Designing a Web-Based Visual Story Tool to Support Relaxed Theatre Performances for Children with ASC

UG4 project

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Abstract

Relaxed performances are a very recent approach by theatres to cater for hitherto neglected audiences, including children with Autism Spectrum Condition (ASC). Their implementation takes into account that children with ASC might react differently to sensory input or emotional content, and the children are encouraged to enjoy the performances in their own personal way. To increase predictability and help children with ASC prepare for their theatre visit, many theatres have handed out visual stories upfront of their relaxed performances. These stories explain in simple words what the child can expect from when they enter the theatre to when they leave it.

In this project, we designed a web-based tool, called *RePeAT your ViSIT*, that can be used by theatre professionals or practitioners to create visual stories for children with ASC who would like to attend a relaxed theatre performance. The design of the tool was informed by the existing literature and input from experts and neurotypical children. Several low-fidelity prototypes and one high-fidelity prototype were designed and evaluated. It was found that the tool has great potential to simplify and inform the creation process of visual stories for relaxed theatre performances and that an example story was well received by children of our target age group.

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1. Introduction

Autism Spectrum Condition (ASC), also called Autism Spectrum Disorder (ASD) or simply autism, describes a range of pervasive developmental disorders. Recent figures estimate that around 1% of the population in the United Kingdom (UK) have been diagnosed with ASC (Baird et al., 2006; Brugha, 2011). According to the American Psychiatric Association (2013), the key manifestations of ASC are deficits in social communication, deficits in social interaction, and restricted, repetitive patterns of behaviour, interests or activities. This includes deficits in joint attention (Rapin & Tuchman, 2008) and the need for routines and predictability (Levy, Mandell, & Schultz, 2009; Perko & McLaughlin, 2002). Over- or undersensitivity to perceptual stimuli is another common characteristic of ASC (Rapin & Tuchman, 2008). As ASC is a spectrum condition, the severity of symptoms can vary substantially. Sometimes, but not always, ASC is accompanied by an intellectual disability (Matson & Shoemaker, 2009). The nature of the impairments makes it difficult for children with ASC to cope with social situations and conventions (Roberts et al., 2011). Due to their adherence to routines, new experiences or environments can also make children with ASC feel anxious or uncomfortable. All of this often leads to them being excluded from social situations and events. One particular social event that children with autism have traditionally been excluded from is going to the theatre (Kempe, 2015). Factors that have contributed to this exclusion are the high intensity of sensory input, like lightening or sound, during the theatre performance and the fear of disturbing other visitors.

Relaxed performances are a relatively new approach by theatres to encourage otherwise excluded audiences, like children with autism, to attend their performances (Fletcher-Watson, 2015). The adjustments made for relaxed performances can vary but often include reduced intensity of lightening and sound, a smaller audience size and fewer surprising effects during the performance (Fletcher-Watson, 2015; Kempe, 2014). The atmosphere is also different to the one of a mainstream performance. As the members of the audience are encouraged to enjoy the performance in their own personal way, more noise and movement can be observed in the audience (Fletcher-Watson, 2015). Many venues additionally offer their visitors a quiet area that they can go to during the performance if they feel that they need a pause (Kempe, 2015). Despite largely positive feedback for reported relaxed performances, not much research has been carried out to determine how the performances are conducted and what impact they could have (Kempe, 2015). A few recent articles have, however, suggested that while relaxed performances were originally introduced to make arts and culture available to neglected audiences, they could also have the benefits of improving social and communication skills (Corbett, 2016). Furthermore, they could be an opportunity to raise awareness for autism within the society (Kempe, 2014).

To help children with ASC prepare for their theatre visit, some theatres have released visual stories upfront of their relaxed performances. The idea of visual stories derives from the concept of Social Stories invented by Carol Gray in the early 1990s. Social Stories can be described as short stories that explain social situations and concepts in a simple way (Gray, 2010). Their format and content is defined by a set of criteria. Visual stories for relaxed performances may contain photographs of the venue, storyboard and characters, Makaton symbols and a list of surprises (Fletcher-Watson, 2015; Kempe, 2014; Kokina & Kern, 2010).

While there already exist applications like *Social Stories Creator and Libra*ry and *Show and Tell* that aid the creation of such stories, these are not specific to relaxed theatre performances. Creating a web-based tool for theatres or schools to build visual stories that support relaxed performances would allow the inclusion of more specific features and design choices and help both the children with ASC and the theatre.

1.1 Roadmap

The upcoming part of the report is structured into the following chapters:

Chapter 2 presents a review of the research literature on autism, with emphasis on the characteristics that children with autism display, technology-based support, relaxed performances and visual stories.

Chapter 3 presents the activities that were used to inform the design of the visual story tool. These activities include a design workshop with neurotypical children and interviews with experts in the fields of autism, relaxed performances and visual stories.

Chapter 4 presents the design process. First, the design requirements and design principles were established. Along with the outcomes from the literature review and design-informing activities, they guided the creation of an initial low-fidelity prototype. In an iterative design process, several improved low-fidelity prototypes and a high-fidelity prototype were designed.

Chapter 5 presents the activities that were used to evaluate the high-fidelity prototype. These activities included an evaluation workshop with neurotypical children, a feedback survey for students and staff members of the university and interviews with experts in the fields of autism, usability and relaxed performances.

Chapter 6 presents an overall conclusion, addresses some of the limitations of the project and gives directions for future work.

2. Literature Review

2.1 Autism Spectrum Condition (ASC)

2.1.1 Characteristics

Autism Spectrum Condition (ASC) has been classified as a neurodevelopmental disorder by the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5) (2013). According to the DSM-5 there exist the following five diagnostic criteria for ASC:

- **Criterion A** – Persistent deficits in social communication and social interaction
- **Criterion B** – Restricted, repetitive patterns of behaviour, interest or activity
- **Criterion C** – Symptoms must be present in the early developmental period
- **Criterion D** – Symptoms impair social, occupational or other areas of functioning
- **Criterion E** – The impairments are not better explained by an intellectual disability or a global developmental delay

As ASC is a spectrum condition, the manifestation and severity of symptoms can vary among those diagnosed (Rapin & Tuchman, 2008). This consequently means that it affects people in different ways and to varying extents. As defined under criteria C and D, the symptoms must be evident from early childhood and interfere with everyday life. In many, but not all, cases, ASC appears in conjunction with an intellectual disability (ID) (DSM-5, 2013; Matson & Shoemaker, 2009).
Another common framework in the literature that describes the characteristics of ASC is the 'Triad of Impairments'. It includes the following categories:

- Impairment of social interaction
- Impairment of communication
- Impairment of imagination

The 'Triad of Impairments' is based on work by Wing and Gould (1979) and was introduced by Wing (1996). In a direct comparison with the diagnostic criteria introduced by the DSM-5 (2013), it becomes apparent that the impairments of social interaction and communication are equivalent to criterion A while the impairment of social imagination seems to differ from criterion B which describes restricted, repetitive patterns of behaviour, interest or activity. However, when looking at the description by Wing (1996), repetitive, stereotyped activities were given as a direct

consequence of impaired social imagination. The other key component of impaired social imagination that Wing (1996) described was a lack of imaginative activities which can be found in the DSM-5 (2013) under criterion A. The types of symptoms introduced by the two frameworks are therefore comparable.

Impairment of Social Interaction

Children with ASC are often more interested in objects than in people (Frith, 2003). They might show very little or no motivation to interact with those around them and consequently develop few or no friendships (DSM-5, 2013; Levy, Mandell, & Schultz, 2009). Their social responses towards others may seem unnatural, odd or inappropriate, sometimes even causing offence. Children with ASC often have difficulties using their eye gaze and body language in a way that supports what they want to communicate, which can reinforce the impression of their responses being unnatural (Frith, 2003). Understanding social cues and subtle rules of behaviour can present a major challenge to children with ASC. Even though some compensation strategies can be acquired with age, their behaviour in social situations often has to be calculated and does not become intuitive (DSM-5, 2013). To show the range of manifestations that impaired social interaction can take, Wing (1996) introduced four different groups:

- **Aloof Group** – This is the most common manifestation of interaction impairments found among young children with ASC. These children are described as behaving as if the people around them do not exist. They might not respond to others approaching them and rarely show emotions through facial expression
- **Passive Group** – Children in this group accept but do not initiate social interaction. They are often willing to follow instructions which helps them integrate into their environment.
- **Active but odd Group** – Children in this group will actively approach other people but in a demanding or egocentric way. They might ignore the feelings of others and continue talking about their own interests.
- **Over-formal, stilted group** – This manifestation of interaction impairments will only become obvious from late adolescence. People in this group will make much effort to comply with the rules of social interaction but might not really understand them. This will make it difficult for them to adapt when the expected behaviour is subtly different across situations.

