntactical errors or any other coding faults.

An additional category **Advanced features** has been identified as part of system-dependent activities while using a tool. Those were either enhancements to the story or the creation of the story such as calculating metrics of visited or linked nodes or enhancing the story experience via advanced effects.

Table 3 below presents the total summary of suggestions collected from the literature review, their group classification as part of an authoring step as they were mentioned above, and the reference of each suggestion. Many suggestions have been addressed by several researchers as a common concern while others derived from a sole researcher. The fact that there were common issues is an indication that many different eyes have stumbled upon the same problems. In the category *Visualising & Structuring* the suggestion *Visual structures* has been mentioned by three researchers whose timeline spans across 13 years. The first two researchers addressed this first in 1987 while the third researcher addressed the same concern in 2000.

List of suggestions on the authoring process		
Step	**Suggestion**	**Reference**
Training & Support	➢ Examples of successful presentation strategies (1) ➢ Emphasize the dual character of the writing space to contain context and be part of the structure (2) ➢ Representation of the environment to deliver infrastructure to author (3) ➢ Education of authors with simple tools distinguishable in use from linear branching methods (4)	1. (Marshall and Irish, 1989) 2. (Joyce, 1991) 3. (Medler and Magerko, 2006) 4. (Spierling, 2009)
Planning	➢ Notetaking (1) ➢ Separation of adaptive from static content (2) ➢ Use of frameworks for separation of concerns (2) ➢ Use of standards for content reuse (2) ➢ Character-based, narrative-based and action-based planning methods (3)	1. (Trigg and Irish, 1987) 2. (Foss and Cristea, 2010) 3. (Szilas and Axelrad, 2009)
Visualising & Structuring	➢ Outlining (1) ➢ Visual structures (1)(2)(6) ➢ Links and node creation and augmentation (2)(5) ➢ Annotated graphical overviews (3) ➢ Generation of overall maps and structures (5)(6) ➢ Development and reconfiguration of transitional organizational structures (4) ➢ Visual indication that all lexias available in a narrative have been visited (7) ➢ Representation of relationships between events (8) ➢ Structure and shape should: tackle boundaries, critical mass for emergence and dead ends in a story (9) ➢ Story simulation (10)	1. (Trigg and Irish, 1987) 2. (Halasz, 1987) 3. (Marshall and Irish, 1989) 4. (Joyce, 1991) 5. (Theng et al., 1995) 6. (Pohl and Purgathofer, 2000) 7. (Calvi, 2004) 8. (Nakasone and Ishizuka, 2006) 9. (Louchart et al., 2008) 10. (Swartjes and Theune, 2009)
Editing	➢ Versioning (1) ➢ Search and query (1) ➢ Extensibility and tailorability (1) ➢ Editing facilities (2) ➢ Sequencing identification of linear events (3)	1. (Halasz, 1987) 2. (Theng et al., 1995) 3. (Dang et al., 2011)
Writing	➢ Collaborative writing (1) ➢ Integrating expository text with other types of metainformation (2) ➢ Enable rapid spawning of hi-directional links for notation and comment (3) ➢ Reachability of story from initial node (4) ➢ Creation of stories from different narrative components i.e. facets, plot (5)	1. (Halasz, 1987) 2. (Marshall and Irish, 1989) 3. (Joyce, 1991) 4. (Dang et al., 2011) 5. (Wolff et al., 2013)
Compiling & Testing	➢ Support for testing and evaluation (1) ➢ Debugging within the authoring environment (2) ➢ Identification of deadlocks (3) ➢ Availability of story parser, context modeler, plot modeler, character modeller (4)	1. (Theng et al., 1995) 2. (Medler and Magerko, 2006) 3. (Dang et al., 2011) 4. (Cai et al., 2011)

Advanced features	➢ Support of activities from other disciplines (3) ➢ Creation of timelines that bring captivating pacing and timing effects to stories (5) ➢ A range of scopes such as character behaviour, story representation definitions, dialogue scripts, etc. should be covered within the tool (5) ➢ Suggestive system features to the needs of the author (6) ➢ Complexity measurement of each node in number of actions and other computational facilities (2)(7) ➢ Referencing (1)(3)(4) ➢ Creation of external links (4) ➢ Recording user requirements (4)	1. (Trigg and Irish, 1987) 2. (Halasz, 1987) 3. (Marshall and Irish, 1989) 4. (Theng et al., 1995) 5. (Medler and Magerko, 2006) 6. (Foss and Cristea, 2010) 7. (Dang et al., 2011)

Table 3 – List of suggestions on the authoring process

This suggestion had been resolved at the time by tools such as *Storyspace*, however having an issue for so many years with so many professionals acknowledging it while working on improving it means that either this issue is beyond human capabilities or people acknowledge it without mending it. It seems as if it takes a long time to understand what the problem is even if many people seem to be onto it. Further than that, it is likely that even if the problem is before the eyes of those trying to solve it, they choose to perfect the functionalities of these tools thus failing to address the concerns that would aid the use of the tools. The best example to this is the difficulty to add content. Of all the steps in an authoring process, if one of the issues an author has to struggle with is adding content then it is hard to imagine how anyone would feel less intimidated to work with interactive narratives. Evidently there is no lack of authoring tools available, no lack of incredible narrative functionalities, no lack of imagination from prospective authors and no lack of skilled tool developers. There is lack in understanding properly what the authoring process is, what it requires and how the tools can best reflect each step of the process.

On a closer inspection of the steps identified as part of the authoring process and the distribution of suggestions in each step of the process, there is an inclination towards the need of authoring activities that enable visualisation and structuring of a narrative, followed by the necessities to include advanced features, not entirely related to storytelling

however relevant to the concerned tools. The activity of writing, which means the activity to input story content seems to be a less cumbersome or less troublesome step. *Writing* and *Editing* could be considered as a sequential activity yet since editing involves editing not only text from the content but also nodes from the structure it is presented as a separate activity. The same goes for *Planning* and *Visualising & Structuring*. While the visual structure of a story can be considered as the plan of how the narrative will pan out it does not account for brainstorming or taking notes for the plot of the story.

Activities that are likely to be carried out during either step of the authoring process identified above should be considered during the development of a tool while reflecting on the skillsets required for each activity. This will make it possible to not only equip a tool with activities that may be necessary during the authoring process but also to identify whether the tool is suitable for a single person or if it will require more manpower in developing a story. This refers to an authoring issue mentioned by Aylett et al. (2011) recorded on Table 1, section 3.4 in Chapter 3 - *"Content production for a graphical narrative is unlikely to be a one-man job. Writing and animating skills are different"*. Developers must consider that for each activity mentioned on Table 3 above, functionalities will likely be coveted by one human with a specific trait of skills that may or may not extend to coding, animating etc. The tools should be able to accommodate those with the least number of skills without taking away the ability from those with particular skills or experience to expand on the basic functionalities.

Particularly interesting is, as the diagram will show in Figure 39 below, how in the recent years nothing has been mentioned with regards to the authoring process or the issues authors are facing while attempting to work with digital interactive authoring tools. This is no indication that this concern has found its resolve but rather that research has stopped focusing on the authoring procedure all together.

References in red are from the Hypertext Conference and references in green from the ICIDS conference which seems to have taken over the work on authoring tools in more

recent years. In order to gain solid understanding on the problem of authoring, research on the authoring process needs to regain attention.

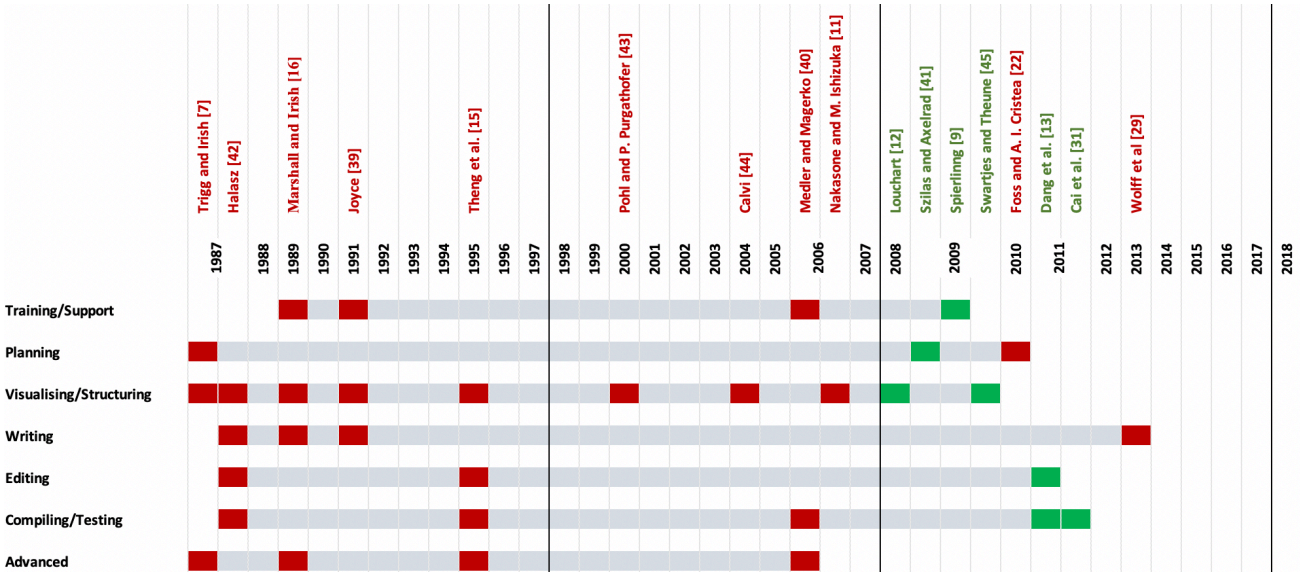


Figure 39 - Sources used for the collation of data on Table 3

5.4 Summary

By conducting a systematic literature review and collating information relevant to authoring concerns, it was possible to combine the findings from research performed throughout the years and identify through the suggestions of other researchers what an authoring process most likely comprises. The authoring experience is as vital as the technical affordances of tools. When a tool is implemented, there must be consideration on how the authoring process will reflect on what the tool can do. The authoring process may not have been something to decode for other means of creating narratives, but as interactive narratives are part of art fusing into computer science, an establishment of what it is, seems necessary.

In the attempt to discover what an authoring process is, the collection of data from targeted research archives of conference proceedings (ACM Hypertext and Social Media, Springer ICIDS) has enabled the identification of six authoring steps: *Training & Support,*

Planning, Visualising & Structuring, Writing, Editing, Compiling & Testing. The remaining step *Advanced Features* reflects less of a step in the process rather it is a category for specialised functionalities non-common in tools. The main discovery of the literature review performed here, is that authoring is a multi-step process that comprises of at least the six steps mentioned above. The process identified here is not a concrete depiction of an ordered sequence of steps that every author is likely to follow as there are steps that may be missed (i.e., due to outsourcing an activity to someone else or because a step is unnecessary), or their order of appearance may shuffle depending on the author's needs, narrative needs and tool's ability to support those steps. Tools are not necessarily built to accommodate each step of that process rather it is safer to assume that they may specialise in one or two specific ones depending on what the developer was looking to achieve. Finally, while it is assumed authoring is a one-person job these authoring steps do not necessarily reflect that they will be followed by the same person as it may be possible that other people will be involved such as when an author lacks a certain skillset or where in the case of publishing, the narrative may be handled by reviewers and website managers that accept works for publishing.

At it currently stands, things are unclear about how an authoring process is perceived or whether one is fully understood.

The following chapter will present the final method chosen to stand as part of the study's overarching methodological approach in the form of interviews with hypertext and interactive fiction authors. The interviews present both inductive and deductive coding approaches that contribute to the formation of a framework describing issues that occur during the authoring process. By using the identified process model in this chapter as part of the questioning it was possible to verify and adapt to it steps in the process. Furthermore, the process model identified in this chapter was matched to the framework of issues developed in the following chapter for a combined overview of where in the process issues are more likely to occur.

Chapter 6 Interviews

6.1 Introduction

This project is focused on the experience of an author while utilising one or more digital interactive authoring tools to create a digital interactive narrative. The report has presented two approaches to the problem of authoring. First, two authoring autoethnographic story adaptations were implemented to provide input on the influence the tools have on the shaping of the stories. The method revealed issues that may be encountered in the attempt to author a story in different tools and allowed to record activities undertaken during the authoring process with each tool. Then, a systematic literature review was conducted putting an emphasis around the issues and the state of the authoring process. The findings have allowed an authoring process to be identified and introduced steps that compile that process. This study would not be however complete unless the findings were collaborated with the personalised experiences of the people who are tackling with the authoring problem. It was vital to listen to people's opinions on what the authoring experience personally entails for each author. There is no dispute that the findings from the literature review and the input of the story adaptations have been invaluable in understanding and developing a clear overview of how the tools work, how they influence stories, how issues are caused, and what process is followed to complete a narrative. To further inform the findings of the study through the variety of experiences interactive narrative authors go through and as such validate some of the findings, a series of interviews were deemed a necessary approach.

6.2 Method of approach

Spierling (2018) gave a set of appropriate and non-conclusive evaluation methods in terms of the use of authoring tools. She explained how people such as the tool developers or

research teams who hire creative professionals for authoring might get biased results about the authoring process and that those methods are best reserved for the evaluation of the tool rather than the authoring process. The same is considered on recruiting students or random workshop participants to do such evaluations who might not conceive the complete overview of the authoring process. Ideally people who have experience in the discipline should be interviewed, in order to give a general feedback that will be presented in an abstract way. Sawyer (2018, p.139) states "*creative works are the outcome of an extended process of making"*. He has developed through empirical work a cultural model from an ethnographic study of interviewing professors in art and design disciplines to identify how creativity as a process is regarded by those who teach it. The approach taken by Sawyer is considered ideal for discovering the traits of the interactive creative process by similarly approaching people who practise the art and ask them to talk about their own approach. This would show similarities and/or differences in actions undertaken during the creative process and in the conceptual difficulties authors are facing. Short (2007) an interactive fiction writer[27], reviewer of game narratives and new media, involved in the development of an authoring tool wrote *"It's possible that no tool will exist that quite meets your needs"* (Short, 2007). In the pursuit to gather feedback from people actively involved with writing interactive fiction she did an informal poll on what interactive fiction tools people wished existed which has proven to be an effective way to gather the opinions of interested parties. She summarised the answers into a list of seven suggestions which included the development of new types of authoring tools and some improvements on the usability of existing ones (Short, 2014). Her main motive behind this poll was to gain some perspective on whether authors had unique or common requirements from the tools.