Another common characteristic that falls under this category is a deficit in joint attention. Joint attention can be described as the coordination of attention with a social partner towards a specific object (Frith, 2003). It also describes the tendency to automatically follow the gaze or pointing of another person. Children with ASC will

often fail to display this tendency and not use their own gaze and gestures to initiate joint attention themselves (Rapin & Tuchman, 2008). In the literature, deficits in joint attention are generally described as a key element in identifying autism among very young children (Frith, 2003; Rapin & Tuchman, 2008).

Impairment of Communication

All children with ASC display deficits in communication. This covers verbal and non-verbal communication and does not necessarily mean that all children with ASC have a language impairment. The main problem rather lies in how children with ASC use the language they have (Wing, 1996). The DSM-5 (2013) emphasises the range of manifestations of deficits in non-verbal behaviour, ranging from poorly integrated non-verbal communication to a complete absence of it. The development of speech can often be described as delayed or abnormal (Frith, 2003; Wing, 1996). Children with ASC do not tend to use gestures or other methods of communication instead which can pose severe problems to their environment. Some children with ASC never develop speech. Those who do often start by repeating what they hear rather than producing phrases on their own (Frith, 2003; Wing, 1996). Generally, they tend to use the language they have to request or label things, rather than to share what they think and feel (DSM-5, 2013). Wing (1996) describes some of the aspects of language that children with ASC tend to find most difficult in more detail. When producing speech, this includes the correct use of grammatical structures, linking words and words that mean the opposite. They often avoid colloquial expression, repeat themselves or speak in a way similar to citing a dictionary. In terms of understanding, children with ASC might only focus on one or two words in a sentence and ignore the rest, interpret expressions literally and have difficulties in understanding jokes.

Impairment of Imagination

The impairment of imagination is not portrayed uniformly in the literature. Originally, Wing (1996) described that children with ASC tend to engage in repetitive rather than imaginative activities or pretend play. She observed deficits in sharing ideas, planning the future and understanding people's feelings and concluded that repetitive and stereotyped activities are the only reassuring and pleasurable activities that are left. Those activities are very common in children with ASC and can take on two forms. The first form are repetitive sensations. This includes touching surfaces, twisting hands and objects and turning lights on and off. The other form are repetitive routines like specific bedtime routines, arrangements of possessions or sequences of movements. Children with ASC can become very angry or upset when a routine gets disrupted and insist on starting the routine from the beginning (Wing, 1996).

The current literature focuses more on the second part of Wing's (1996) description, including repetitive motor activities, an adherence to routines and narrow interests (Firth, 2003; Levy, Mandell, & Schultz, 2009; DSM-5, 2013). The term 'impaired

imagination' can therefore be misleading. To avoid this confusion, a term that focuses on the lack of flexibility might be more suitable.

Related Characteristics

Another common characteristic among children with ASC that is widely reported in the literature is over- or undersensitivity to sensory input, including visual, acoustic and tactile information (Rapin & Tuchman, 2008). For visual information, children with ASC might display a tendency to focus on details, fail to notice obstacles (Rapin & Tuchman, 2008) or be fascinated by certain lights or movements (DSM-5, 2013). The avoidance of eye contact and deficits in facial recognition also fall under this category. With regard to acoustic input or speech, children with ASC commonly show an aversion against or preference for loudness or specific sounds. Sometimes children with ASC get distracted very easily by noise or, on the contrary, fail to respond to calls or requests (Tomchek & Dunn, 2007). Another category is tactile sensitivity. Manifestation of tactile sensitivity include an indifference to pain or temperature, the avoidance of body contact or an increased desire to touch people and objects (Tomchek & Dunn, 2007). In the DSM-5 (2013), atypical responsiveness to sensory input falls under criterion B.

Wing (1996) described two other common, but not defining, characteristics of ASC. The first is a severe anxiety of objects or activities that are generally seen as harmless. This includes balloons, certain colours or animals and taking a bath. However, situations that are objectively dangerous might not always be perceived as such by children with ASC. The other characteristic is difficult behaviour. Reasons for difficult behaviour can be confusion or fear in unfamiliar situations, disturbances in routines or sensory overstimulation. Also without obvious reasons, children with ASC can show a restless or aggressive behaviour or have a tendency to run away when there is an opportunity for it.

2.1.2 Prevalence and Impact

Until the 1990s, around 4-5 out of 10,000 people were diagnosed with ASC (Baird et al., 2006). However, Wing and Gould (1979) reported that around 20 out of 10,000 children were actually showing the triad of impairments. From 1992 to 2001, the median rate of people diagnosed with ASC increased to around 13 in 1,000, as reported by Brugha et al. (2011) on the basis of 16 published surveys. This rate has increased drastically until now. Recent estimations uniformly report a rate of around 100 in 10,000 people or, in other words, 1% of the population, being diagnosed with ASC (Baird et al., 2006; Brugha et al., 2011; DSM-5, 2013). This rate applies to adults as well as children. The male-female ratio is estimated to be 3.3:1 (Baird et al., 2006). The reasons for this drastic increase in prevalence are not uniquely determined but itis likely that an expansion of the diagnostic criteria, increased awareness for ASC and changes to the study methodology play a role in it (Baird, 2006; DSM-5, 2013). Some

sources also give a true increase in prevalence as a possible explanation (Brugha, 2011; DSM-5, 2013).

The described increase in prevalence also led to an increase in research publications. Currently, autism-related research publications clearly surpass the number of publications for similar health related topics. Most of the publications are centred around the biology, genetics and risk factors of ASC (Dawson, 2013). These areas of autism research have also received significantly more funding than other areas. Between 2007 and 2011, 56% of the available funding went towards projects in these areas (Pellicano, Dinsmore, & Charman, 2014). Based on the results of an online survey, Pellicano, Dinsmore and Charman (2014) were able to show that there is a clear disparity between this allocation of funding and the areas that most of the people with ASC, family members, practitioners and researchers outlined as important. Instead of focusing on the biology of autism, they emphasised areas that are related to improving the day-to-day lives of people with ASC, including services, interventions and support.

2.1.3 **Technology-Based Support**

Many children with ASC spend a significant amount of their time using technology, and computer-assisted learning (CAL) has frequently been used to support their learning (Fletcher-Watson, 2014). The advantages of this approach are numerous and directly related to the common characteristics of ASC. Grynszpan, Weiss, Perez-Diaz and Gal (2014) argued that computers are not socially demanding and provide immediate and predictable feedback. Clearly defined tasks, fewer unannounced changes and fewer perceptual distractions help to avoid confusion or anxiety (Fletcher-Watson, 2014; Grynszpan et al., 2014). CAL has traditionally been used for academic learning but is now also employed to teach knowledge about social and life skills (Fletcher-Watson, 2014). It can for example be used to improve vocabulary, facial recognition or spatial planning and teach skills about safe and appropriate behaviour in different situations.

Fletcher-Watson (2014) describes some advantages that go beyond the improvement of skills. She states that CAL can increase the confidence of children with ASC by gaining the respect of their peers when successfully interacting with the technology. It is also a tool for making interventions accessible internationally and providing benefits to many people of the autism community. Generally, CAL can improve the well-being of children with ASC and the people interacting with them by addressing challenging behaviour or confusing subjects. On the downside, CAL could reinforce social isolation (Fletcher-Watson, 2014). Its clinical validity is still debated and the recent literature underlines its potential more than it shows its effectiveness (Parsons, & Cobb, 2011). As the overall aim should be to make a difference to the quality of everyday life of children with ASC, Fletcher-Watson (2014) concludes that CAL

should only be one way of supporting them in a world that is not as predictable and simple as a tablet interface.

2.2 Relaxed Performances

Relaxed performances are a recent initiative by theatres to give hitherto neglected audiences, including those with ASC, the opportunity to attend their performances (Fletcher-Watson, 2015). Due to their recent emergence, less than 10 years ago, little research has yet been conducted as to how they are presented and what impact they can have (Kempe, 2015). In the beginning, the term 'relaxed performance' was used interchangeably with the terms 'autism-friendly performance' or 'sensory-friendly performance' but has now prevailed against the other two. Kempe (2014) suggested that this might reflect the growing interest in these performances by a wider audience than only individuals with ASC. Relaxed performances could for example also be suitable for children with learning disabilities or sensory disorders, mothers with babies and people with dementia (Access London Theatre, n.d.; Potter, 2013). The social and cognitive deficits of individuals with ASC that many relaxed performances are trying to address are shown in Table 1.