[27] https://emshort.blog

When considering the issues or improvements on authoring tools it is important to uphold that needs differ to the type of narrative an author is trying to develop, the skills they possess, and also whether the narrative will be mostly based on text or graphics. Offering a microphone to a group of active authors in the field of interactive digital narratives seemed an essential method for gathering vital information, to enable this research to achieve complete answers for the research questions. Since this is a study focused on the experience of authors as users of technology their opinion was considered of great importance when the research is an attempt to configure what it means 'authoring digital interactive narratives' and by discussing with them about how they work towards the creation of a narrative would enable the validation of the authoring process presented in Chapter 5 as well as the collation of real-life issues during that process.

6.3 Assembling authors

Interviews are one of the most common methods of research for gathering qualitative data. They provide concrete data from people who are offered the chance to be heard and help verify findings. This study is a qualitative approach on an opportunistic sample with a series of semi-structured interviews. It was approved by the University of Southampton ethics committee with a number: ERGO/FEPS/47296. The sample of authors was targeted to represent people from a variety of backgrounds and skills such as the interactive fiction community, academia and commercial game industry. Authors were approached through online interactive fiction forums such as the Interactive Fiction Community[28], Choice of Games[29], Interactive Fiction on Reddit[30] and Text Adventures[31]. This approach has been an inspiration that proved effective by Short's (2014) previous

[28] https://intfiction.org/
[29] https://forum.choiceofgames.com/
[30] https://www.reddit.com/r/interactivefiction/
[31] http://textadventures.co.uk/forum

example on addressing the community for tool suggestions. Other authors were approached personally via email due to their background with interactive narratives or the games industry. Finally, some authors were approached in person during the 30th Hypertext and Social Media conference in Hof, Germany (2019) where many expert researchers mostly in hypertext fiction were present. In total 20 people were interviewed, 15 male and 5 female participants, with 12 (10 male, 2 female) coming broadly from the interactive fiction community, 5 (4 male, 1 female) from the academic community, and 3 (2 female, 1 male) from the game development community. As an opportunistic sample this gave a 3:1 ratio of male to female which may have impacted the importance of statements on different stages however while codifying the results, each individual's background seemed to have played the greater role in the importance of statements.

All interviewees were asked a structured set of questions categorised in three sections: context, process, and issues and effects. This allowed follow up questions and discussion where appropriate to clarify their answers. In the context section people were questioned on the tools they have used and their reasons behind wanting to engage with interactive storytelling. This part served as an icebreaker point with the participants and also as a means to contextualise the study's results. In the process section people were questioned about the authoring process that they followed. In the issues and effects section people were asked about any issues they have encountered and what effect those issues had on their overall authoring process and stories. The questionnaire can be examined in Appendix C. The interview protocol was to contact interviewees, explain them briefly the reason they were approached, provide them with the participant information sheet and give them time to read it. Upon agreement they were asked to sign a consent form. When the consent form was signed each interview was scheduled and conducted, mostly by video or audio conference. Interviews lasted around thirty minutes and they were recorded, transcribed and coded. Codes were generated in two sets, one set was coded deductively to reflect the steps in the authoring model identified in Chapter 5 (*Training & Support, Planning, Visualising & Editing, Writing, Compiling & Testing*) as a form of validation,

the second set was coded inductively based on issues participants encountered while authoring. The second set of codes were grouped together in high-level themes through an iterative process and mapped to the steps in the authoring model.

6.4 Overview

The participants were interviewed on a total of eight questions that were important in acquiring the desirable information with regards to their authoring experience. Where necessary those questions were followed up with additional questions for clarification. From the 20 participants (identified in the following as P1-P20), the following is a generic analysis of the information gathered for each question.

Q1. What digital interactive authoring tools have you used so far?

To gather a rough overview of which tools people are using and which tools are the most popular within the interactive fiction community participants were asked to list a number of tools they worked with. Table 4 below shows a list of authoring tools and how many times each tool has been mentioned.

20 participants have listed a total of 36 different authoring tools they have been using to write their own versions of digital and interactive stories. One of those (no. 34) is not a software authoring environment as much as it is the use of traditional computer programming. Two of the tools excel in popularity with being used by more than half of the participants and those are *Twine* (no. 1) a branching-hypertext tool and *Inform 7* (no. 2) a parser-based tool, both examined in Chapter 4 as tools used in the autoethnographic story adaptations. The two tools seem to be the most popular tools around the community of interactive fiction authors and other experienced authors. Part of the reason they were chosen as tools for the autoethnographic story adaptations was their seeming popularity.

Tool	No of mentions	Tool	No of mentions
1. Twine	16	19. Desmos	1
2. Inform 7	11	20. director	1
3. ChoiceScript	6	21. Flash	1
4. Quest	4	22. Fight	1
5. HyperCard	3	23. GameMaker	1
6. TADS	3	24. Gennarator	1
7. Storyspace	3	25. Ginger 2	1
8. Ink	2	26. Hypergate	1
9. Inklewriter	2	27. Inkle	1
10. Notepad++	2	28. Klynt	1
11. Proprietary or Bespoke	2	29. Macromind Director	1
12. AGS	1	30. RPG Maker	1
13. AGT	1	31. StoryNexus	1
14. Apple2	1	32. Tinderbox	1
15. Articulate Storyline	1	33. Unity	1
16. Captivate	1	34. VIA programming	1
17. Construct2	1	35. Visual Basic	1
18. CSIDE	1	36. VKB	1

Table 4 - Authoring tools used by participants

"I am not really sure what it was about Twine, but I was already in the games industry and been writing stories for games and not being an artist, I needed something that was primarily text based and that would be free and accessible so I could use it even in the browser or download it in the computer and use it online so it's a really flexible tool."
– P15

Participants span through a variety of ages and experiences, therefore some tools mentioned are not available today or not as widely used as some of the modern tools. In

addition, some tools are discontinued which means that for authors that began their interactive authoring journey during the 90s and 2000s, it is most likely that they will have encountered first the tools that most people are using today and have no knowledge of the tools that pre-existed.

Q2. What prompted you to start using digital interactive authoring tools?

In order to be able to understand what has drawn people into the discipline of interactive storytelling or the activity of authoring digital interactive narratives participants were asked to explain what introduced them into working with the tools.

As with many other activities, reasons why the participants decided they wanted to engage with interactive authoring vary between personal interests, to getting drawn by other projects related to their professional capacities, to comparing the notion with a beloved childhood activity. Several have mentioned their personal admiration of the *Choose your own Adventure* books that were created to allow children follow their own path in a game-oriented story. When this notion was transferred on the web with the *Text Adventure* games during the 1980s those who enjoyed it wanted at some point to turn their roles from consumers to creators and develop something of their own. Back in the early years, programming was an essential requirement to create anything of the like leaving many people reluctant to step into the door of interactive authoring. When modern tools were developed it became accessible for people without experience or technical background to create even in its simplest form a digital interactive story.

With competitions rising and a community growing, every year more and more people are introduced into the possibility of authoring interactive narratives. Table 5 above summarizes a variety of reasons held accountable for people being drawn to the discipline of interactive digital narratives. The reasons were clustered in four groups and each reason is attached to the number of times people have mentioned it. The four groups representing the reasons are elaborated below.

Group	Reason	No of mentions
Personal interest	Interest in recreating adventure games.	7
	Love of experimental literature, writing and/or interest in interactive narratives.	4
	Ability to blend programming and fiction into one discipline.	2
	Curiosity of issues arising around the development of interactive narratives.	1
	Desire to write hypertext.	1
Tools	Ease of using the tools to create different features for interactive narratives	2
	Research curiosity on how the tools informed the writing and desire to write interactive fiction.	1
	Creative mind was already aligned with what the tools offered in narrative development.	1
IF Community	Attraction of the community and the competitions.	1
	Market around the discipline.	1
Work environment	Involvement through other work or personal related projects.	3

Table 5 - Interviews Q1 findings

Personal Interest – Describes reasons that were drawn from the participants' personal interests in writing, experimental literature, programming or in games and a blend of those in the form of digital interactive narratives.

"In the 1980's a lot of the games that I played were text adventures and I was interested in both programming and in fiction writing so it was a natural marriage of two of my interests." – P13

Tools – Describes reasons related to authors attracted from the availability of tools and the functionalities they offer for creating interactive narratives.

"[Twine] Has a shallow learning curve, is fairly simple, and you don't have to read through tons of documentation to get started." – P14

IF Community – Describes reasons referring to an existing online community of interactive fiction authors that communicate with each other via competitions and forums.

"[Interactive fiction] I realised that I definitely felt that there was a market for it and a growing area and there's a lot of people really interested in it and I thought I'll start." – P4

Work environment – Describes those reasons that were brought forward by people whose work environment brought them in contact with interactive narratives through new or existing projects.

"Initially, I was interested in using the text adventures as a framework for e-learning, inspired by two games used in the 1980s in secondary schools" – P20

Q3. On what criteria do you select the tool you are going write with? (i.e., Do you select a tool based on the story you want to tell or because of its abilities?)

To be able to draw the reasons behind an author's decision to work with a particular tool and discover whether the tools or the stories inform the selection or the shaping of one another, participants were asked to state what factored in when they were considering which authoring tool to use for what they wish to author. Table 6 below separates the participants in two groups and enumerates how many belong to each.

Group	Participants	No of mentions
Selection based on tool	P1, P2, P3, P4, P5, P6, P7, P8, P10, P11, P13, P15, P17, P20	14
Selection based on story format	P9, P12, P14, P16, P18, P19	6

Table 6 - Interviews Q5 findings

The first group, and majority of participants, represents those who select their tools based on what the tools can offer in terms of flexibility, ease of use, functionalities, popularity

and market rather than whether the tool conveys a specific story format they have in mind.

"When you learn a tool very well then everything else looks like a nail... I say that I have an idea for a game, the idea will be formed or constrained to the tool that I have in mind" – P2

The second group represents those who select their tool based on their personal needs to write a particular story which the tool can be used to adapt depending on how they want the story to look at the end.

"The tool comes after the idea, that's the point I come up with an idea and then I finish it and then I put it away until I see a tool that fits it. I don't try to fit a work in the tool." – P3

Chapter 4 contemplated the possibility that authoring tools influence the narrative of a story because of their technological nature of inducing certain constrains. As part of configuring whether that is indeed true and whether it affects the author's critical and creative thinking and the story they have in mind, this question was aiming to discover the reasons behind the eminent decision authors make when selecting a particular tool and whether any of those reasons have to do with what shapes which. While a lot of the reasons mentioned ease of use of a tool, popularity within a community, free access, financial gain or personal preference, some mentioned that they select a tool based on the type of narrative they want to bring to life. Participants who knew what they wanted to achieve found a tool to match their goal rather than just worked with a tool to create something interactive. Others relied heavily on the tool's possibilities rather than shape their ideas beforehand. These participants could be people who are heavily attached to a particular tool, or who perhaps have less knowledge of the number of tools available out there. This means that a lot of people engage with the tools without really knowing the

full depth of what a tool can do or that other tools out there may be better suited for their ideas.

Q4. What is your process of writing a story with a digital interactive authoring tool? (Think of steps such as Training, Planning, Visualising, Writing, Editing, Testing, Publishing as part of that process as examples.)

Chapter 5 of this project presented a systematic literature review that helped develop an underlying model of an authoring process, identified as a series of steps. To compare whether any of those steps is being followed by authors, participants were asked to identify tasks they follow during their write up of a narrative. All of the study participants have mentioned at least two or more activities they follow that were identified as steps in the process during the systematic literature review thus verifying those findings. The only step that has not been featured through the mouth of authors was *Advanced features*. That was added as a process not to describe a specific step as part of authoring but to include those suggestions from researchers that were dependent on some specialist tools (for example authoring guided tours). This shows the sampling bias between what researchers consider as important authoring steps, and the real-life experience of authors using mainstream tools. On the contrary two steps in the process that were previously missed have been identified as important steps in the authoring process. Those are *Ideation* where the bringing up of ideas mostly takes place and *Publishing* where the completed work is exposed to an audience. These were not steps discovered through the academic research, perhaps because for academics studying the field of interactive digital narratives great importance falls on understanding narrative patterns, design patterns, models of interactivity, creating simple tools and simplifying authoring, all which sit somewhere in the middle steps of the authoring process. Ideation and publishing are mostly the concern of authors who are wrestling with wider pragmatic questions: what should I write, how will people read it, and how will I get paid? A more detailed account on the steps in the process is explored in the following section 6.5.

Q5. Have you published any works and what do you think of the options and methods available for publication and the process for publishing digital interactive narratives?

Unless an author is creating a narrative for themselves, most want their work out there, interacted with and commented on.

"You are ultimately writing to communicate something, and the publishing step is critically important for making that connection and for providing a space on a shared environment. For me yes you can write and self-publish and just share with your friends and that's fine but having a place that people know to go to for this kind of fiction is really important." – P11

Publishing is one of the final steps in the series of iterations around creating a book. Surprisingly little is mentioned or even considered on this matter and not many researchers have talked about the publishing venues or opportunities authors are offered with in the interactive narrative space. In addition, it seems that for a lot of authoring tools a published piece of work means that it will come in a format that might be difficult to disseminate around. There is also not an appointed place or places such as bookshops except from a couple of online websites to lure readers into buying interactive stories. In order to identify how publication works, participants were asked to talk generally about the publication process and the release of their work into the public.

"With Inform tool you can just click a button and it will turn it into a game file and then it's up to you to find hosting and share that file. With Twine it bundles up into a website and it's up to you to get hosting for that and similarly with ChoiceScript[32] *I could host it on a website."* – P2.

[32] Authoring tool offered by the Choice of Games publishing website

Many have mentioned that publishing is interchangeable with transforming the finished project in a web supported format and hosting it on websites online where those are dedicated to host interactive narratives but for many of those there is not an appointed source of revenue for authors. In that sense publishing a story is assumed to be an easy task provided the story will end up somewhere on the web but sometimes tools are mystical in what formats they publish a story hence unless the web supports it, the dissemination process of a story becomes more complicated for authors who are looking to reach a wide audience. One of the few websites that people can attach a price tag on their published work after being exported to a web related format is *itch*[33], an independent game publishing website which works similarly to the website *Steam*[34].

Publishing in interactive fiction as with publishing in print comes with rules attached from whomever is responsible for publishing. Each publishing house follows a similar process of turning a manuscript into a book and places that into bookshops around the world. The process differs in interactive narratives because there are few officially appointed story publishers that handle that work. An author has to first publish their work and find a space to host it so that people can access and use it. Because the work is done using specialised tools, each bearing their own formats of story files the most popular option for authors is to host their story on a website. The problem then is whether those websites will maintain the stories for a long while or if they will be taken down taking access to stories with them, as such has happened before with a website called *Philomela*[35].

Perhaps the only organisation that offers some form of paid contract between them and authors is *Choice of Games* where people can pitch their ideas and get an advance on creating a piece of work that they can sell. Further from that the authors continue to gain

[33] Website that sells interactive stories (https://itch.io/)

[34] Website that sells a mass number of games (https://store.steampowered.com)

[35] Website that used to host *Twine* stories – discontinued until further notice (https://philome.la)

from a percentage of their revenue as agreed with the organisation. The *Text Adventures*[36] website seems to have a review process in which games are examined before approved for upload on the site but there is little promotion hence discovery of stories is up to the reader and revenue is not attached. The most popular place outside of conventional publishing seems to be the website *itch*, where authors can submit their completed stories and create a portfolio where people can access and purchase. While suitable for their work to be promoted, *itch* remains a site dedicated to the concept of games which means interactive stories are automatically labelled as such. For fiction limited to hypertext, *Eastgate systems* have been hosting an online collection of hypertext fiction stories that people can buy. Everything else is up to the individual, provided that it is possible to attach a story file on the web.

Q6. Have you encountered any issues while authoring with digital interactive authoring tools? (i.e., while trying to: learn how to write a story, create a structure and visualise your plot, add or edit your content, test or publish your story?)

The tools contain technical limitations that authors may not be keen to invest in learning how to use them. As a result, the medium's full capabilities are limited to those with advanced technical experience. It is also the case that the tools do not have room for flexibility in how the built-in constructs can be used. An author can imagine doing a lot of things only to realise how difficult it actually is to implement those things. These are some of the reasons a lot of authors are facing issues when authoring. In order to draw some of these issues through personal experiences, participants were asked to talk about the issues they came across when trying to create their stories. Through an iterative coding process seen in Appendix C.2 the issues have been categorised into 18 codes. The

[36] Website that allows for the creation and publication of text adventure and other interactive stories with a dedicated tool called Quest. (http://textadventures.co.uk)

codes were grouped under five high-level themes. Section 6.6 that follows will give a detailed account of these findings.

"There is a technical barrier in a lot of toolsets that keeps people away from them. You have to invest a certain amount of technical learning and scripting learning that maybe doesn't come naturally to some people who are great writers and want to write so I would say technical limitations as much of that as you can take away from a tool because you are gonna vastly expand the number of writers that feel like they have access to the medium." – P16

Q7. How did you try to overcome any issues whilst authoring your story?

As issues are an eminent topic among interactive narrative authors, it was deemed vital to discover what actions authors result in taking when they are trying to overcome them. This is an intermediate question between discovering the issues and also figuring out whether those determine the outcome of a story. This made it possible to discover that people will either go to extremities to make what they want, but they will also be willing to give up their ideas if the tool is not evidently enabling them to do what they want.

Table 7 shows five groups that generally describe the workarounds authors put forwards to resolve their authoring issues and the number of times a workaround was mentioned.

Group	No of mentions
Advice from tutorials, documentation or trial and error	9
Help from other tools or people	5
Amending story idea or giving up the story	5
Hard coding story behaviour	4

Table 7 – Interviews Q7 findings

A majority of participants have been working around their issues by turning to documentation and facing trial and error or when that did not prove effective, to the

community of people who might have had something similar to deal with and expected to resolve their concerns through there.

"I try to keep a growth mindset about roadblocks while doing any kind of project with these types of tools. The answer is always there. Someone else has done it at some point, so there must be a way to accomplish what I'm trying to accomplish. I have consulted support documentation, example files, community forum posts, and just experimented until I got it right. The only way out is through. " – P14

Participants who acknowledged there is something else out there that can help them achieve what they were trying to do, decided to turn into the use of other tools or hiring experienced people if those would help them better with their goals.

"I find it easier to build my own stuff than try and figure out stuff other people have built. Essentially with Twine I did sort of not use it and that was a nice solution. I used tools that did have the features I wanted or did have interfaces to let me build it myself." – P5

"I've got a friend more technically minded, so I had him to have a look at it." – P4

That however can become hectic in itself when people have to navigate from one tool to another in order to organise themselves and do what needs to be done. While a one-tool approach has been debated among researchers, it is generally understood that because there are so many forms of interactivity out there, it is impossible to master all of them in one tool. Rather it would be best to master the way existing tools communicate their purpose with the willing authors.

Participants without the expertise to code or time to learn decided to give up their idea and re-implement something similar although less ideal to conform with their chosen tool's environment. Some even gave up on their idea because it seemed an impossible barrier to break between their knowledge and the tool.

"I know that if I stuck with it, I would probably got there but the time to reward vas very poor because I knew the time I spend to bang my head around that I could have easily made it in another tool that I was familiar with, but I would have to compromise how it looked." – P2

This action raises the question of how are the developers making sure that their tools are understood? Do they provide appropriate documentation? Examples? Is the user interface easily perceptible or does it need a deep approach of trying to figure out the tool before actually being able to use it? A lot of these factors have been proven to be contributing to the difficulties many authors are facing.

Finally, those who were programmatically skilled, hard coded features into their story or built functionalities in the tool they were using to be able to achieve their purpose with the story's behaviour.

" I simplified the computation going behind the scenes so in some cases where I had something more procedural to decide what the other non-player characters did, I ended up sort of hard coding in making shortcuts. In some of that, it required more fiddly hand coded behaviours" – P13

Q8. Have your actions in resolving any issues or the nature of the tool had any effect on your story in terms of content or story behaviour?

As a final overview on the topic around issues, participants were asked to discuss whether having issues or trying to resolve issues has somehow informed their final story. Aside from trying to discover how authors are affected, the question targeted to equally understand what the determining factor is that informs how the story is shaped. Can a tool shape with its constructs the story an author is trying to tell, or can an author exploit the tool and shape the story they want to tell?

Table 8 below shows which participants felt their story was affected by the tool and which participants felt their story was not necessary affected by the tool.

Group	Participants	No of Mentions
Story unaffected by tool	P5, P6, P7, P8, P9, P11, P12, P13, P14, P18, P19	11
Story affected by tool	P1, P2, P3, P4, P10, P15, P16, P17, P20	9

Table 8 - Interviews Q8 findings

One participant said that they waited for the tool that would fit with their story before attempting to turn it into an interactive narrative. While this means the participant was clear on what they wanted to achieve thus they chose the right tool for the job, for the story this means it was left unwritten and would have remained so until the appropriate tool was released. This is one of the reasons a lot of tools are being built. People feel that one always misses something. While the participant felt they never had to adapt to a tool *("I've never had to change one story to fit into one medium and that is pretty amazing."* – P12) waiting for the right tool to be invented is in a way affecting their story which remains untold.

Similarly, other participants who knew what a particular tool can do claimed that they did not have to change anything because they shaped the story knowing the limitations of the tool.

"I tried to be mindful especially as the range of available tools grew to pick stories or work with stories that fit within less the tools and more the motive play." – P13

On the other hand, participants whose story was affected by the tool said that the narrative ended up not behaving as they wished because the tool was unable to cope with what they were trying to achieve or did not fit entirely with their needs. In that sense, their story had to adapt to the environment of the tools they were using forcing them to give up what they were hoping to achieve.

"I was forced by necessity to take out a large chunk of format from the text and reformat to something that had the appearance of something that looks like it's letting you move around but it's not really letting you move around... Twine's natural structure couldn't handle what I was trying to achieve." – P1

This, if compared to what it means for a conventional narrative author, shows how they are clearly not inclined to worry about shifting their ideas due to outside factors aside from their own personal mind not being satisfied with the plot. That means that interactive narrative authors aside from the burden of having to learn to work with a tool to create an otherwise complicated, for lack of linearity plot, it is also the case that they are constrained from the tools which might prevent them from materialising the plot they have in mind.

6.5 Authoring process

Chapter 5 has presented a model with six authoring steps as part of identifying an authoring process for digital interactive narratives. To verify the existence of those steps, authors were asked to describe in question 4 of the questionnaire what steps they undertake as part of their own personal authoring process. It was possible to confirm that the authoring model is compiled by steps that many authors are truly undertaking. In addition the existing process model has expanded to reflect an additional two steps that were previously missed in the original systematic literature review albeit relevant literature that discusses them in media production (Hardman et al., 2008). The following Table 9 shows a complete list of the steps identified as part of the authoring process from a combination of the systematic literature review and the interviews, alongside the number of interview participants that identified each step as part of their personal authoring process.

Authoring step	No of mentions
Ideation	4
Training & Support	8
Planning	17
Visualising & Structuring	12
Writing	18
Editing	10
Compiling & Testing	9
Publishing	1

Table 9 - List of authoring activities and number of independent mentions by interview participants

The additional steps identified are *ideation* and *publishing*. *Ideation* here is defined as the stage of creative thinking, the birth of ideas and the coming together of story components to build the narrative foundation of a story. An example quotation from one of the participants that led to identifying this step is the following:

"I work with a sketchbook, with a notebook all the time, and most of the things that I write come out of, I will often write a note that has an idea and have an idea that connects to that and literally in the sketch book I might draw lines that you might even imagine to be links and that will be the nucleus of something and then I begin to write around that. For me it starts often with a particular idea, with a character with a moment with a beat, a particular moment in the story and that will provide the place around which the rest of the story grows and because it's happening in a nonlinear fashion, I don't feel constrained to write the story" – P11

Publishing is defined as the step of exporting a story format and making it available or distributing it through a venue where readers will be able to access and read it. An example quotation from one of the participants that led to identifying this step is the following:

"I figure out how to do it (if it's something I don't know yet), write the code and text, and then make sure it works or fiddle with it until it does. There's a heavier emphasis on the Editing and Testing parts towards the end as I fix things and respond to feedback from other testers. And Publishing is the end." – P17

Question 5 was implemented specifically to target information on the venues of publishing and therefore opinions were heard from most participants on that step of the process. *Publishing* was however only coded as a step from those participants who mentioned it specifically as a step in the authoring process.

6.6 Authoring issues

Question 6 of the questionnaire has asked the participants to discuss about any issues they have been tackling with the tools during the authoring process. This was perhaps the most crucial question looking to be answered given the reputation of the authoring process as problematic. From each participant a list of issues was gathered. Those issues were classified under unique codes and then placed under distinct high-level themes.

Figure 40 below shows a sample of issues quoted by participants next to their relevant codes and under the relevant high-level theme.

For each code a summary of the total number of participants who mentioned an issue under said code has been recorded. Descriptions of the high-level themes and their attributed codes follow below.

6.6.1 User/Tool Misalignment

This theme covers those issues that relate to the misalignment between the expectations or expertise of the user and the capabilities and approach of the tool. The most common problem is a **conceptual misalignment** between what the authors wanted to achieve and what the tool could actually do.

Theme	Code	Mentioned	Example
USER/TOOL MISALIGNMENT	CONCEPTUAL MISALIGNMENT	**10**	*I wanted to have a much more constructed programmed occasions...something I could have done relatively easily in HyperCard or Python or a more robust programming language...but I ended up coming up with a solution that approximated that but it was definitely not the way I originally envisioned it and that's because of the constraints of Twine.*
	EXPERTISE MISALIGNMENT	**2**	*People came into it and even if they had a really good idea of what they wanted to do with it, people were often very overwhelmed by the amount of functionality available.... that cause a lot of people a certain amount of angst.... A lot of people opened it with the idea of I know I need this and I know this can help me but I don't know why or how to use it and even when they were trying to tell stories there was just a weird tension on it...*
	ONTOLOGICAL MISALIGNMENT	**2**	*It's made me think way more about simple things than I ever thought I would have to, and to deconstruct common objects that I think everybody has a pretty comprehensive mental image of in order to make them work in the tool.*
	WORKFLOW MISALIGNMENT	**1**	*[With Inform7] I could be a player and see aw this is missing this there is obviously an error. But with Twine and CS (ChoiceScript) I couldn't really play the whole game until I finished it and by then I had less motivation to go back and fix things.*
DOCUMENTATION	THE KNOWN UNKNOWNS	**7**	*With Twine there seem to be a couple of options; you either use a CSS on top of an exciting story template and I couldn't find good documentation for that or you could write your own story format which there is almost no documentation for it.*
	THE UNKNOWN UNKNOWNS	**2**	*There are things that I found myself saying I'd really kind of like to do something like this but I am not sure I know how to do it or I am not sure it's worth the effort. Those are problematic.*
COMPLEXITY	VARIABLE TRACKING	**3**	*In Twine there have been difficulties sometimes because it's not a traditional programming language where you check to make sure that for example all of the variables that you are referencing exist in some way and it's hard to track variables across nodes.*
	SCALABILITY	**3**	*Definitely some of the chapters probably got a bit too complicated so actually testing them and getting them to work was a bit difficult.*
	VERSIONING	**2**	*[Twine] Like it doesn't have any version control at all which is horrible. You can lose a lot of work immediately. It does have an autosave basically which is excellent but it's really tough to do different*
	CONTENT TRACKING	**1**	*I wrote a 3000 word 30 lexia scene in one day and then got to the end of it and realised that I'd called one character Brianna and I didn't mean Brianna I meant farm girl and I was completely confused about which I really meant so keeping track of the cast was tricky.*
PROGRAMMING ENVIRONMENT	LACK OF PROGRAMMABLE ENVIRONMENT	**4**	*When you had a tool (HyperCard) with a built in programming language that is really robust and that was the baseline that we had three years ago, it seems like the tools that we have now are a little bit more fragmented in the sense that you have to step out of the tool to do scripting, you have to step out of the tool to do basic things like building a button so where we had a unified environment, now it seems that you have to have several tools.*
	SEPARATION OF CONTENT AND BEHAVIOUR	**3**	*In terms of proof reading and editing Inform 7 all of your pros, English language sits together with the programming code and so in terms of typos that's actually quite hard.*
	LACK OF DEBUGGING TOOLS (TESTING)	**2**	*The one thing that Twine doesn't have is good tools that check if there are problems with your code. The only thing it has is that it tells you if it has dead links that don't go anywhere.*
LIFECYCLE	PROFITABILITY	**2**	*The challenge seems to be getting any money out of it because for most of these I am not selling them and while each would let me do that quite easily I don't know how many people would actually pay for it.*
	PLATFORM SUPPORT	**1**	*One of the biggest problems I have is that running the stories in a web browser often limits kind of how well it work.*
	MAINTENANCE	**1**	*With Desmos you write all of your interactive activities and then you get a single class code that you give out that opens up a link and takes duty. That works for the initial publication but then I discovered that there is no way to update the game after you release it.*
	CURATION	**1**	*Curation is a second level concern, it's not just does the tool help you get there it's also the mechanisms of curation that are going to help writers get found and get exposure that's I think something that we are still working on and honestly IF is still a relatively young medium.*
	DISTRIBUTION	**1**	*Once you put the files on there sometimes it's a bit difficult for the end user to get them like an Inform form file consists of a story file which its either running on a custom built website or it needs to be loaded in an interpreter that a user has to download separately and sadly people are becoming totally adverse to doing other work other than clicking on a link and getting the game to play....*

Figure 40 - List of codes and themes with associated quotes from participants relevant to the codes and the number of times each code was mentioned

This code describes those issues when the authoring tool's natural environment, whether the mindset of an author is aware or unaware, does not suit what the author wants to achieve in several phases of the authoring process which may result in abandoning or altering the creative idea to conform. This type of misalignment is not deemed as a missing functionality, since in some cases users were clearly attempting to do things that the tool was not designed for:

"Inform 7 is very physical where you have a layout you can move from room to room and it keeps track of you. I wanted that experience for people in Twine. And so, I created a story where you can move from room to room and go back and from where you came but Twine was no good for that physicality." – P1

One exception to this was when the issue was particularly referred to interactive dialogue, which was frequently mentioned, especially in the common tools (*Twine* and *Inform7*). Interactive dialogue is essentially the dialogue that a reader will have with the narrative similar to how ELIZA the artificial intelligence program reacted with the users and this was an issue that can be considered as a missing functionality.