Social or cognitive deficit	**Possible manifestation in a theatrical setting**
Difficulty understanding others' desires and needs	May not realize their own behaviour has potential to impact the theatre experience for others in the audience.
Difficulty understanding and showing emotions	May react to emotional content of performance differently than rest of audience.
Limited imaginative or symbolic thinking	May not understand abstract or symbolic content in performance.
Repetitive speech patterns	May repetitively utter a phrase, hum, or make noises during a performance.
Repetitive movement patterns	May frequently move or repetitively move body or arms and hands during a performance.
Repetitive use of objects	May be holding or fidgeting with an object during the performance.
Rigidity in following routines	May be reactive if there is a change to what he or she expected from the theatre experience.

Difficulty with transitions and change	May show disruptive behaviours when entering and leaving the theatre or intermissions.
Fixated interests that may be highly specialized and developed	May express interest or react to content in performance at unexpected times. May repeatedly talk about an object of interest or refuse to move away from it.
Overly sensitive to sensory information	May avoid being touched, near others in crowds or the sensation of escalators or elevators. May be reactive or overwhelmed by noises or smells of a particular type, or bright lights.
Limited response to sensory information	May not be attending to entire performance or respond to others. Appears to not hear you at times and unaware of other members of the group.
Seeks out sensory experiences	May stamp their feet while walking or purposefully bump into objects. May crave movement during the performance, seek intense touch pressure, or touch everything within their reach.

Table 1. Common social and cognitive deficits in children with ASC and how they manifest themselves in a theatrical setting (adaptation after Ideishi et al., 2013)

Most relaxed performances are addressing the deficits shown in Table 1 based on the SPELL framework (Fletcher-Watson, 2015). The National Autistic Society in the UK introduced this framework for understanding and responding to the needs of people on the autism. SPELL is composed of:

- **Structure** – to support individuals with ASC by creating structure environments and using visual information
- **Positive** – to develop and maintain positive approaches and expectations
- **Empathy** – from those who interact with individuals with ASC
- **Low arousal** – to reduce distraction and confusion
- **Links** – between the individual with ASC, their wider support networks and the community

The implementation of the SPELL framework in relaxed performances can take on many forms. Very common changes include a lower intensity of lightening and sound as well as fewer special effects (Corbett, 2016; Kempe, 2014). While flashing lights might be reduced, house lights could be kept on at a low level and the sound volume is often decreased. This is done to avoid sensory overstimulation and to reduce anxiety

(Access London Theatre, n.d.). Around the performance, switched off hand dryers in the bathrooms, trained staff and a smaller audience can also help to reduce stress (Fletcher-Watson, 2015). Many theatres offer their audience members a quiet space where they can go to during the performance if they feel that they need a pause (Access London Theatre, n.d.). In some cases, a screen will be set up in the quiet area showing what is happening on stage (Kempe, 2015). Sometimes it is possible for the audience members to visit the theatre before the actual performance takes place to familiarize themselves with the settings (Access London Theatre, n.d.). During the performance, theatre visitors often choose to wear ear defenders (Fletcher-Watson, 2015). Generally, the idea behind relaxed performances is to create a welcoming and supportive environment where people can be themselves without having to fear rejection (Kempe, 2015). There is consequently more noise and movement in the audience noticeable than during a mainstream performance (Fletcher-Watson, 2015). While the theatre etiquette is less strict during a relaxed performance, some conventions, like sitting in rows, clapping and raising curtains, are normally preserved (Fletcher-Watson, 2015).

An important factor that led to a recent increase in the popularity of relaxed performances in the UK, was the 'Relaxed Performance Project'. It was jointly organized by the Society of London Theatres, the Theatre Managers Association, and the Prince's Foundation for Children and the Arts in 2012/13. This project was able to raise awareness for some of the beneficial aspects for theatres that decide to open up their performances to more diverse audiences (Kempe, 2015).

Corbett (2016) reports that theatres who offer relaxed performances have generally received very positive feedback. Many visitors stated they that greatly enjoyed the experience and that they were looking forward to upcoming performances. Some have even felt confident to attend mainstream performances later on. However, as Fletcher-Watson (2015) and Kempe (2015) have outlined in their work, it is a right, not a privilege, of individuals with ASC to be able to access the theatre. As stated in Article 30 of the United Nations Convention on the Rights of Persons with Disabilities, people with ASC have the right to access cultural activities in accessible formats (United Nations, 2007). To give children with ASC and their families the opportunity to exercise this right by attending a relaxed performance can therefore be a powerful tool to increase social justice (Kempe, 2015).

2.2.1 **Benefits**

Within the literature, there is an agreement that relaxed performances can support the development of social and communication skills in children with ASC (Corbett, 2016; Fletcher-Watson, 2015; Kempe, 2014). Kempe (2014) argues that when children with ASC attend the performance with a group, they can see how others are reacting and

start to learn the appropriate responses themselves. Observing the actions on stage could stimulate their imagination and help them gain more insight into social communication and the art of storytelling (Corbett, 2016). The dynamic environment and role-playing activities are thereby particularly beneficial. Kempe (2014) describes that relaxed performances can support the development of joint attention in children with ASC. Another beneficial aspect of relaxed performances is that they can help children with ASC to build positive associations with going to the theatre (Kempe, 2014; Kempe, 2015). By making children with ASC feel comfortable when attending a performance, they might learn that the theatre is a space where emotions can be expressed physically and verbally (Kempe, 2014).

However, the benefits of relaxed performances are not only with the child with ASC. For the theatres, they are an opportunity to widen their audience, expand their staff's qualifications and receive positive media coverage (Fletcher-Watson, 2015). The literature does not agree on whether there exists a substantial financial incentive for the theatres (Fletcher-Watson, 2015; Kempe, 2015). For families with children with ASC, relaxed performances are a chance to enjoy some time together in a non-judgemental atmosphere (Fletcher-Watson, 2015). In turn, this can help to raise awareness for autism within the community and remove stigma (Corbett, 2016; Kempe, 2014). This again can help people with ASC to develop the confidence they need to attend not only relaxed but also mainstream performances in the future (Kempe, 2015).

2.2.2 **Challenges**

The fact that individuals with ASC can display both a hyper- or hyposensitivity to sensory stimuli, makes it difficult for the theatres to adjust their performances (Kempe, 2015). This applies to the technologies that the theatre is using as well as to the interaction between the performers and the members of the audience. Fletcher-Watson (2015) adds that there exists a lack of research as to how the performers are affected but the dynamics of the audience and whether they require more specific training. He proposes that if performers obtained a greater understanding, they might be able to adapt their acting accordingly and make it more autism-friendly.

Kempe (2014) raises the issue that theatres, by trying to be inclusive, do in fact become exclusive. This is reinforced as relaxed performances are often subsidised and only cater for a smaller than usual audience (Fletcher-Watson, 2015). However, Kempe (2014) adds that relaxed performances could in the long term help to teach children with ASC how to behave at other social and cultural events, for example by improving their joint attention skills. Fletcher-Watson (2015) criticises that individuals with ASC are often excluded from this discussion about inclusivity and solely seen as theatre visitors. In those cases where feedback is obtained, he argues that the existing methods are not suitable for individuals with ASC. While younger children are often observed, older individuals with ASC might be ask to provide verbal or pictorial feedback. Due

to the nature of their impairments, these methods might not be as informative as they would be for neurotypical audience members (Fletcher-Watson, 2015).

Another issue that is raised by Fletcher-Watson (2015) is the idea that relaxed performances are used as a learning experience rather than an enjoyable cultural event for people with ASC. While for neurotypical people it is considered normal that they attend cultural and artistic events solely for pleasure, the engagement of people with ASC is often described as a socialisation program imposed on them by other. Fletcher-Watson (2015) calls for a shift in perception so that relaxed performances will be seen as aesthetic rather than learning experiences. He thereby questions the emphasis on skill-related benefits for people with ASC.