"The particular area where it falls down is with dialogue trees or any kind of tree, choices as I was saying before Inform is not good at dispensing one two three choices technically, but the problem is that nobody has worked out a great tool for organising like say 'the character walks into a room, the other character says 'hi how are you feeling' and then the game has to dispense four choices. Well then actually writing the four choices the physical act of doing that is actually difficult." – P8

A second misalignment is **expertise misalignment** which describes issues where the tool's environment assumes advanced levels of technical knowledge or the possibility space is too big or too small. In other words where authors where either left wondering what they could do with a tool that did not well communicate through the interface what it could offer or when a tool had a complicated and rich interface and authors were overwhelmed.

"A criticism that we got of Tinderbox quite a lot was that there was kind of this black canvas problem so people came into it and even if they had a really good idea of what they wanted to do with it, people were often very overwhelmed by the amount of functionality available but what was interesting about that was that we were also very conscious of this and we tried to teach people a bunch of different ways but because Tinderbox was so open ended was kind of the thing that caused a lot of people a certain amount of angst." – P10

Other types of misalignment included **ontological misalignment**, where the vocabulary and structures in the tool did not match the favoured mental model of the user; and **workflow misalignment**, where the tool required the author to work in an order that they were uncomfortable with.

Ontological misalignment describes those issues where the author's efforts in understanding how the tool's environment works impacts their creative imagination and constraints their creative ideas or forces them to change them.

"That is the single wildest thing I've had to get my head around. It's made me think way more about simple things than I ever thought I would have to, and to deconstruct common objects that I think everybody has a pretty comprehensive mental image of in order to make them work in the tool. For the purposes of my story, at one point the player needs to catch a fish. Fairly simple. But given my lack of experience with Inform, the clearest path to do this is to not define the fish as an animal, but as a thing. This is in contrast to another animal, which for narrative and mechanical purposes is defined as an animal. I imagine others might not get sucked into this but to reconceptualize a living creature as a thing in contrast to a higher order animal and to then do work to give the thing the illusion of life and agency… the exercise of separating the mechanical necessities of an element of the game from its narrative goals and narrative intent is not always an easy one for me" – P14

Additionally, **workflow misalignment** describes those issues where the tool's environment workflow process is not aligned or lacking constraints that demotivate or confuse an author's authoring process.

"Inform 7 being able to make a game from the beginning and play it and just see what's wrong. I could be a player and see aw this is missing this there is obviously an error. But with Twine and CS[37] *I couldn't really play the whole game until I finished it and by then I had less motivation to go back and fix things."* – P1

6.6.2 Documentation

Documentation covers issues arising from a tool's tutorials and user manuals failing to describe properly how things work or failing to convey the full capabilities of the tool. Inspired by the Johari window (Luft and Harrignton, 1955) (made famous by Donald Rumsfeld) issues in this category were codified into the **known unknowns** (where authors knew what they wanted to do with a tool, were aware that the tool could do it, but could not figure out how to make it happen) and the **unknown unknowns** (where they did not know, and found it hard to discover whether the tool had a particular capability or not).

The **known unknowns** best describe those issues where documentation for things that the tool can do or people can do with the tool are not well documented or not documented at all.

"For writing one of those story formats yourself if you wanted to expand to what Twine can do is not really documented anywhere as far as I can tell. I am not sure how anybody

[37] CS refers to ChoiceScript an interactive authoring tool developed by the Choice of Games company

does it. I expect they just know a lot more about HTML[38] *and JavaScript*[39] *than I do but a lot of the other things, trying to implement features with Twine in a game there is been good documentation so the fact that there isn't for that, stands out." – P3*

Unknown unknowns on the contrary best describe those issues of inability to conceptualise or find through documentation a lot of features the tools allow an author to do.

"With Twine I run into a lot of issues where I wanted my game to look a little different and couldn't figure out how to make that happen." – P5

6.6.3 Complexity

Complexity describes the technical issues that make it challenging for content to be created consistently or for the story to be developed coherently as the story is written. Examples identified are **content tracking**, which refers to the internal consistency of the text and **variable tracking**, which refers to the external consistency of the state machine around the text

Content tracking specifically addresses those issues that correspond to the fact that when working with many content variables it becomes hard to track the story content and the connections between characters, places etc.

"Keeping everyone straight was a problem. I wrote a 3000 word 30 lexia scene in one day and then got to the end of it and realised that I'd called one character Brianna and I didn't mean Brianna I meant farm girl and I was completely confused about which I really meant so keeping track of the cast was tricky." – P7

[38] Hypertext Markup Language - for creating pages on the web
[39] Programming language for developing interactive components on the web

Variable tracking addresses those issues which signify that working with many variables it becomes hard to track the many different state combinations.

"It's hard to keep track of all the variables floating around and all the possible combinations of those variables and so because of that sometimes I'll forget one thing. I'll play through one thing and I'll realise there is an entire chunk of text missing so I tried to list the case but there are so many cases." – P1

As the story grows the above-mentioned codes seem to compound into a general problem of **scalability** where the sheer size of the text (and any behaviour specifications) simply become overwhelming.

Scalability comes into position for issues that emerge when large scale projects burden the testing functionalities of a tool or complicate the process.

"The one that existed on Storyplaces was basically a series of sort of sophisticated videos that had interactivity build into them and as a result it consumed more data that I would have liked, and it was slower to start than I would have liked, and it was slower to create pushing more buttons." – P19

A final code is **versioning** the inability to maintain working versions of a story as it develops, and guard against any potential loss of work. This describes issues where appropriate mechanisms for saving the state of narrative or versioning are not in place.

"[Twine] The editor itself is in a browser and so it's missing a lot of features that you get used to into integrated development environment or even in a really good text editor. Like it doesn't have any version control at all which is horrible. You can lose a lot of work immediately. It does have an autosave basically which is excellent but it's really tough to do different versions." – P18

6.6.4 Programming Environment

The programming environment is the part of the authoring tool where authors can define behaviour, sometimes independently, and sometimes directly alongside the content of the story. In cases where the actions were amalgamated it sometimes caused concerns on the lack of **separation of content and behaviour** which complicates editing and testing when things such as spelling errors and machine language errors are not differentiated. In this code, issues reflect the inability to cope with editing programming code and natural language when building a story in the authoring environment.

"If you are not using Harlowe[40] *and you don't have autocomplete it's very difficult to see what's code and what's not and it's tough to separate the writing from the functionality and see it very clearly at a glance."* – P18

Other codes include the **lack of debugging tools** that clearly state what a programmable error may be when a story does not compile, and in some cases the **lack of a programmable environment** which for some is very restricting in terms of what they can do with a tool.

Lack of debugging tools are those issues where a tool has inadequate means for testing the state of a story or is not clear on what may be wrong.

"I think sometimes the errors might be the what we don't know what went wrong error seems to suggest that something kind of outside of Twine going wrong almost so whatever it is trying to identify the error might not have access to the information to tell it what it is exactly but it's always something that you have written in Twine that's causing it so it would be more helpful to have something in the editor that would flag up that this thing you typed might cause problems." – P3

[40] Harlowe refers to a story format in the Twine authoring tool

Lack of programmable environment describes those issues where the simplicity of a tool limits the creative complexity of a story by limited constructive elements.

"[Twine] Doing some of the complex variables and all that staff is less easy than an actual full programming language." – P9

6.6.5 Lifecycle

The last theme relates to those issues that describe the overall lifecycle of a digital interactive story. A number of authors mentioned the lack of venues for **distribution**, and a resulting problem with **profitability** from their work, as well as a lack of spaces that could provide **curation** for all these works for longevity and accessibility.

Distribution defines issues related to when story exports are difficult to distribute to readers or is difficult for them to acquire.

"So that's a common outlet for people doing indie text based games and the trouble is, once you put the files on there, sometimes it's a bit difficult for the end user to get them like an Inform form file consists of a story file which its either running on a custom built website or it needs to be loaded in an interpreter that a user has to download separately and sadly people are becoming totally adverse to doing other work other than clicking on a link and getting the game to play with." – P8

Profitability defines issues related to when the ways to make profits from publishing stories written with the tools are not seemingly or widely available.

"I feel bad when someone feels like they have a cool Twine game and then think but how do I sell it? Push button publishing for people is something people really want." – P18

Curation defines issues where there is a lack of options for curating and archiving interactive narrative works.

"Curation is a second level concern; it's not just does the tool help you get there it's also the mechanisms of curation that are going to help writers get found and get exposure. That's I think something that we are still working on and honestly IF[41] *is still a relatively young medium."* – P11

On the same topic **maintenance** was a code identified as the difficulty of making updates to a story after publication. This describes issues where maintenance of a story is not possible after publication.

"With Desmos[42] *you write all of your interactive activities and then you get a single class code that you give out that opens up a link and takes duty. That works for the initial publication but then I discovered that there is no way to update the game after you release it. That didn't really work well to my case. I wouldn't do another game with that system just for that reason."* – P5

Finally, **platform support** was identified as issues related to publishing platforms not being able to fully support the functionality of a story (for example, compatibility issues with web browsers), which means some effects are likely to be lost from the reading experience. Therefore, this code generally describes the issues relevant to when platforms for reading digital interactive stories are unable to support story performance.

"One of the biggest problems I have is that running the stories in a web browser often limits kind of how well it works." – P3

6.6.6 Endnote

The authoring challenges are many and spread across the various authoring stages. The majority of issues reported by most authors was that they suffer from a misalignment

[41] Participant here refers to Interactive Fiction as IF
[42] Software for interactive exercises predominantly for teaching (https://teacher.desmos.com)

between their own expectations and the tool they are using, mostly because they either do not know how to approach the tool or because they have approached the wrong tool. Documentation also seems to be either inadequate for helping them discover how to realise their creative vision, or too slow to communicate that what they want to achieve is not possible. As could be expected between a user-system interaction, the complexity of managing both the narrative to tell a story and machine to execute behaviour of a story is considerable. When tools contain a programming environment they can be perceived as too complicated by people who want to do programmable things in a simple way because they lack programming skills. When tools do not contain enough of a programming environment they can be perceived as too simple by people who want to do more complex things than what the tool may offer. This seems like a fundamental tension and contradiction between what authors deem as a problematic tool. Everyone bases their opinion on their technical background and most of the blame will fall onto the tools that are not complicated enough and not simple enough. Truly, responsibility falls both on authoring tools that lack the flexibility in providing certain authoring features and on authors who are not researching well enough which tool they should use for a given project. Yet, those who manage to overcome any misalignment whatsoever and prepare their story as they will, are faced with a halt on the crucial step of sharing their creation. As it stands today, the venues for publishing interactive stories are limited to a handful of online repositories which host, but do not promise much in terms of maintenance and profitability.

Figure 41 below shows the full list of high-level themes and codes identified through the interviews matched against the total number of related issues mentioned by participants. For example, participant 'P9' addressed a total of two issues: one due to lack of programmable environment - *"[Twine] Doing some of the complex variables and all that staff is less easy than an actual full programming language.*" - and one due to separation of content and behaviour - *"[Twine] fairly easy to use one slight thing is that it doesn't*

have in built spell checker". In a similar manner, the rest of the data on the table were collected by all participants. A total of 59 issues has been recorded.

Theme	Code	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	Total
USER/TOOL MISALIGNMENT	CONCEPTUAL MISALIGNMENT	2	2	2					2			2				1	2		2	1	1	17
	WORKFLOW MISALIGNMENT	1																				1
	ONTOLOGICAL MISALIGNMENT														2			1				3
	EXPERTISE MISALIGNMENT						1				1											2
COMPLEXITY	VARIABLE TRACKING	1				1								1								3
	CONTENT TRACKING							1														1
	SCALABILITY				1									1						1		3
	VERSIONING							1											1			2
PROGRAMMING ENVIRONMEN	LACK OF PROGRAMMABLE ENVIRONMENT	1								1		1	1									4
	SEPARATION OF CONTENT AND BEHAVIOUR								1	1									1			3
	LACK OF DEBUGGING TOOLS (TESTING)	1		1																		2
LIFECYCLE	PROFITABILITY			1															1			2
	PLATFORM SUPPORT			1																		1
	MAINTENANCE					1																1
	CURATION											1										1
	DISTRIBUTION								1													1
DOCUMENTATION	THE KNOWN UNKNOWNS			1	2	1									1			1	2		1	9
	THE UNKNOWN UNKNOWNS			1								2										3
		6	2	7	3	3	1	2	4	2	1	6	1	2	3	1	2	2	7	2	2	59

Figure 41 - Codes of issues matched against participants who referred to them

Having identified these authoring issues, it was possible based on when they occurred, while the author was in the process of authoring, to map them against the extended set of authoring steps identified on Table 9 in section 6.5.

Figure 42 below shows a summary of the issues mentioned by interview participants, represented by the 18 codes identified, and mapped to the step of the authoring process those issues likely occurred. On some cases, issues recorded were relevant to more than one step in the authoring process and as such they were recorded under each step individually. The majority of issues lie within the writing step most of them occurring because of conceptual misalignment. Looking at how the numbers are distributed on the table it is possible to make out approximate phases of authoring and the common issues that occur within those phases. For example, in the first phases of the process (which can be called pre-production, from ideation to planning) the main issues are due to misalignment and problems with documentation. Then in the middle phase (production, from visualising to editing) many of these previous issues persist and they are joined by several additional issues that have to do with the complexity and the programming environment of a tool. During the final phase (post-production, from testing to publishing) only a few of the previous issues persist and are adjoined by a final set of issues that are

almost exclusively related to publishing. This makes intuitive sense, as it is in the pre-production phase where a lot of preparing and planning is undertaken. This continues into production where they manifest as issues with the generation of content in terms of writing, editing and some testing, and are joined by a set of other more technical issues as programming may become necessary. At the end, an entirely new set of issues arises as final testing and publishing commence. Thus, reflecting a gradual progression of diverse issues emerging and then fading as the author moves through the different authoring steps and phases of production.

		Pre-production			Production			Post-production	
Theme	Code	IDEATION	TRAINING SUPPORT	PLANNING	VISUALISING STRUCTURING	WRITING	EDITING	COMPILING TESTING	PUBLISHING
USER/TOOL MISALIGNMENT	CONCEPTUAL MISALIGNMENT	3		1	1	10	1		
	EXPERTISE MISALIGNMENT					2			
	ONTOLOGICAL MISALIGNMENT			1		2			
	WORKFLOW MISALIGNMENT						1	1	
DOCUMENTATION	THE KNOWN UNKNOWNS		7			3			
	THE UNKNOWN UNKNOWNS		2						
COMPLEXITY	VARIABLE TRACKING				3	3			
	SCALABILITY							3	
	VERSIONING						2		
	CONTENT TRACKING				1	1			
PROGRAMMING ENVIRONMENT	LACK OF PROGRAMMABLE ENVIRONMENT				1	4			
	SEPARATION OF CONTENT AND BEHAVIOUR					3	1		
	LACK OF DEBUGGING TOOLS (TESTING)							2	
LIFECYCLE	PROFITABILITY								2
	PLATFORM SUPPORT							1	1
	MAINTENANCE								1
	CURATION								1
	DISTRIBUTION								1
		3	**9**	**2**	**6**	**28**	**5**	**7**	**6**

Figure 42 - List of codes and themes matched to issues as reported by the participants

Tool designers should therefore consider which parts of the authoring process they are targeting (likely to fall into one or more of pre-production, production, and post-production). They should then look to address the specific issues that arise within those stages, as well as attempt sensible import or export facilities with tools that come before or after their own tool in the process.

The issues mentioned in the pre-production phase are arguably the most problematic and most difficult to address. This is because they are mostly concerned with the misalignment of authors and tools, which is both an educational and a technical challenge. It is possible to create powerful self-teaching tools, a recent example would be the Play Station 4[43] (PS4) game and platform Dreams[44] meant to enable anyone to create their own complex games and digital stories, but the balance between complexity and expressive power will not simply go away and seems a fundamental tension for interactive story authoring. No matter how many tools are built, there will always be a risk that authors will have a hard time with it.

The production phase is the one most relevant to tool designers as those issues are mainly concerned with the difficulty of using the system and also the relationship between author and the programming environment. A key design challenge is clearly to help authors manage the complexity of their stories, but while there are examples of systems doing this for behaviour (using patterns, natural language, or graphics) it is less common to see the internal complexity of the story managed or linked successfully to that behaviour. Often authors will struggle to find an example with a precise depiction of what they are trying to achieve, thus finding themselves scavenging online forums and seeking advice hoping that someone else has faced a similar production setback. If they are lucky enough to resolve their issue, the story commences, otherwise their hands are tied to the tool and what else within their power they can do with it.

Finally, the post-production phase is one that is associated with the whole social and technical infrastructure of finding, buying, and reading stories. *Text Adventures* is a website that offers an informal assessed publication pipeline to authors but with minimal control over the site. It acts more like a repository of stories. *Itch* is a website that

[43] Video game console by Sony Interactive Entertainment
[44] http://dreams.mediamolecule.com

currently allows authors to self-publish and advertise their work, with the option of gaining a small profit. *Choice of Games LLC* is one of the most popular publishers of text based interactive stories that maintains their own tool and associated publishing pipeline. None of the above-mentioned benefit from the same mass awareness and coverage as similar initiatives for games or smartphone application stores. Therefore, even if it seems as if there are some options out there, they are either not concrete enough or have little control over what is published and how it is advertised. Often authors feel like they are fighting a one-person battle unless they take part in a competition or their work receives feedback from someone who came across their work.

6.7 Summary

A total of twenty interviews have been conducted for gathering feedback on the experience of authoring digital interactive narratives. These interviews from interactive narrative authors provided a picture of the authoring process that overlapped significantly with the systematic review of the literature discussed in Chapter 5 and revealed how authors see an extended process which starts before many tools are involved as part of the ideation phase and continues into a publishing phase.

Participants who were scouted through online interactive fiction forums, international conferences and personal contact due to their expertise, were asked a total of eight questions designed to flush out their personal experiences with authoring digital interactive narratives and provide insights on the authoring process and the authoring issues that so heavily contribute to the challenge of authoring digital interactive narratives. Through their input the authoring process that was established in Chapter 5 was verified and extended and issues that have been troubling authors were grouped together and attached to each step of that process for a deeper understanding on when and how those usually occur. Through the authors' reflection it was also possible to

determine where the tools stand in terms of influencing the creative mind towards a better story or towards setting up a roadblock to what authors are trying to achieve.

Many authoring tool developers pursue technical solutions to the authoring problem, exploring new interfaces or abilities that they hope will strike a chord with authors and encourage them to experiment more deeply with what the technology can do. It is mostly assumed that authoring issues are a result of the restrictive nature of the tools, their opacity, and their lack of appropriate features. Findings from the interviews reveal a more complex picture in terms of the fundamental tensions between expressivity and complexity, the author's mental model, the tool's data model, and the stages of the authoring process. Where it seemed as if what was problematic was solely the tools, findings prove that there are mindful misalignments between the actors in the authoring process that work independently. An author uses a tool that someone has created without their input, to create a story hopeful that the tool will help them do so. The tool is the mediator between authors and designers who never talk to each other. Therefore, one has to trust in the skills of the other. When developers trust that authors know more than they do, issues will arise as the authors will fail to utilise the tool to the best of their abilities because that is how far the best of their knowledge goes. Developers and designers should bear this in mind when developing the tools. Not everyone can be satisfied, but an author can at least have a clear view of what they can and cannot do with a tool.

Let it be noted that in game design and development where similar tools are out there, used without many issues and enabling considerable profits to companies that use them is a matter of being financially able to employ people in a variety of roles that are experts in writing, graphic design, programming, narrative development, production and so on. In the case of tools used for interactive narratives, even if some are referred to as games, for most cases there is only one person behind the scenes. If any comparison should arise, it would not be able to stand. Games have also been around in many forms and provide a different sense of agency for users. It is a form everyone is born into knowing and their

success is unparalleled. Interactive digital narratives have only one concept able to be embedded in different forms such as literature, films and games. In the future it may expand and receive the same glory as those forms, but in order for that to happen, authors should be heard and they should research their tools well, designers should try to make the tools as flexible, clear and with adequate documentation as possible, and publishers should commit to the work they publish out there wherever possible. This discipline persisted in existence for over thirty years, and it looks like it will persist for so many more. Interactive digital narratives need to be written for them to be explored and experienced. For this to happen, authors need to know their tool and their tool needs to be as transparent as possible.

The following chapter will present a discussion on the collaboration of findings as they were presented in each of the chapters that constitute the methodological approach (Chapters 4,5,6). A generic discussion will explain how the methods helped answer the research questions individually as well as by a combination of their findings and discuss some of the key findings from each method as well as make suggestions for things to be considered in future research on the authoring problem and the relevant development of tools.

Chapter 7 Discussion

The previous chapters have presented the three different approaches that have been conducted for information gathering as part of this project's methodology for resolving the following research questions:

1. *What are the conceptual difficulties authors face with digital interactive authoring tools, what are their attempts to overcome them and how are their actions affecting their stories?*
2. *What is the process of authoring digital interactive narratives and how do the authoring issues identified over the years match that process?*

To answer each of these questions a mixture of qualitative methods has been selected. The methods implemented were two autoethnographic story adaptations that helped set the ground base of an authoring process and identify authoring issues when authoring the desirable narrative, a systematic literature review that helped establish an authoring process through an analysis of the literature and finally interviews with current hypertext and interactive fiction authors that helped identify issues experienced by them and map those to steps in the authoring process where they are likely to occur. In working with these methods and combining their findings it was possible to understand how the creativity of an author in shaping their story can be altered due to story implementation issues. It was possible to determine an authoring process and verify that steps from it are followed by the authors who participated in the interviews. It was also possible to understand what issues authors are faced with and what actions they implement to overcome those issues. Each method has worked to solve a piece of the puzzle that would show a picture of addressing all the research questions by ensuring that findings cover a range of opinions within and outside of academia where the discipline of interactive storytelling is supported by a community of authors and developers. Limitations on the study arise from the selection of the tools for the story adaptations and the participants

for the interviews. A greater scale of both would potentially draw a much different picture therefore while the analysis is not complete given its scope, the findings were noteworthy and genuine. This project has been designed specifically to answer questions about the process of authoring that will concern authors and inform the research around the field of digital interactive storytelling on the authoring experience.

The autoethnographic story adaptations saw two stories written and completed by the author using *Twine,* a branching hypertext authoring tool and *Storyplaces,* a sculptural locative hypertext authoring tool. Both stories have been obtained from their tool of origin and adapted into each other as well as in *Inform 7,* a natural language parser-based authoring tool. This was necessary for exploring the process of authoring within the tools, identifying what steps were followed to create a story with a clear purpose of how it was necessary to function, as well as understanding what issues could occur while trying to develop the story's narrative plot and behaviour. Through a series of observations, it was possible to determine some of the issues that may occur while implementing the narrative within the tool of choice but also to determine how these tools function in the development of common story elements.

For the story adaptations, the stories selected were targeted based on their narrative structure and tool of authorship. With each tool that the stories had been adapted, to be able to visualise the paths and directions of the narrative it was necessary to create visual maps that connected nodes of text and explained the relationship between them. If it was *Twine* it was necessary to see the passages that connected through the hyperlinks, if it was *Storyplaces* it was necessary to see which passages were made available on a map every time an appointed location was visited, if it was *Inform 7,* it was necessary to draw a diagram of the directions between defined locations so that the path in the story while traversed made sense. It seems almost interchangeable that with every interactive digital narrative, a diagram, a map or a visual overview of how the narrative connects is necessary. The only tool that provided this by default was *Twine*, and by having that

functionality available felt like the tool could accommodate the need to refer to a graphical representation of the story in question. Otherwise an author would have to step out of the authoring tool and utilise another tool to do this. Millard (2019) noted that to create one story with their authoring tool they had to use a set of other tools to cover planning, only to use their tool for building the structure already sketched on whiteboards and for copying the content that was previously written in collaborative Google documents. In that sense, it is as if the bulk of the work was done using other tools rather than the authoring tool itself. Similarly, outside of academia, the creators of the interactive episode *Bandersnatch* part of the *Black Mirror* tv series began mapping their story on post-it notes, migrated into *Twine* the hypertext fiction branching tool to manage the arcs of where the story would go and worked with the *Netflix* platform to develop technology for the episode to stream with embedded choices (McHenry, 2019). These examples depict how an author may have to rely on a number of additional tools. Authoring tools lack in that sense because while they may be enabling the author to accomplish some steps in the authoring process, ultimately it becomes less of an aid if it fails to encapsulate all of those necessary. To quote Nelson (1965, p.88) on the use of hypertext systems for writing:

"If a writer is really to be helped by an automated system, it ought to do more than retype and transpose: it should stand by him during the early periods of muddled confusion, when his ideas are scraps, fragments, phrases, and contradictory overall designs. And it must help him through to the final draft with every feasible mechanical aid-- making the fragments easy to find, and making easier the tentative sequencing and juxtaposing and comparing." (Nelson, 1965, p.88)

In the story adaptations it was also discovered that the user interface is an important factor in how an author interacts with the background features of a tool. A programmable environment should ideally be hidden from the authors and made available to those with additional skills so that those without them can work the tool without the need to write

complex code, but those who do wish to add code can still enrich their story structures by adding to the basic tool capabilities.

The identification of an authoring process (the second research question) has been identified through the systematic literature review conducted on both the ACM Hypertext and ICIDS conferences as well as the interviews with authors in the field of digital interactive storytelling. The authoring process identified contains the following steps: *Ideation, Training & Support, Planning, Visualising & Structuring, Writing, Editing, Compiling & Testing, Publishing*. The ability to create a structure of the story and visualise where everything goes as well as being able to shift things easily as the story progresses is a feature that seems vital as part of the planning, visualising & structuring and editing steps in the authoring process. At least two of the tools used in the story adaptations described in Chapter 4 have little provisions for assisting the author with planning the structure of a narrative and visualising the connections of nodes. In that sense the author who risks losing themselves, as the interviews have proven, in the different variables declared in the story has to resort to planning their narrative using another tool whether it be sketching or drawing it. Planning and visualisation are steps that every authoring tool should be able to accommodate in some way. Such functionalities will be a necessary aid for the creative author who will not need to step out of a possibly foreign and automated environment in order to configure how to write the story within it. This could be remedied with multiple tools, when tool developers are clearer about where their tools fall strong in the authoring process. It may be the case that a tool is designed to better encapsulate a particular step in the process. In that case should an author need to deviate from their main tool for accomplishing another step in the process, additional tools would be of aid if they provide import and export mechanisms of the story by supporting a variety of story formats.

It was further discovered in the literature review that adding content can sometimes be difficult, and as *Inform 7* showed in the authoring autoethnographic story adaptations, it is

indeed complicated on occasions to decide how to attach the necessary content within the tool's vocabulary. Unlike *Storyplaces* for example there is no dedicated authoring interface other than the interface that utilizes both text and scripting code. This makes writing difficult and this is furthermore ascertained by the interviews when several participants stated that the lack of separating content and behaviour resulted in confusion. The ability to add text in a story is the backbone of an interactive narrative's context, especially in a tool like *Inform 7* whose entire purpose is to make text interactive. Text in *Inform 7* is understood as something that describes a location, and authors can manipulate text to appear depending on the location the text is attached to. The tool may be doing this well, yet if an author wishes to engage with *Inform 7* and write a story of its nature, they will be prohibited by freely adding text in an editor where vocabulary of tool and story content must be attached together for the story to compile and work. The author is restricted, and the story is limited precisely because the tool governs how the story should be told. The tool is shaping the narrative as well as the way the narrative is written. This is not a criticism of how *Inform 7* functions, just an example of what may be deemed as an issue for some authors.