2.3 Visual Stories

The idea of visual stories was derived from the concept of Social Stories that was invented by Carol Grey and first described in Gray and Garand (1993). The idea behind visual stories as well as Social Stories is to share relevant social information with children with ASC (Gray, 2012; Kempe, 2015). Both types of stories are usually presented as short stories with or without illustrations (Kempe, 2015; Kokina & Kern, 2010). However, as the structure, language and content of Social Stories are defined by a set of criteria, the term cannot be applied to all stories that share the aim of providing social information (Gray, 2015b). For this reason, the term visual story is usually preferred in a context where the criteria cannot be fully applied. This, however, does not exclude the criteria for Social Stories as a valuable resource for developing visual stories.

2.3.1 The Concept of Social Stories

Social Stories can be described as short stories that describe a skill, situation or concept in a simple way and meet all defining criteria (Gray, 2012). Social Stories are mainly targeted at people with ASC and used to provide accurate social information, including descriptions of specific activities and the behaviour that is expected when engaging in these activities.

Social Stories were invented by Carol Gray in 1991 while she was working as a consultant for children with ASC (Gray, 2012). The initial goal was to share social information that these children might be missing. Gray then analysed the stories that were considered successful to determine the shared characteristics. The first guidelines for writing Social Stories were published in Gray and Garand (1993). Since then, Gray has actively worked on refining these guidelines based on research, feedback and personal experience. In 2004, the guidelines became criteria (or defining characteristics) and the latest version of these criteria was published in 2014 (Gray, 2015a). While the underlying ideas remained the same, the criteria were reorganized

and became more detailed. This is a summary of the current set of criteria for Social Stories:

- **Criterion 1**: The goal of the Social Story is to share accurate information in a way that is that is descriptive, meaningful, and safe for the audience.
- **Criterion 2**: Authors gather information to improve their understanding of the audience and identify the topic of each Social Story; at least 50% of all Social Stories applaud achievements.
- **Criterion 3**: A Social Story has a title and introduction that identifies the topic, a body that adds detail, and a conclusion that summarizes the information.
- **Criterion 4**: The Social Story format is tailored to the individual abilities, attention span, learning style and - whenever possible - interests of its audience.
- **Criterion 5**: A Social Story has a 'voice' and vocabulary that is defined by 1. First- or Third-Person Perspective; 2. Past, Present, and/or Future Tense; 3. Positive and Patient Tone; 4. Literal Accuracy; 5. Accurate Meaning.
- **Criterion 6**: A Social Story provides information about the place (WHERE), time-related information (WHEN), relevant people (WHO), important cues (WHAT), basic activities, behaviours, or statements (HOW), and the reasons behind them (WHY).
- **Criterion 7**: A Social Story is comprised of descriptive sentences, as well as optional coaching sentences.
- **Criterion 8**: Every Social Story describes more than it directs.
- **Criterion 9**: A story draft is always reviewed and revised if necessary to ensure that it meets all defining Social Story criteria.
- **Criterion 10**: The goal that guides the story development is also evident in its use.

Social Stories are usually presented in a written format with or without illustrations but can also be presented through audio or video equipment or through computer-based programs (Karkhaneh et al., 2010; Kokina & Kern, 2010). They are usually read or presented in advance of the targeted situation, often in small fragments and several times (Gray, 2012; Kokina & Kern, 2010).
As presented in Gray (2012), there exist several types of sentences that can be used when writing Social Stories. They are the following:

- **Descriptive sentences** – objectively describe the context or a certain aspect of a situation, person, activity, skill or concept.
- **Perspective sentences** – describe a person's thoughts, feelings, motivation beliefs or opinions.
- **Coaching sentences** – describe a suggested response, a choice of responses or self-coaching strategies.

- **Affirmative sentences** – emphasise the meaning of surrounding statements and often express a commonly shared value or opinion in a given culture.
- **Partial sentences** – are used to check understanding through a fill-in-the-blank format.

Descriptive sentences are the only sentences that are required, all the other types of sentences are optional. Gray (2004) recommends a ratio of one coaching sentence to two or more sentences of the other types to avoid that the story becomes a list of things to do. Gray (2004) also recommends the use of 'flexible' words like 'usually' or 'sometimes' if a certain outcome cannot be guaranteed.

Social Stories are particularly suitable as a tool for people with ASC due to a number of reasons. They increase predictability for upcoming events or activities and present response chains in a meaningful way (Kokina & Kern, 2010). To aid understanding, they often provide visual supports like symbols or pictures and descriptions of the views, feelings and beliefs of other people (Kokina & Kern, 2010).

The effectiveness of Social Stories with regard to the development of social skills is still little researched. The existing literature was reviewed by Kokina and Kern (2010) and Karkhaneh et al. (2010). Kokina and Kern (2010) conducted a meta-analysis with 18 studies that all used a single-subject design with a control condition, involved participants that were diagnosed with ASC by an independent diagnostician and used Social Stories as a sole intervention. Their results showed higher effectiveness when Social Stories were used in general education settings, with children as their own intervention agents and when addressing inappropriate behaviours rather than teaching social skills. Other factors that they identified as potentially decisive were timing, the age and diagnosis of the participants, the duration of the intervention, the use of assessments and the complexity of the Social Stories. Karkhaneh et al. (2010) reviewed six studies that evaluated a Social Story intervention versus a different intervention in individuals with ASC. The studies were published in English and either randomized controlled trials or controlled clinical trials published. Five of the six trials showed statistically significant benefits for several outcomes that were related to social interaction. Kokina and Kern (2010) and Karkhaneh et al. (2010) concluded that Social Stories can be effective under certain conditions but that further research is needed to determine the factors and their dose/frequency that are associated with lower or higher effectiveness of Social Stories.

2.3.2 Visual Stories for Relaxed Theatre Performances

Some venues circulate visual stories upfront of their relaxed performances. The aim of these stories is to increase predictability. As children with ASC can get anxious about going to new places or engaging in new activities, visual stories can help them to reduce their anxiety ("Autism: a guide for theatres", 2016). Visual stories for relaxed theatre performances often include pictures of the venue, song lyrics, short character

guides, Makaton symbols (used by many children with ASC) and a description of what will happen during the theatre visit and the performance (Fletcher-Watson, 2015). Some venues also provide a separate 'list of surprises'. This allows the carer to decide whether they want to share this in advance of the theatre visit. Surprises can be described as sensory input that appears unexpectedly or might cause anxiety in children with ASC. Examples include flipping chairs, loud music, bright lights and dry ice (Kempe, 2015). As the format and size of visual stories can differ substantially, not every visual story will contain all of these elements (Fletcher-Watson, 2015). As it is usually encouraged that children with ASC enjoy relaxed performances in their own personal way, visual stories can be used as a tool to make children with ASC aware of this policy before they attend the performance (Kempe, 2015).

2.3.3 Existing Tools

There already exist several applications like *Social Stories Creator and Library* and *StoryMaker* that aid the creation of visual stories and/or Social Stories. These applications are usually designed to be used by parents or practitioners and allow the creation of visual stories and/or Social Stories about a variety of topics. One application that has a more specific focus in the sense that it supports the creation of interactive visual stories specifically for circus performances is called *Show and Tell* (Logan, 2014). It was created by Circus Starr to help children familiarize themselves with the circus experience. Following a slightly different approach, the Theatre Royal Brighton gives their visitors the possibility to go on virtual tours through the theatre by using an application called *Inside the Magic*. However, as presented in Fletcher-Watson (2014), technological support and mobile applications that support experiences in the arts or culture domain are not as common yet as they are for other domains like education or communication.

Below is a more detailed presentation of the four applications mentioned above.

Social Stories Creator and Library

Social Stories Creator and Library is an application that can be used to create Social Stories and visual schedules. It supports images, recordings and text and allows users to share their stories among each other. Users can also purchase pre-made stories for common behavioural skills and social situations ("Social Stories Creator & Library", n.d.). All the stories a user has created or purchased can be categorized and printed as PDF files. *Social Stories Creator and Library* is aimed to be used by parents or professionals. Its interface is shown in Figure 1.

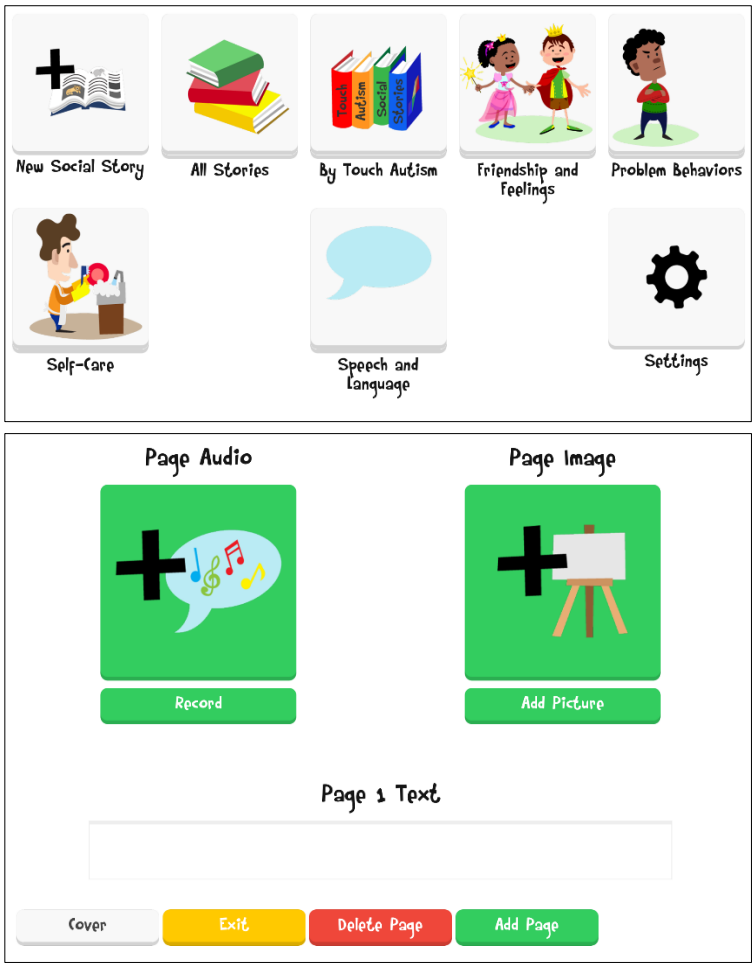


Figure 1. The interface of the *Social Stories Creator and Library* application

StoryMaker

StoryMaker is an application that can be used to build and present Social Stories. It supports images, text and audio and some of its content has been created by Carol Gray, the inventor of Social Stories ("StoryMaker", n.d.). While users can upload their own images, they are also given the option to search for images in a stock library. StoryMaker has text-to-speech voices integrated that can be activated by the user if they want the text to be read aloud. The finished stories can be downloaded as PDF files are sent via email.

Inside the Magic

Inside the Magic is an application that can be used to take virtual tours of the Theatre Brighton Royal. The user can explore several virtual locations in and around the theatre and access additional information about the theatre experience, videos and activities. Inside the Magic is aimed at children and adults with special needs who are worried or anxious about going to the theatre or have limited mobility ("Welcome to Inside the

Magic!", 2015). Depending on the user's needs and interest, they can choose from different virtual tours, showing all or only those parts of the theatre that are open to the public.

Show and Tell

Show and Tell is an application created by Circus Starr that aims to introduce children with ASC to all the elements that are usually associated with circus performances. By increasing predictability, the application can help to reduce anxiety and build up excitement in advance of a circus performance (Logan, 2014). It is also aimed to help develop the children's confidence and social skills ("Circus Starr 'Show and Tell' App", 2014). The application has circus images and footage included and presents them as part of an interactive and customisable visual story ("Circus Starr 'Show and Tell' App", 2014). *Show and Tell* is intended to be used by children with ASC, with or without support (Logan, 2014).

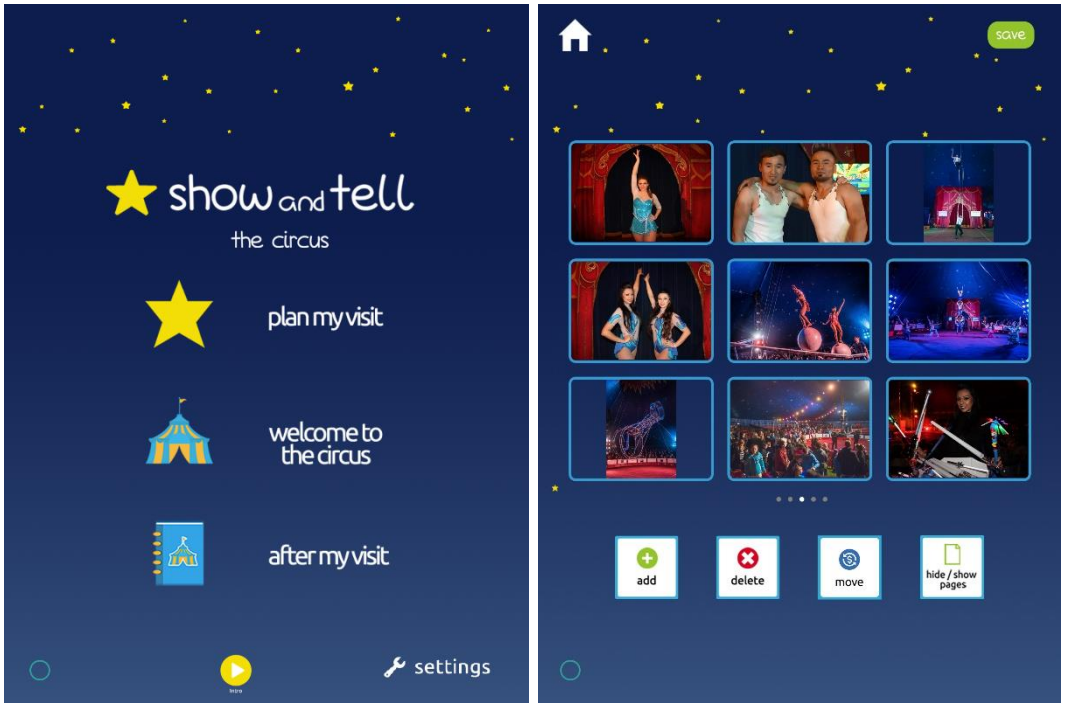


Figure 2. The interface of the *Show and Tell* application

2.4 Conclusion

Within the last decade, ASC has received a lot of attention in the literature. While the underlying reasons for this development are likely to be manifold, the increase in awareness and the higher number of diagnoses made can be seen as key factors. Currently, around 1% of the population in the UK has been diagnosed with ASC (Baird et al., 2006; Brugha, 2011). According to the American Psychiatric Association

(2013), the key manifestations of ASC are deficits in social communication, deficits in social interaction, and restricted, repetitive patterns of behaviour, interests or activities. As ASC is a spectrum condition, individuals can be affected in many different ways and to varying extents. Their adherence to routines and predictability, difficulties in understanding social convention and the fear of disturbing people around them often leads to an exclusion of individuals, including children, with ASC from social events and activities (Roberts et al., 2011). Within the arts and culture domain, relaxed theatre performances have attempted to counter this exclusion. Due to the fact that venues have only started their implementation very recently, little research has yet been conducted as to what impact they can have (Kempe, 2015). However, the research that has been conducted shows the huge potential of relaxed theatre performance not only to counter exclusion but also as an opportunity for social skill development and model for further relaxed events and activities.

To support relaxed performances, many venues have used visual stories. By describing and presenting what the potential visitors with ASC can expect (and what might be expected of them), visual stories are intended to reduce anxiety and build up excitement (Kokina & Kern, 2010). As visual stories for relaxed performances are usually are not intended to teach explicit behavioural skills, the yet to be extended research on their effectiveness with regard to teaching these skills is not highly relevant. There exist several applications that simplify and support the creation of visual stories, whereby most of them are not subject-specific. The existing applications that are most related to creating visual stories for relaxed theatre performances are *Show and Tell*, an application that can be used to create an interactive visual story for circus performances, and *Inside the Magic*, an application that allows users to take visual tours through the Theatre Royal in Brighton.

To close this gap in the technological landscape, we are aiming to design a tool that can used by venues or practitioners to create visual stories for relaxed theatre performance. For more experienced professionals the tool could function as a time-saving device while less experienced professionals could use the tool as a guide and source of information. By supporting the creation of individualized visual stories for children with ASC, the tool could help to promote accessibility and open doors for an audience that has too long been excluded from arts and cultural events.