Many participants in the interviews have mentioned the necessity to shift the way the story was headed because of how the tool functioned. Thus, similar to *Inform 7*, other tools have similar effects. Authors who encounter such restrictions have to be patient and persistent enough to overcome them. Participants in the interviews have mentioned giving up projects, shifting their purpose or - where the skills were adequate - coded their way into managing what they wanted to do. Many of the issues discovered in the interviews had as much to do with adding the narrative content as much as it had to do with fixing the structure of the story. There were a few participants who mentioned that a push from the tool was welcome as they felt it ultimately benefitted the end story, or that they purposefully crafted the story so that it adapts with the tool without too much impact on the content. This means that a level of restriction from the tools may be tolerable as long as it does not restrict the creative content on a great scale. As observations have shown in

Chapter 4 during the autoethnographic story adaptations trying to figure out how to add the content in *Inform 7*, trying to implement how to prevent rewinding nodes in *Twine* and coming up with locations in the physical environment just to be able to attach them to chapters in *Storyplaces* were some of the features that deviated from how the original story was envisaged. What was particularly evident on the story adaptations was that for the most part, it was possible to re-enact the stories without removing or altering the content except when it was necessary to add a couple of sentences for directive purposes. But in the case of other authors, they usually have an idea of the story they want to build, not the entire story written as it was the case during the story adaptations. Therefore, for them it will be much harder to predict how to use the tool to their advantage. In such cases, it seems that the tool may be the overwhelming factor to how the story shall be determined even if the story is already drawn in the author's mind.

From the codification of the interviews, it was strongly indicated that several misalignments of purpose existed between the author and the tool of their choice. It is normal then once encountering an unfamiliar tool, one needs time to assess its capabilities and adapt to the way the tool works. However, it was often mentioned by authors that the tools failed to successfully communicate what their purpose is, and documentation was not properly framed to present an understanding of how the tool operates. Understanding a tool comes down to two things based on what was discovered in this study. How much the user interface communicates and how much documentation communicates. If either one fails, there may be a way to work around it, but if both fail, not only does it mean that authors are most likely to disengage but also that even if utilised the end product will fail to demonstrate the true ability of the tool. Certainly, practice with the tools is the only way to improve on the success of author and tool interaction, but for this to happen the author needs to persist with a tool. This relates to the lack of communication between developers and users.

A software engineering methodology called Agile is implemented in many organisations who are building software for their clients, as a way of successfully managing a project with the user's continuous input (Fowler, 2005). This methodology works to iterate regularly the milestones in the end product which are revised every so often with the presence of the client for improvements at the beginning, during and before the final release of the product. By keeping the client in the loop of development, it informs the developers constantly how the tool will be used and what the client predominantly seeks. This methodology works, because the client is engaged. In digital interactive storytelling, when building authoring tools, the systematic literature review has proven that engagement with authors is lacking significantly. The author needs to be addressed more, and there is the need to include them in discovering issues and improving on the use of the tools. It may be small changes such as how to frame documentation or shift things in the interface that will help authors work better as opposed to trying to satisfy the need of every author, as that will be impossible with an interdisciplinary audience.

The tools that make it possible are out there, waiting to be manipulated into developing a narrative that will decorate the tool's potential. But the tools and the authors are not in alignment. The tool may overwhelm the author, or the author may feel the tool offers too little to satisfy their creative vision. If the tool offers creative potential, the author may not be able to see it through the tool. When the two interact, there may be a clash in what the author wants to do, and how the tool dictates the way that will happen. The risk that an author will choose to disengage themselves from the tool grows with every component that the author cannot figure out how to put into place. The tools are made to aid, so they ought to be simple to use, yet not so simple to just mimic the functionality of a word processor. Authoring tools of interactive digital narratives must go beyond text manipulation in order to be an appropriate aid for authors. It must educate the author and act as the middle layer between user and programmable complexity (Brooker, 2018). It must also offer some inspiration through the potentials of its use. Help the author visualise and identify the pieces of an otherwise fragmented puzzle that makes sense if

pieced together several different ways (Nelson, 1965). Ideally the author should be able to do the lot by using that one tool rather than many, for that brings a set of other complications when the author needs to switch from one interface to another to find their story. However as Millard (2019) describes, it can take several systems to encapsulate an entire narrative structure. Proving this way that authoring tools may not be able to capture fully the authoring process through their environment when they are only provisioned for specific hypertext or other narrative structures. This reminds us that this particular inadequacy of the tools may be why there are many similar ones out there (Millard, 2019). Hence authors need to resort to other tools if they want to see their work through every step in the process. If we compare the process to that of publishing a book, indeed a book is mandated to go through a rather long and arduous procedure to reach an audience. But it must go through that process[45] regardless. In literary interactive storytelling, publishing does not have a traditional pipeline, nor does it concern a standard process. It is not discussed very much as part of the authoring process, so authors begin an uncertain journey. A publishing pipeline worthy of consideration is one similar to the one run by independent web-comic and web-novel publishing websites such as WEBTOON[46], WebNovel[47], Tapas[48] and other similar publishers. These offer a writing environment and publishing platform for authors to promote their work for free, while also providing different financial options that authors can apply for and gain revenue. This for readers might be purchasing virtual coins to unlock chapters and episodes of a story,

[45] The process as thoroughly explained by Clark (1994) is the following: Desk editing (Editing manuscripts in detail, supervising the progress of books from manuscripts to bound copies, working with the production and design department and advising marketing and sales people), Picture Research (Research for pictures to be included in the manuscript), Design (overall style of the book i.e. typographies, illustrations, cover design), Production (obtaining materials, producing, printing, binding and finishing the book), Publicity and Promotion (promoting the book), and finally Sales (managing the sales of the book locally and internationally).

[46] https://www.webtoons.com/en/

[47] https://www.webnovel.com

[48] https://tapas.io

viewing ads, or obtaining a monthly membership which will ensure payment for contracted authors with the publishing website. A similar pipeline, given the freedom and independence of interactive narrative creators could mean a promising venue for the advertisement of their work as well as the assurance that some profit will be attributed to them. Publishing has also been proven in this study as an aspect of this discipline that remains relatively unexplored.

Authors on their part need to be more open with the discipline and the use of a tool. It will not be the same as authoring a conventional novel. This is a different kind of novel, an interactive novel, whose era is still young, and understanding is still developing. There is a need for authors to write good hypertext and interactive fictions, which researchers can study and explore in order to form new narrative theories and educate future authors. The tools have long been studied and used but the author has not. The authors' input is highly valuable as the interviews in this study have shown given the concerns addressed during the authoring process. If the authors are better heard, the tools will be better understood, and the authoring process will undoubtedly be improved.

Chapter 8 Conclusion

8.1 Summary

This report has presented the work for a research project evolved around the experience of authoring digital interactive narratives with an emphasis on those created in textual or literary form. Beginning with a short introduction to the topic of interactive narratives and topic establishment, the report has introduced digital interactive storytelling via a history of its origins and the tools that make its vitality possible. Two questions have been set and explored through the combination of three qualitative research methods, each providing its own insights but also blending with each other to provide conclusive results that emerge from all three of them.

The methods used in this study are autoethnographic story adaptations that contributed to answering question 1; a systematic literature review to answer part of question 2; and interviews to verify the findings obtained for research question 1 and answer the remaining part of question 2. The autoethnographic story adaptations involved two story adaptations between three digital interactive authoring tools. The first story originated in a locative literature tool and was adapted to a hypertext branching tool and a parser-based fiction tool. The second story originated in a hypertext branching tool and was adapted in a locative literature tool and a parser-based fiction tool. The adaptations enabled an evaluation of the authoring tools and the possible ways they influence story making and provided insights on the necessities and issues an author may face while attempting to migrate an idea in a tool to make a story the way they imagined it. The systematic literature review involved identifying and reading a set of sources that could provide evidence on an authoring process for interactive digital narratives. By pulling information from research papers that addressed a process in some way or activities that could much a process it was possible to put together a number of steps and identify an

authoring process. To verify that process and match issues that occur in each step for authors while authoring, the interviews enabled collection of data from the experiences of interactive narrative authors that verified that process, introduced additional steps and helped develop a framework that describes many of the authoring issues they encounter during that process.

This work has addressed the authoring problem as a whole by combining not only superficial issues that emerge by using the tools, such as technical constraints, but also deeper concerns of the mindful understanding between an author and their tool. Specifically, the way the tool may affect the purpose of the author. It has also succeeded in determining an authoring process by collecting words of other researchers, thus providing a model of what this process most likely entails. This process has been verified by the authors that utilised a set of authoring tools available to the public, thus assuring that a common process exists within a variety of experiences. Finally, the study has managed to codify as many issues as have been gathered from authors and matched those against the steps in the authoring process, they are most likely to occur. In doing so this made it possible to gather information relevant to developers and authors that would inform the former on things they need to look out when developing tools and the latter on things they need to look out when searching for an appropriate tool to work with.

Authoring as this study has shown is not one action. It is compiled of many activities that include the process of coming up with ideas for the story and visualising how the narrative elements will connect, and how the content will be presented. It involves some form of planning where all the story elements will be designed to anticipate the reader's intent when traversing the narrative. Then the addition and implementation of text and the story's programmable elements which will add context and functionality to the narrative's behaviour. The behaviour of the narrative will need to be tested and debugged for any potential programmable errors such as broken links or unwanted text appearing in nodes that it should not and once all is completed, the creator will want to find a venue for

distributing their work, receive feedback from readers and ultimately gain financial profit as fruits for their labour in what they enjoy doing.

Unlike the industries of book and games publishing, interactive digital narratives do not have a stable pipeline for interested authors to submit their work aside from *Eastgate Systems* and *Choice of Games* who have developed a tool for interactive narratives and maintain a database of works from authors who have used their tool to publish stories. *Choice of Games* unlike *Eastgate* offer contracts to authors who pitch solid ideas to the company. Other than this, authors self-publish, without the intervention of professional editing and depend on a minimal number of websites to promote their work.

This is a discipline that started over thirty years ago, and while the initial works are hard to find or even forgotten, new works have replaced them and a new approach to storytelling survives in academia and a non-academic community of authors. Authors exist, authoring tools exist, research exists, but there is a detachment from lack of communication between them.

8.2 Research Questions

The following research questions have been set for this project.

1. *What are the conceptual difficulties authors face with digital interactive authoring tools, what are their attempts to overcome them and how are their actions affecting their stories?*
2. *What is the process of authoring digital interactive narratives and how do the authoring issues identified over the years match that process?*

The first question was targeted by the studies designed and presented in Chapters 4 and 6 that were the autoethnographic story adaptations and the interviews respectively. The second question was targeted by the studies designed and presented in Chapters 5 and 6 that were the systematic literature review and the interviews respectively. The interviews

presented in Chapter 6 were designed to contribute not only new input on answering the research questions but also knowledge that would enable verification of findings identified by the other research methods presented in Chapters 4 and 5 that were designed to answer each question individually. In that way the interviews draw all the results together and provide the necessary information to conclude the answers to the research questions.

For research question 1,

What are the conceptual difficulties authors face with digital interactive authoring tools, what are their attempts to overcome them and how are their actions affecting their stories?

Conceptual difficulties authors face while authoring, became evident in the process of story adaptation described in Chapter 4. Things such as learning a tool's vocabulary and referring to guides or documentation to figure out how to implement the story behaviour as well as stepping out of the tool to design visual structures of how the nodes in a story connect and where the content must go and on occasions how the content goes into the tool. Some tools were more difficult to handle than others either due to their limited user interface components or due to their unique environment. When the tools required an amount of coding it was necessary to spend some time familiarising with code in addition to learning how to use the tool's interface. On occasions it seemed as if some limitations were asserted with the tools such as components in a story that were meant to be avoided. It became clear that there may be a way to achieve what is wanted if certain skills are obtained, otherwise there has to be a compromise between the original idea and the final product. The interviews provided in depth insight on the difficulties encountered during the autoethnographic story adaptations. People have talked about their issues and provided detailed explanations of how they attempted to overcome issues. Many of them mentioned their own journey with documentation and seeking advice from forums online, they explained their shift from the main tool to work around an issue by using another tool and then returned back to their main tool, some shifted the direction of their story or

changed some parts of it to accommodate the tool, some built extensions to the tools where necessary if they were not able to compromise, and others simply gave up.

It is evident that the difficulties with the tools vary depending on an author's point of view, skills and needs. There may be issues such as the need to spend some time and learn the tool and all that comes with it, trusting that there is enough out there to explain the tool and what it does well. There may be issues such as the tool not being suitable for what the author is trying to achieve, so the author may need to shift to an additional tool they feel grasps what they need to achieve better. Authoring issues are caused partly by the tools and partly by the authors' own understanding of what the tools can do. Some tools can communicate their purpose better than others. Some are built to accommodate a specific step in the authoring process while doing less well in accommodating other equally important steps. Some are built for a specific narrative form such as locative or parser based. The tools are not interchangeable, but some may be similar. The choice an author makes to use a tool may bring issues if the tool is not entirely suited to the author's needs. In that, the story may also end up being different than what the author has imagined because they were restricted to the tool of choice. Using the wrong tool will always bear some conceptual difficulties. Even for those who chose to use the right tool, authoring issues were still present and authoring was still in some ways difficult. Chapter 6 has introduced a framework of issues that authors have addressed through interviews on their own experience with authoring. Section 6.6 and Figure 40 show that framework. Issues were classified in five high level themes: *User/Tool Misalignment, Documentation, Complexity, Programming and Lifecycle*. Each theme was then broken down into different codes representing the issues as mentioned by authors. By doing this it was possible to address a lot of issues that transpire throughout an author's authoring lifecycle as well as identify how an author and the tool may be failing to communicate. Identifying the issues was an important piece that needed to be explored because their presence ultimately makes some of why the authoring problem is a problem. There are too many issues lying

around during the authoring process. This brings the topic to the authoring process and the need to identify one such process.

For this reason, research question 2 was set.

What is the process of authoring digital interactive narratives and how do the authoring issues identified over the years match that process?

Much of why the authoring problem is a problem is because whilst in the authoring process with the tools, authors feel they are faced with difficulties. Those difficulties can sometimes be unique to an individual but more often than not they are common among authors. It was important to name an authoring process because acknowledging steps in that process helps tool developers be mindful of what authors are likely to need while using their tool. When developers emphasize and reflect what the user experience may be like, while they might not be able to create a perfect tool for all, they will be able to improve on the tool based on how it is used. The systematic literature review described in Chapter 5 was enough to allow the formation of steps that seem prevalent in the authoring process. Those steps are *Training & Support, Planning, Visualising & Structuring, Writing, Editing, Compiling & Testing.* Through the interviews described in Chapter 6 it was possible to add two more steps in the process: *Ideation and Publishing.* With a process established it makes easy for developers then to consider what an author may need in each step of that process and consider implementing activities that are likely to be necessary such as allowing a visual map of the story to be crafted within the tool and possibly linking that to the content so that if one changes the other can reflect the change. It does not mean that every tool out there should implement the entire process but by strongly implementing one or two steps, the tool becomes less prone to cause issues.