2.5 **Methodology**

The methodology for the project was adapted from the Scaife and Rogers (2001) framework for informing the design of virtual environments that support learning in children. It consists of the six stages described below

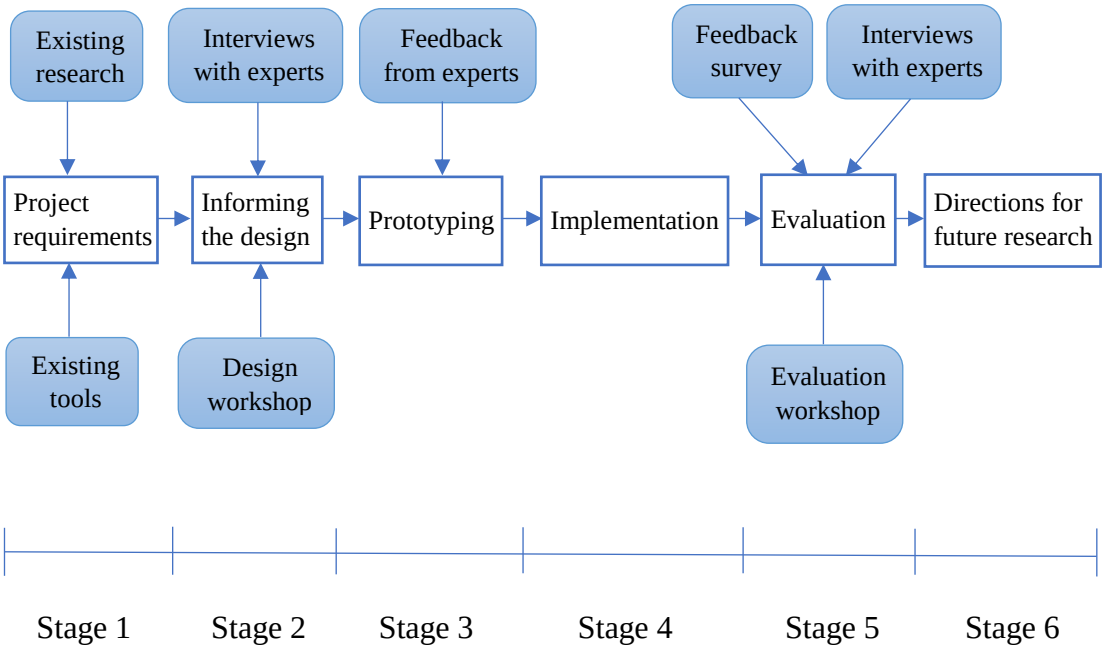


Figure 3. The project methodology (adaptation after Scaife and Rogers, 2001)

Stage 1 – Specifying the Project Requirements

At this stage, our aim was to determine the problem to be addressed and the most suitable method to do so. To achieve this, the literature was reviewed in relation to the different manifestations of autism, the benefits and challenges of relaxed performances and the use of visual stories. Existing applications in the field were identified and analysed. The outcomes of this stage included a definition of the problem space, a target for the project and possible benefits.

Stage 2 – Informing the Design

During this stage activities were carried out to inform the design. This included a design workshop with neurotypical children and interviews with experts in the fields of autism, relaxed performances and visual stories. Based on the outcomes of this and the first stage, a set of initial requirements was determined.

Stage 3 – Developing and Evaluating a Low-Fidelity Prototype

Based on the initial requirements that were determined at the end of the second stage and a set of design principles from a literature, a low-fidelity prototype was developed. To test its suitability, it was presented to several experts in the fields of usability and Social Stories. Their suggested changes were analysed, related back to the project and design requirements and where applicable, implemented. The outcome of this stage was an improved version of the low-fidelity prototype.

Stage 4 – Implementing a High-Fidelity Prototype

Based on the results from stage 3, a high-fidelity prototype was implemented. The focus of the implementation was placed on the design aspects that were determined during the previous stages.

Stage 5 – Evaluating the High-Fidelity Prototype

During this stage, the high-fidelity prototype was evaluated. The evaluation activities included a feedback survey that was handed out to students and staff of the university, an evaluation workshop with neurotypical children and interviews with experts in the fields of usability, relaxed performances and Social Stories. The suggested changes were analysed and where applicable, implemented or suggested as future extensions.

Stage 6 – Giving Directions for Future Research

Based on the initial problem space and the feedback regarding the high-fidelity prototype, future extensions to the tool were determined. This included changes that were suggested during the evaluation activities.

3. Informing the Design

3.1 Design Workshop with Neurotypical Children

As part of the design process, it was crucial to find out how children of our target age group experience a theatre visit. More precisely, we wanted to find out what parts of the visit children feel particularly emotional about and what advice they would give to someone who has never been to the theatre. To gather this data, a design workshop with typically developing children was conducted. These children acted as proxies for our target audience of children with ASC .

3.1.1 Aims

We had three aims set for the design workshop.

- **Aim 1**: Determine how children of our target age group experience a theatre visit.
    - Which stages do they emphasize when describing the experience to someone else?
    - Which aspects of theatre visits do they particularly enjoy and which do they feel particularly emotional about?
- **Aim 2**: Determine which information should be provided to someone of our target age group to best prepare them for their theatre visit.
- **Aim 3**: Gather further ideas on the most suitable design of visual stories

3.1.2 Method

Participants

The participants were 16 typically developing children and young teenagers (14 girls and 2 boys) between the age of 7 and 11. They were recruited through the university and acted as proxies for the target audience of children with ASC. As shown in Table 2, three different sessions were conducted with five to six children each.

- **Session 1 and 2**. The participants of sessions 1 and 2 were members of a Brownie group. The sessions were run at their usual meeting place, a church hall, and in parallel with 3 other workshop sessions.
- **Session 3**. The participants of session 3 were children of Informatics staff and might have had previous experience with design workshops. The session was run in a room within the university that was separate from the rooms where

other workshops were conducted. Due to unforeseen circumstances, only activities 1 and 3 were performed.

Session	**Participant**	**Gender**	**Age**
Session 1	P1	Female	9
	P2	Female	9
	P3	Female	7
	P4	Female	7
	P5	Female	8
	P6	Female	7
Session 2	P7	Female	10
	P8	Female	8
	P9	Female	8
	P10	Female	8
	P11	Female	7
Session 3	P12	Male	7
	P13	Male	7
	P14	Female	9
	P15	Female	11
	P16	Female	9

Table 2. Details about the participants of the design workshop

Procedure

Before the design workshop, we sent a child information sheet to each participant and a parent information sheet to their parent/guardian. These two information sheets included the contact details of the researcher, the aim of the project and the design workshop as well as a summary of the workshop activities. They also contained information about the audio (all sessions) and video (session 3) recording during the workshop, the confidentiality and use of the data and the right of the participants to withdraw from the study at any given point without having to give an explanation. To each parent information sheet we attached a parent consent form and asked the parent/guardian to fill it in and return it to us if they agreed that their child took part in the study. Similarly, we attached child consent forms to the child information sheets and asked that those would be filled in and returned to us before the workshop. The information sheets and consent forms can be seen in Appendix A. We clearly stated that both, the participants and their parents/guardians, were encouraged to contact the researcher if they had any questions or needed any further information.

On the day of the workshop, the participants were briefed and asked to indicate if they were still happy to participate as well as getting audio (all sessions) or video (session 3) recorded during the activities. It had been decided that a recording was useful as it allowed the researcher to focus on the participants rather than having to take extensive notes during each activity. If a child decided that they did not want to participate or get recorded, this was respected regardless of their initial decision and the decision of their parent/guardian. The participants were given the opportunity to ask questions and were reminded that they could take a break or leave at any time without having to give a reason. When all questions were answered, we started the recording and began with the first task.

Background story

The activities were all integrated into a background story. This was done to facilitate the children's understanding of the tasks and to have one task follow logically from another. The general idea was to have an alien called 'AL' coming to earth for the first time and seeing a poster about the pantomime 'Jack and the Beanstalk' (the alien and the poster were created from cardboard and shown to the participants). This pantomime was chosen as it was the one the King's Theatre offered in 2016/2017 which made the results more applicable. The participants were told that the alien had never been to a theatre before but that he got interested when seeing the poster. They were then told that the alien displayed several characteristics that they might need to keep in mind when preparing him for his theatre visit. These characteristics were:

- Being able to see and hear very well
- Not liking surprises
- Struggling to understand sayings like "It's raining cats and dogs"
- Having the favourite colour green

These characteristics were chosen to represent some of the characteristics that many of the children with ASC display. However, the list was kept short to not overwhelm the participants. To remind the participants of the characteristics during the activities the above list (with an added symbol for each of the entries) was placed visibly in the room during the workshop.

Figure 4. The posters that were presented to the participants during the design workshop

Activity 1: Group discussion about the different stages of a theatre visit

In this activity, the participants were asked to specify all the different stages of a theatre visit that they felt the alien should know about. Everyone was encouraged to freely say and discuss any ideas or suggestions they had. Every suggestion made was represented as a key word and/or symbol on a small sheet of paper. To save time, some sheets with possible suggestions had been prepared in advance. After all sheets had been created, the participants were asked to order them chronologically.

This activity was intended to provide insight into which stages of a theatre visit children of our target age group would see as most important. It was also thought of as an opportunity to see how the children would order the different stages and if they would add any stages that were specifically related to the performance of 'Jack and the Beanstalk'.

Activity 2: The creation of a still image for some of the stages

The children were asked to create still images for some of the stages that were suggested in activity 1 – either on their own or in small groups. They were encouraged to think about the still images in terms of a 'comic' or 'storyboard' for the alien. One child was also asked if they wanted to take pictures of the still images and was given a camera if they agreed. The researcher and the participants were jointly choosing the stages to create still images of. Due to time constraints, not all of the suggested stages could be represented.

The goal of the activity was to determine how children would represent each of the stages. The representations they created were considered to be very valuable in the process of deciding on the design and content of social stories.

Activity 3: Drawing ideas about how to conduct relaxed performances

For this activity, the participants were asked to draw or write recommendations for the theatre on how to make the performance more enjoyable for AL. These recommendations could have included ideas on which information the theatre should provide and how they could adapt the play. At the end the participants were asked to present their ideas in a couple of sentences.

We choose this activity to determine how theatres could make theatre performances more enjoyable for children with ASC. More precisely, we wanted to see which adjustments neurotypical children considered to be most intuitive and how they would implement these. We also wanted to gather ideas for the design and content of the social stories in general and the performance of 'Jack and the Beanstalk' in particular.

Feedback session

Before the actual workshop took place, a test run was organized. At this test run, the supervisor, all of her Honours project students and one of her PhD students were present. This test run was intended to provide feedback on the workshop activities. As a result of this feedback session, we modified the workshop activities slightly. We firstly added a warm-up phase in which we asked the participants to talk about their theatre experience. This was also helpful to determine how to best approach the following activities. For the first activity we additionally prepared some of the sheets of paper, namely those that represented stages that were likely to be suggested by the participants, in advance. This allowed us to think more thoroughly about how to best represent them and gave us more time during the workshop.

To increase the participants' understanding for the second activity, we explained it in terms of 'building a comic or storyboard' for the alien rather than in terms of 'still images'. For this activity it also became clear that it become necessary to decide on a certain number of stages from the first activity. Otherwise the second activity would have taken too much of the time allocated for the workshop.

The original version of the third activity included the allocation of the participants into two groups. While one group would have been asked to give advice to the theatre, the other would have been asked to give advice to the alien. However, as the task for the latter group seemed rather confusing, we removed it and focused on the first task instead.

3.1.3 **Results**

Analysing activity 1, it was noted that the participants felt very emotional about the appearance of the actors. In all three sessions, the words 'scary' or 'evil' were used in association with the words 'characters' or 'costumes'. 'Scary pantomime', 'scary masks' and 'make up' were mentioned as well. Besides, there was a lot of emphasis

on the sensory input during a theatre performance. In all sessions, the lights or changes in lighting ('flashing lights', 'lights out') were mentioned. In sessions 1 and 2 the words 'steam', 'special effects', 'loud noises'/'noise' and 'music' came up as well. With regard to food, the word 'ice cream' was suggested in every session. 'Eating sweets' and 'snack' were added in sessions 1 and 3 respectively. Some suggested points addressed the question of how to behave when attending a theatre performances, including 'phones off', 'no photographs' and 'don't go on stage'. The idea of finding one's seat or sitting down came up in every session, the idea of not talking in sessions 1 and 3.

The ordering of the stages followed a similar pattern in all 3 sessions: 'Before the performance', 'during the performance' and 'after/at the end of the performance'. In sessions 1 and 2, the sheets with 'break' and 'interval' were also used as reference points.

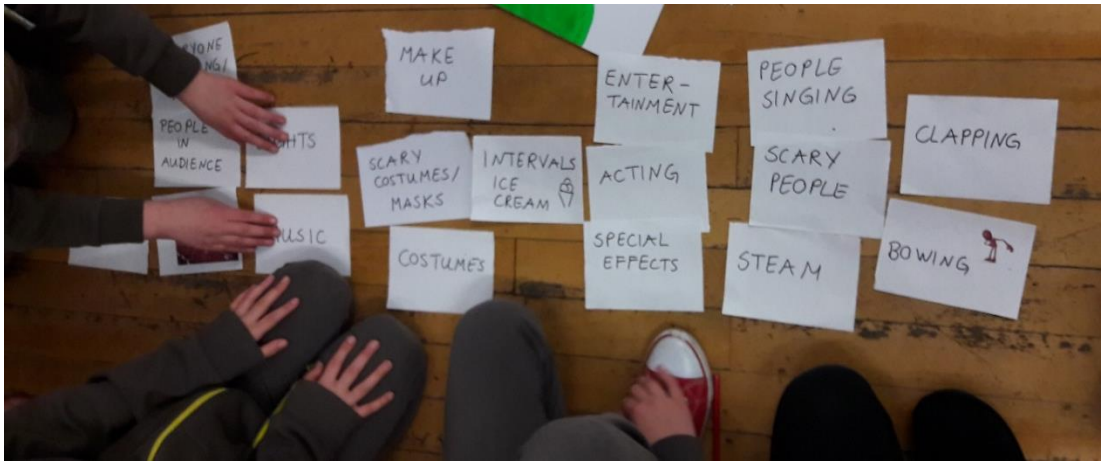


Figure 5. The participants in session 2 are discussing the order of the stages

As it was not possible to carry out activity 2 in session 3, the amount of data obtained from this activity was smaller than for the other tasks. The results from sessions 1 and 2, however, revealed two important aspects. Firstly, not being allowed to use speech or sounds made it very difficult for the participants to represent stages like 'music' and 'singing'. Even though they were aware that camera could not record sound, they intuitively used it to emphasize what they were doing. Similarly, not being allowed to move made it very difficult for the participants to represent stages like 'bowing', 'clapping' or 'eating ice cream'. As they felt that they could not represent those stages without movement, many of the pictures taken are slightly blurred or need to be seen together to understand the action they represent.

When analysing the drawn pictures and their explanations from activity 3, it was noted that it seemed to be a very intuitive idea for many participants was explain to AL upfront of the performance what to expect and how to behave. These explanations were presented in different forms. **P1**, **P2**, **P5** and **P8** described printed guides that

could be given to AL. These guides included information about the sensory input (**P1**, **P2**, **P5**), surprises (**P1**), characters (**P2**) and storyline (**P2**) and gave behavioural guidance (**P2**, **P5**, **P8**). Instead of a guide, **P7** proposed to give AL a map of the theatre and **P14** and **P16** described a tutorial that AL could do before the theatre visit. Following a slightly different approach, **P9**, and **P11** suggested having someone more knowledgeable or experienced individuals accompanying AL and giving him explanations. **P15** also mentioned warnings about certain aspects of the performance.

Another common suggestion was to adjust the performance itself to make it more enjoyable for AL. The ideas were to make the characters less scary (**P3**, **P14**) or more similar to AL (**P6**), to include fewer surprises (**P4**) and more green (**P4**, **P11**, **P16**), to use quieter voices (**P4**) and comfier chairs and to adjust the scripts (**P15**). **P13** also proposed a phone translator for AL and entertainers or bouncy pads in case he would get bored.

P12 had the idea of having another alien accompanying AL when he is going to visit the theatre. A related idea was to invite other aliens to the show and giving AL the impression of not being different (**P14**). P10 proposed to conduct the whole show on AL's home planet.