By establishing an authoring process, it became possible to align this process with the framework of issues discussed in Chapter 6. Each code that classified a series of issues was

matched with a step in the authoring process established in Chapter 5 and a clear view of what those are and where they would be expected in the authoring process was moulded. With a table of issues aligning with steps, the steps in the process were collated in three production phases. Pre-production for ideation, training and planning, production for writing, editing, and structuring, and post-production for testing and publishing. It became evident that most issues fall within the production phase where an author is tackling with narrative structures, placement of content, editing and on some occasions programming. Knowing a process and knowing the nature of issues that are most likely to appear would be a critical aid for a tool developer and for future researchers who can use both the framework of issues and the process model combined to see clearly why the authoring problem is a problem and how research and development can mitigate it by moving forward with this knowledge.

8.3 Reflection

Authoring digital interactive narratives has proven to be an elaborate process. One that needs to be explored further for an understanding of its technical and creative concepts. The role of the interactive author remains unexplored because without a clear account of their action in the creative process their work is a mystery. The authoring problem may always be a problem. There are conceptual difficulties that an author will be suffering with any simple or complex authoring tool, however there are ways for researchers to come out of the dark and learn more about those difficulties.

Three novel approaches to explore the authoring problem have been presented here, each inspired by the works of other researchers but each bearing its own unique and fresh traits to learning more about the problem. The project aimed to demystify an authoring process and shed light on the issues. An process has been discovered but it is young and needs to be verified further. An exploration of similar creative processes from other creative fields would potentially tell more on what researchers in the interactive digital narrative field

may have missed. Further, an expectancy lingered on that the technical constraints of the tools would undoubtedly be to blame yet interviewing authors showed a slightly different picture. An author is equally responsible to the work they want to produce as their tool is responsible for making their work happen. While authors on their side should study and get to know their tool of choice well before hand, on the research and development side of things a field that seems to be missed a lot and one that should be at the forefront for research related to tools is User Experience (UX) design. It is only in the recent years that work has started to involve UX perspectives as seen in Green et al. (2020); Revi et al. (2020), and it stands to reason that when looking to improve on the use of the tools and improve the authoring experience then the user experience design methodologies should have been a vital part of research a long time ago. When it comes to the creative process that happens between tool and author, a turn to other artistic and creative fields such as art and design have proven to contain relevant empirical studies as seen in Botella et al. (2011); Lubart (2001); Sawyer (2018) on the concept of creation as a process and may prove relevant if applied to the examination of the interactive narrative creative process.

Communication also seems to be an integral aspect of where research on the authoring problem might be lacking. This work has offered a small approach via the interviews to unite knowledge from communities that work on literary interactive fiction and has shown how advocates of these communities suffer with the same sorts of issues. Yet they do not speak to each other at all. A different vocabulary is exchanged between academics and commercial users of literary interactive narratives and one side does not seem to know the other side exists. If the knowledge is combined, then research will unlock new empirical findings to consider that will benefit this field. There are more authors out there than academia acknowledges and it is a shame not to include them in the attempts of improving a problem they are facing.

The role of the author as well as the actions that describe their labour can only be conclusive when the author is involved. It has not been explored in this study but in

future studies the position of the interactive author in cultural and societal themes is worth exploring. The differences an author pertains from the interactive author would give this new author a new identity. It might be the case that the interactive author will also be a conventional author or a narrative designer or a filmmaker. All those roles are distinct in their field of study. In the field of interactive digital narratives, in order to move forward with the authoring problem, attempts to create the perfect tool should ease and attempts to knowing about the author should begin.

8.4 Contributions

Work from this study has been aiming to contribute knowledge to a long-term problem in the remits of digital interactive storytelling which involves the authoring process and the difficulties behind it. The approach to the problem has been focused on the perspective of an author as a user of digital interactive authoring tools and examined through the use of tools as to what reflects as a process and where conceptual and technical issues fall within that process.

This work has made the following contributions:

1. A set of narrative design observations while navigating a combination of tools to create an interactive digital narrative.
2. An authoring process model specific to the field of interactive digital narratives.
3. A list of challenges encountered during authoring digital interactive narratives by interactive narrative authors based on their personal experiences.
4. A framework of the authoring challenges typology and a map of that typology to the authoring process model that shows what issues are likely to occur in each step of that process model.

The contributions combined provide a theoretical basis for a better understanding of the authoring problem and are such that future researchers can further examine and built

upon, ideally with an amplified inclusion of digital interactive narrative authors to the discovery of findings.

Throughout the progress of this project, work carried out as part of the methodology has also been a contributing factor to publications of several conference proceedings. Below is a list of publications that were possible with the work presented in this report.

1. Kitromili S., Jordan J., Millard D.E. 2018. **How Do Writing Tools Shape Interactive Stories?**. In: Rouse R., Koenitz H., Haahr M. (eds) Interactive Storytelling. ICIDS 2018. Lecture Notes in Computer Science, vol 11318. Springer, Cham. https://doi.org/10.1007/978-3-030-04028-4_60
2. Sofia Kitromili, James Jordan, and David E. Millard. 2019. **What is Hypertext Authoring?** In Proceedings of the 30th ACM Conference on Hypertext and Social Media (HT '19). Association for Computing Machinery, New York, NY, USA, 55–59. DOI:https://doi.org/10.1145/3342220.3343653
3. Sofia Kitromili, James Jordan, and David E. Millard. 2020. **What Authors Think about Hypertext Authoring**. Proceedings of the 31st ACM Conference on Hypertext and Social Media (HT '20). Association for Computing Machinery, New York, NY, USA, 9–16. DOI:https://doi.org/10.1145/3372923.3404798
4. Kitromili, S., 2020. **Tools make it possible authors make it real**. In: Authoring for Interactive Storytelling 2020. Presented at the 13th International Conference on Interactive Digital Narratives, Bournemouth, UK, p. 3.

The paper '**How Do Writing Tools Shape Interactive Stories?**' was presented as a short paper at the 2018 International Conference in Interactive Digital Narratives and shows the work presented and described in the first part of Chapter 4 where the first set of observations by story adaptation occurred with the story *Fallen Branches* being adapted from *Storyplaces* into *Twine* and *Inform 7*.

The paper '**What is Hypertext Authoring?**' was presented as a short paper at the 2019 Hypertext and Social Media conference and shows the work as presented and described in Chapter 5 of this report. It provided insights on the authoring process of hypertext narratives as they belong in the general form of interactive digital narratives.

The paper '**What Authors Think about Hypertext Authoring**' was presented as a full paper at the 2020 Hypertext and Social Media conference and shows some of the work that was covered in Chapter 6 following the interviews with interactive narrative authors. The paper was awarded with the Ted Nelson Best Student Paper award.

Finally, the paper '**Tools make it possible authors make it real**' was presented at the 2020 Authoring Digital Storytelling workshop part of the International Conference in Interactive Digital Storytelling, as an abstract proposal for a chapter in a book addressing the authoring problem with interactive digital narratives. The proposal for the abstract has discussed the need to address the authoring problem by talking directly to authors because as Chapter 6 has shown they can provide unique findings that can inspire approaches to solve some of the problem.

Work presented in the report and as published in the aforementioned academic venues stands to benefit not only the concerned academic communities for which the project has based most of the literature but also other academic and commercial communities.

Examples of academic venues would include but not be limited to the following:

1. ACM Hypertext and Social Media conference
2. International Conference on Interactive Digital Narratives
3. IEEE Games Entertainment and Media
4. Elsevier journal of Entertainment Computing
5. Electronic Literature Organisation

In terms of commercial venues, the most relevant will be the games industry given the similarities interactive literary narrative works bear with the mechanics and behaviour

found in games. These findings might also relate to industries such as film, TV and theatre, literature, and cultural heritage all of which can potentially incorporate the interactive element in their storytelling practices. In addition findings will inform and benefit narrative designers or otherwise writers attached to games companies and authors of the interactive storytelling community mostly found active on the online interactive fiction community when trying to work through the creation process as well as game engines developers when looking at improving the creative pipeline in all the relevant storytelling forms to enable authors to utilise an easier process when blending narrative content and narrative behaviour.

Further, findings presented in this report will be directly relevant to members of the recently established association of research in digital interactive narratives (ARDIN) which hosts academics, students, and professionals from all over the world that conduct work in the discipline of digital interactive storytelling.

8.5 Limitations

While the study has overall provided answers to the research questions and while the methods used to address the questions have proven efficient, the project does bear limitations that could have shaped the findings differently or have added significantly to what was already found.

Primarily the story adaptations presented in Chapter 4. Three different tools were used in those story adaptations and the experience of authoring with each has been a contributor to discovering much about the process as well as the influence in the story. The sample of tools could have been greater and similar tools could have been used to compare authoring between them as well. Adding more tools to the story adaptations could potentially bring to the surface more in-depth observations than the ones already discovered.

In the case of the literature review presented in Chapter 5, which has been based on the two most relevant communities for interactive storytelling (Hypertext and Social Media and International Conference in Interactive Digital Storytelling) and results were heavily concluded from their published content. While they did provide the necessary evidence to answer the relevant questions, there are other journal or conference libraries that may address this topic less often than the selected sources, but with work directly related to interactive narratives. Such sources would be the conference proceedings of the Electronic Literature Organisation, and of other proceedings related to Games, Human Computer Interaction, Multimedia, and Artificial Intelligence to name a few.

Finally, the interviews presented in Chapter 6 while holding an adequate sample of people from different backgrounds, it would be of more benefit if authors from the game industry participated in equal numbers with those outside of the gaming industry. This is because the gaming industry has an established game development pipeline that spans across different steps, holds specialised people in each step of the process and is done in a much greater scale than the one currently doable in the interactive narratives community. Writers who participate in game development will have a lot of similar and interesting issues to discuss, with authors limited to interactive narratives, because of their involvement with developing a narrative to match a specific gameplay using more often than not proprietary tools. Given the success of narrative games as part of the very powerful games industry it would be of benefit if knowledge in the younger field of interactive digital narratives could draw from those relevant authoring experiences that are of such great scale and would potentially have more things about the authoring process and the authoring issues to reveal.

8.6 Future Work

Work presented in this report will benefit from enhancement in the methods that constitute the methodology as suggested in the limitations section above. At a first

instance work that derives from this report will be used for the draft of a chapter in a book about the 'authoring problem' which organisers of the 2020 workshop in Authoring Interactive Storytelling have put together during the 2020 Proceedings of the International Conference in Interactive Digital Narratives.

Further than that, a research grant application is planned to be put in place to continue with the gathering of information where it relates to interviewing more authors but incorporating a panel of participants that will include more people from the games industry. A rough plan of this work will be to set up individual workshops with participants and go over their unique experience with activities during the steps of the authoring process while referring to a particular piece of work they were involved in. This will enable a further understanding about the work processes of authors as well as enable knowledge to form around the role of the interactive narrative author. A role that at the moment is undefined or misinterpreted.

8.7 Concluding remarks

Murray (2017) tells us that we need storytelling because stories are what maintain our history, shape our culture, and protect our traditions. It is also a form of entertainment that everyone engages with. Digital interactive storytelling is a relatively new form of storytelling. It is already embedded in games, a significantly successful industry, and recently has found a way to be projected to the wider public through television (Aarseth, 2012; Dormans, 2006; Kolhoff and Nack, 2019; Roth and Koenitz, 2019). For reference purposes and as the history of the interactive discipline claims, interactive cinema and television has been in motion for many years however has never been so widely known (Koenitz et al., 2015b).

Despite this, the authoring problem is real, discouraging authors from exploring the power of the medium, and acting as a barrier to new voices and types of work. The work for this project has attempted to shed light on the authoring process itself, to break down the

monolithic view of authoring, and help tool creators design more focused tools with an awareness of the challenges ahead. The challenge as Murray (2017) points out for the future of writing procedurally, with rules and constructs dictated by authoring tools that make storytelling possible as interactive, is to "*make those rules and constructs recognisable and available to authors as musical notation is to composers"* (Murray, 2017, p.90). It is the way contemporary medium creators can easily recognise and understand the mediums of their work, that interactive storytelling creators should be able to do as well.

Digital media and the use of a computer have made it possible to experiment, develop and study narrative content in ways that were previously not possible. The ways in which narratives behave and are experienced have changed (Koenitz et al., 2015a). The ways which the narratives react on a reader's action have changed (Murray, 2017). The narrative which one could only witness, one can now interact with and where applicable make their own. Bernstein (2015, p.7) through his account on the use of hyperlinks to write stories says, "*Links let us write in new ways for new audiences to tell stories that were once difficult to tell".* The authors who started writing with these links, and those who started writing through computer code, saw the potential of using the computer to create this new form of storytelling and while the initial works have remained as pillars of work to study in academia, they have been the cause of why today there are numerous ways to express interactivity in digital narratives (Rettberg, 2015).

Now the discipline is prospering, and new authors are getting accustomed to the idea of writing in a disordered sequence. As the discipline matures, so will the stories, the authoring tools and the skills of authors. There is no doubt that from the hands of a creative mind whom has learned their tool well, the audience will receive a very satisfying experience (Murray, 2017). Technology is only moving forward, so storytelling that is digital must move forward with technology as well. As this study has shown, researchers can experiment with tools and will receive results, researchers can also put together the

work of other researchers and again receive results, but the results will not come close to the findings that can be discovered by giving a microphone to an author and asking them to talk about their experience with authoring. There are plenty of authors out there waiting to be heard and aided with their work. Should research focus on the work of authors, how they understand the technical tool, how they work with the technical tool and acknowledge the authoring process as well as the issues presented in each step of that process, there could be an end to the authoring problem as it is known today. To a point where an author will be more concerned about what to do with the possibilities of the tool, knowing clearly what it can do, how to do it, and how to share it with an audience. People cannot live without storytelling, and digital interactive storytelling is a new form of storytelling that the world has not entirely experienced yet. It will be a change to people's reading experiences and bound to change the way the world has known literature, creative writing, gaming, and film making. The future remains to be authored, and the narrative should be interactive.

Appendix A

A.1 Evidence of authoring tools developed in academia

Authoring tools				
ACM HYPERTEXT 1987-2018				
Tool	**Model**	**Motive for creation**	**Indented users**	**Reference**
Storyspace	Calligraphic hypertext	Connection of textual episodes via links	Authors Readers	(Bolter and Joyce, 1987)
WE	Calligraphic hypertext	Creation of hierarchical structures from loose associative content on electronic and printed documents	Professionals	(Smith et al., 1987)
Card Shark	Sculptural hypertext	Creation of hypertext narratives and exploration of hypertext patterns	Hypertext fiction writers	(Bernstein, 2001)
Thespis	Sculptural hypertext	Extension of Card Shark to allow multi-agent participation in a story	Hypertext fiction writers	(Bernstein, 2001)
FluidWriter	Fluid Hypertext	Construction and management of alternative paths in fluid hypertext	Authors	(Zellweger et al., 2002)
HEFTI	Calligraphic / Sculptural hypertext	Recombine and evaluate story components, generated from a set of story templates	Authors	(Ong and Leggett, 2004)
ART001/006/014	Spatial hypertext	Use spatial hypertext with each tool to author linear text, hierarchical structures and network structures	Authors	(Yamamoto et al., 2005)
StorySpinner	Sculptural hypertext	Experimentation of authoring by organising narrative segments in automatically generated stories	Readers	(Hooper and Weal, 2005)
AHA!	Adaptive calligraphic hypertext	Perform content and link adaptation of x(html) and xml documents	Authors	(De Bra et al., 2006)
MOT	Adaptive calligraphic hypermedia for education	Simplify authoring process and encourage authors to create complex works without authoring overhead	Non-technical content authors	(Foss and Cristea, 2010)
GALE	Adaptive calligraphic hypermedia	Built to solve genericity, extensibility and usability issues from previous	Authors	(Smits and De Bra, 2011)

		adaptive hypermedia systems		
Storyspace	Sculptural hypertext (by components)	Creation of multiple museum narratives through a selection of stories from exhibitions	Curators	(Wolff et al., 2012)
Storyscope	Sculptural hypertext (by events)	Development of stories and plots for museum narratives through heritage objects, events and plots	Authors	(Wolff et al., 2013)
Touch-Story	Spatial hypertext	Interaction with spatial hypertext narrative structures through multitouch applications	Variety of readers and authors i.e. students, teachers	(Atzenbeck et al., 2013)
AMAS	Adaptive calligraphic hypermedia for education	Creation of interactive adaptive activity-based eLearning courses	Non-technical subject matter experts i.e. Teachers Lecturers Pedagogical designers	(Gaffney et al., 2014)
redframer	Calligraphic hypertext	Modelling of narrative structures from text-centric chunks with a focus domain on long form film and television stories	Writers	(Goranson, 2015)
Authoring tool	Adaptive calligraphic hypermedia for education	Approach to the creation of location aware experiences in-situ	Users	(Alconada Verzini et al., 2015)
ALAT	Adaptive calligraphic hypermedia for educational purposes	Easy to use adaptive hypermedia authoring system for the Generic Adaptation Language and Engine (GALE)	Non-technical authors	(De Bra et al., 2016)
ICIDS 2001 - 2018				
Tool	**Model**	**Motive for creation**	**Intended users**	**Reference**
RENAISSANCE	Rule based AI engine	Encoding of game Artificial Intelligence components in games	Technical staff with no experience in Computer Science or Artificial Intelligence	(Zancanaro et al., 2001)
StoryEngine	Generative with complex models	Authoring of interactive narratives by a framework that implements authoring based on an author's main actions in a way to avoid technical details	Professional authors	(Schneider et al., 2003)

IDTension	Adaptive procedural hypertext	Demonstration of the possibility to create interactive narratives by combining narrativity and interactivity	Digital Writers	(Szilas, 2003; Szilas et al., 2003)
AESOP	Composable and reusable storyworld engine	Support of authoring of pedagogically oriented interactive games	Game authors	(Silverman et al., 2003)
DraMachina	Natural language based with hypertext structure	Creation of interactive drama narratives by describing narrative elements and automation of communication between authors and producers	Interactive fiction authors	(Donikian and Portugal, 2004)
Art-E-Fact	Branching via directed graphs	Creation of interactive experiences in museum environments	Curators	(Iurgel, 2004)
Jeherazade	Branching	Allow readers to act as story chasers via virtual characters and expansion of non-linear to linear stories story lines	Readers	(Hoffmann et al., 2004)
Scenejo	Branching via transition graphs	Allow authors to create structured conversations by a knowledge-based definition of dialogues	Dialogue writers	(Spierling et al., 2006; Weiss et al., 2005)
Scribe	Branching	Creation of event driven interactive drama	Authors with little programming experience	(Medler and Magerko, 2006)
INSCAPE	Spatial hypertext / Branching	Development of interactive stories through organising story assets and presenting story structures as patterns of information	Non-specialist users	(Dade-Robertson, 2007)
Wide Ruled	Generative based on the Universe model	Creation of generative stories	Authors with wide variety of backgrounds	(Skorupski et al., 2007)
Authoring technology	Ontological	Initially a debugging tool, turned communication system between authors and technologists for formalistic planning and representation of narrative content	Authors and technologists	(Pizzi and Cavazza, 2008)
PRISM	Adapted branching	Creation of branching interactive narratives through automated association of nodes	Non-expert users, Artificial Intelligence researchers	Cheong et al. (2008)

StoryTec	Environmental branching with runtime engine	Authoring and experiencing non-linear interactive stories with a writing and runtime platform (based on feedback from tools INSCAPE and U-CREATE)	Authors with no programming skills	(Göbel et al., 2008)
WordsAnime	Generative - 3D	Creation of animation interactive stories through recycled animated scenarios based on user input and selection	Generic users Children	(Sumi, 2009)
The Virtual Storyteller	Generative with multi agent model	Co-creation of interactive storytelling systems via iterative authoring and system debugging for story generation	Authors	(Swartjes and Theune, 2009)
HypeDyn	Procedural hypertext	Visual authoring of procedural interactive stories via adaptive hypertext fiction through reader actions – Research and teaching tool	Non-technical authors	(Mitchell and McGee, 2012)
ASAPS	Procedural / Branching – 2D	Creation and presentation of interactive digital narratives and teaching	Non-expert authors	(Koenitz and Chen, 2012)
Travel teller	Location based thematic recommendation system	Creation of stories by collecting shared user experiences and suggesting thematic recommendations on further shares	Tourists	(Mitchell and Chuah, 2013)
CHESS	Plot based procedural / Branching - 2D, 3D	Enrichment of museum visits via personalised interactive storytelling	Visitors as consumers and story authors as designers	(Vayanou et al., 2014)
CoDICE	Real time distributed and multi device system	Co-design of narratives in cultural heritage institutions to present smart objects for user experience enhancement between designers and engineers	Designers, curators and software engineers	(Díaz et al., 2015)
March22	Branching	Accommodation of author's requirements via simple scripting language to create interactive narratives, primarily visual novel games	Authors Developers Artists	(Lynch et al., 2017)
Stroyplaces	Sculptural hypertext (Constraint based)	Creation of higher-level narrative constructs for constraint based locative hypertext fiction and exploration of locative narrative poetics	Authors Readers	(Millard et al., 2017)

Communics	-	Creation of comic based interactive digital stories to facilitate self-expression on discrimination	Young migrants	(Rutta et al., 2018)
Novella	Sculptural hypertext	Development of genre-independent models of interactive narratives for games	Authors	(Green, 2018)

For an overview of commercially available digital interactive authoring tools taken from Short (2007) a list is available in an excel spreadsheet accessed with the following link: https://docs.google.com/spreadsheets/d/1-B1yKIateTpwTdRNT9W_ZjDzC6XnFpHXrcZ4nr_x7LQ/edit#gid=0

Appendix B

B.1 Draft table of identifying authoring steps

List of authorial practise assumptions		
Category	**Term**	**Reference**
Planning	Notetaking	(Trigg and Irish, 1987)
Planning	Organising	
Visualising	Structuring	
Visualising	Outlining	
Referencing	Referencing	
Editing	Search and query	(Halasz, 1987)
Editing	Composites – augmenting the basic node and link model	
Visualising	Visual structures for dealing with changing information	
Analytics	Computation in hypermedia networks	
Planning	Versioning	
Support	Support for collaborative work	
Editing	Extensibility and tailorability	
Training	Annotated graphical overviews	(Marshall and Irish, 1989)
Visualising	Tour stops that explicate layout conventions	
Advanced	Integrating expository text with other types of metainformation	
Referencing	Context-sensitive reference.	
Support	Persistent gestures and cards	
Training	Tools to support activities from other disciplines.	
Training	Examples of successful presentation strategies.	

Visualising Structuring Planning Editing Editing Compiling Referencing	Creation of nodes and links Generation of overall map and structure Support for capturing and representing users' needs Provision of a full range of editing facilities Support for tracking and checking Support for testing and evaluation Creation of external links	(Theng et al., 1995)
Visualising Visualising Training	Facilitate the development and reconfiguration of transitional organizational structures, offering both intuitive representations of explicit hierarchy and multiple views and reading paths to massage these transitional hierarchies Enable rapid spawning of hi-directional links for notation and comment Emphasize the dual character of the writing space, i.e., that it contains structure and text in a single object which occupies a place in the evolving structure of elements	(Joyce, 1991)
Training	Visual indication that all lexias available in a narrative have been visited.	(Calvi, 2004)
Compiling / Testing Editing Advanced Advanced	Debugging: By allowing debugging inside of an authoring tool, the author will save time by not having to switch into the story environment and will be able to play through the story quicker, with various story navigation options. Environment representation: To protect against these varying environment definitions, an authoring tool will need an infrastructure to understand these definitions and have a relative representation of any environment defining these definitions. Pacing and Timing: An authoring tool should allow an author to create timelines that bring captivating effects to their stories, which has been done in other narrative media, such as computer games, film, and literature. Scope: Interactive drama content includes character behaviour, story representation definitions, dialogue scripts, etc. and an authoring tool must cover this wide scope with authoring functions.	(Medler and Magerko, 2006)
Visualising	Representation of relationships between events	(Nakasone and Ishizuka, 2006)
Visualising	Structure and shape should: tackle boundaries, critical mass for emergence and dead ends in a story.	(Louchart et al., 2008)

Training	There is also a need to educate authors with systems that are simple, but still distinguishable from linear branching methods. Writers for interactive storytelling – if educated in the basics – could contribute a lot to the successful development of future tools.	(Spierling, 2009)
Planning Planning Visualising	Character-based planning: consists in calculating all possible story paths from an initial situation and selecting a plan that can reach each character's goal. Narrative planning: consists in setting a story goal as well as various narrative constraints, then calculating a plan that reaches that goal, possibly modified by user's action. Narrative actions and constraints: consists in choosing a parametrized representation of actions and calculating the next action according to narrative constraints.	(Szilas and Axelrad, 2009)
Planning Writing Compiling / Testing	Generate ideas Implement story Offer simulation	(Swartjes and Theune, 2009)
Planning Planning Planning Advanced Training Training Training	Separation of adaptive from static content Use of frameworks for separation of concerns Use of standards for content reuse Adaptive system to the needs of the author by suggestive features Accessibility to simple adaptation features Consistent with existing application interfaces Interoperability with familiar creation modes	(Foss and Cristea, 2010)
Editing Compiling/Testing Writing Advanced Training	Reachability of story from the initial node Deadlocks identification Sequencing identification of linear events Complexity measurement of each node in number of actions Authors need to be introduced in the method of planning.	(Dang et al., 2011)

Compiling / Testing	Story Parser	(Cai et al., 2011)
“”	Context Modeler	
“”	Plot Modeler	
“”	Character Modeler	
Planning	Identification of story agents	
Planning	Identification of agents goals	
Compiling / Testing	Compilation of agent goals	
Writing	Create stories from different narrative components i.e., facets, plot	(Wolff et al., 2013)

Appendix C

C.1 Interviews Questionnaire

Part A – Context

1) What digital interactive authoring tools have you used so far?
2) What prompted you to start using digital interactive authoring tools?
3) On what criteria do you select the tool you are going write with? (i.e., Do you select a tool based on the story you want to tell or because of its abilities?)

Part B – Process

4) What is your process of writing a story with a digital interactive authoring tool? (Think of steps such as Training, Planning, Visualising, Writing, Editing, Testing, Publishing as part of that process as examples.)
5) Have you published any works and what do you think of the options and methods available for publication and the process for publishing digital interactive narratives?

Part C – Issues and Effects

6) Have you encountered any issues while authoring with digital interactive authoring tools? (i.e., while trying to: learn how to write a story, create a structure and visualise your plot, add or edit your content, test or publish your story?)
7) How did you try to overcome any issues whilst authoring your story?
8) Have your actions in resolving any issues or the nature of the tool had any effect on your story in terms of content or story behaviour?

C.2 Iterative coding of interview data

1st draft of coding

Codes	No of times code occurred	Participants
1. EPISODIC	2	P1, P3
2. LOCALISING CHANGE	1	P1
3. STATE COMPLEXITY	12	P1, P5, P7, P8, P9, P11, P12, P13, P18
4. STAGING	11	P1, P2, P6, P10, P11, P14, P16, P17, P18, P19
5. STATE CHECK	4	P1, P3, P4, P13
6. TECHNICAL PREPARATION	7	P3, P4, P5, P14, P17, P18
7. TECHNICAL PERCEPTION	4	P3, P4, P11
8. COMPLETION	4	P3, P5, P8, P11
9. SCENE DESIGN	6	P7, P8, P16, P18

2nd draft of coding

Theme	*Code*
TECHNICAL PERCEPTION	MISALIGNMENT
STATE COMPLEXITY	VARIABLE TRACKING
TECHNICAL PERCEPTION	AUTHORIAL EXPECTATION
STATE CHECK	TESTING
TECHNICAL PERCEPTION	SIMPLE YET COMPLICATED
PREPARATION	DOCUMENTATION
COMPLETION	PLATFORM SUPPORT
STATE COMPLEXITY	PROJECT HANDLING
TECHNICAL PERCEPTION	THE UNKNOWN
COMPLETION	MAINTENANCE
ENVIRONMENT	ENVIRONMENT EXPECTATION
STATE COMPLEXITY	VERSIONING

COMPLETION	EXPORTS
DESIGN	DIALOGUE
ENVIRONMENT	ENVIRONMENT LANGUAGE
COMPLETION	CURATION
DESIGN	CONSTRAINED CREATIVITY
ENVIRONMENT	ENVIRONMENT CONCEPTUALISATION
STATE COMPLEXITY	HANDLING

3rd draft of coding

Theme	*Code*
TECHNICAL PERCEPTION	CONCEPTUAL MISALIGNMENT
TECHNICAL PERCEPTION	WORKFLOW MISALIGNMENT
STATE COMPLEXITY	VARIABLE TRACKING
ENVIRONMENT	LACK OF PROGRAMMABLE ENVIRONMENT
STATE CHECK	TESTING
COMPLETION	PROFITABILITY
PREPARATION	DOCUMENTATION: THE KNOWN UNKNOWN
PREPARATION	DOCUMENTATION: THE UNKNOWN UNKNOWN
COMPLETION	PLATFORM SUPPORT
STATE COMPLEXITY	SCALABILITY
COMPLETION	MAINTENANCE
TECHNICAL PERCEPTION	EXPERTISE MISALIGNMENT
STATE COMPLEXITY	CONTENT TRACKING
STATE COMPLEXITY	VERSIONING
COMPLETION	DISTRIBUTION
ENVIRONMENT	SEPARATION OF CONTENT AND BEHAVIOUR
DESIGN	INTERACTIVE DIALOGUE
COMPLETION	CURATION
TECHNICAL PERCEPTION	ONTOLOGICAL MISALIGNMENT

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