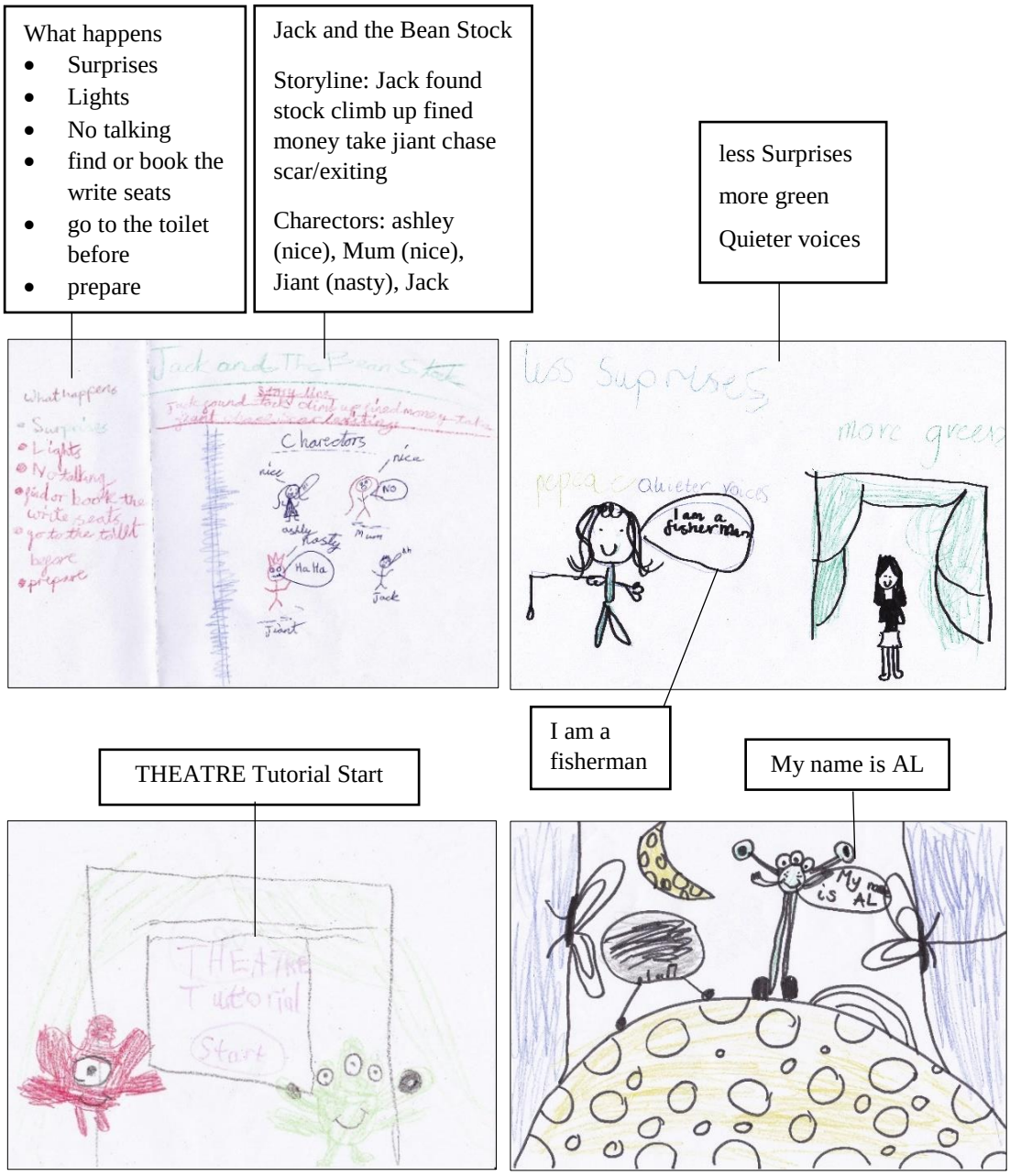


Figure 6. Some of the drawings created during activity 3

3.3 Interviews with Experts

While the design workshop was intended to provide insight into how children of our target age group experience a theatre visit, we also wanted to learn about relaxed performances and visual stories from the perspective of the theatres and practitioners. In this context, we were particularly interested to know what challenges they had been facing, to what extent they were using visual stories and whether they felt that there was a demand for a visual story tool.

To gather this information, three interviews were conducted. The participants were two theatre professionals working at different theatres in the UK that were offering relaxed performances and a speech and language therapist who was working at a school for children with complex needs, including children with ASC.

3.3.1 Aims

We had four main aims set for the expert interviews.

- **Aim 1**: Determine how relaxed performances are currently implemented.
    - What are the adjustments made to relaxed performances?
    - What challenges have arisen during their implementation and how were they overcome?
    - What feedback have the theatres received from the visitors?
- **Aim 2**: Determine to what extent visual stories have already been used to support relaxed performances.
    - How were the visual stories created and designed?
    - What information did they contain?
- **Aim 3**: Determine how the tool could support theatres/practitioners/children with ASC and whether there is a demand for a visual story tool.
- **Aim 4**: Gather further ideas for the design of the tool and obtain feedback on some general design ideas.

3.3.2 Method

Participants

An overview of the participants and their areas of expertise is presented in Table 3.

Expert	Position	Areas of expertise
E1	Head of Creativity and Diversity at a theatre in the UK	Relaxed performances, accessibility, inclusive arts practice
E2	Access officer at a theatre in the UK	Relaxed performances, visual stories, accessibility, inclusive arts practise
E3	Speech and language therapist at a school for children with complex needs	Autism Spectrum Conditions, Social Stories

Table 3. Details about the participants of the design-informing expert interviews

Procedure

The interviewees were contacted via email. They were given a brief summary of the research and of what had already been done to inform the design of the tool. They were then asked whether they would be willing to participate in an interview that would last around 30 minutes. If they agreed, a suitable time was arranged. The interviews with **E1** and **E3** were conducted face-to-face while the interview with **E2** was conducted via phone. Before the start of the interview, the participants were given an information sheet about the project and the opportunity to ask questions. When all their questions had been answered, the participants were asked to fill in a consent form and indicate whether they would feel comfortable with being recorded during the interview. The information sheet and consent form can be seen in Appendix B. They were also reminded that they could skip any of the questions or end the interview at any given time without having to give a reason.

Interview Structure

The interviews were semi-structured as this provided a good balance between the certainty to cover all important aspects and the possibility to go into depth or ask follow-up questions where necessary. Most of the questions were open questions that were intended to encourage the interviewees to provide details and in-depth examples for their answers.

3.3.3 Results

Aim 1: Determine how relaxed performances are currently implemented.

E1 and **E2** both emphasised the welcoming character of their relaxed performances. **E2** stated that they operate an open-door policy where everyone is welcome and that they encourage the audience to respect the different ways in which people are enjoying the performance. **E1** also said that during relaxed performances any noise or behaviour is appropriate.
Regarding the changes made to relaxed performances, **E2** underlined that they attempt to make as few changes as necessary as they want the “same product” for everyone but that sometimes the lights or pyrotechnics are adjusted. They also provide a chill-out area for their visitors. **E1** explained that the key elements of their relaxed performances are (live) music, highly visual, simple narrative and little to no dialogue. **E1** emphasized that the changes made to their relaxed performances differ but that some changes are very common. This includes the reduction or absence of sudden, unexpected sounds, special effects (like pyrotechnics) and flashing lights, a lower sound volume, a flexible start time, a smaller audience size and additional (highly skilled) staff. House lights are often kept on 50% or 75% brightness. To determine which changes are necessary, they usually meet with teachers of special schools and ask them to provide feedback.

E1 also mentioned that their relaxed performances need to be booked personally which allows the theatre to know whether any additional support is needed for their visitors. It is possible to request certain seats or ask for a free seat next to their own. Many of the children come from special schools. Some of the relaxed performances they offer are adapted mainstream performances while others are especially chosen for this purpose. **E2** explained that they provide detailed information about their performances on their website which has a variety of settings integrated such that it can be converted to plain text or read out loud.
E1 and **E2** both stated that they have received very positive feedback from visitors who have attended their relaxed performances. **E2** described them as a "great success" while **E1** underlined that many visitors particularly enjoyed the inter-generational component of relaxed performances.

Aim 2: Determine to what extent visual stories have already been used to support relaxed performances.

E3 explained that they have used Social Stories to facilitate transitioning and to show what a new place/state looks like. Their stories are usually highly visual, meaning that they include many pictures of places and people. With regard to preparing children for relaxed theatre performances, **E3** explained that this does not necessarily mean to create entire stories but rather to show the children pictures and videos or to tell them about the performance. This preparation starts well in advance of the performance and is aimed at helping the children cope well with the new environment. **E3** also mentioned the positive impact on teachers and parents as they can be relatively sure that the children know what to expect when they go to the theatre and are not concerned that the children might disturb other theatre visitors during the performance.
E1 and **E2** both explained that visual stories have been used to support their relaxed performances and emphasized that they are a very important element of the theatre experience. **E1** stated that from their experience, teachers consider them as the most important aspect of the preparation process for relaxed performance. **E2** described them as "incredibly useful" and underlined that it is a valuable resource for the individual but also their parent or guardian. Both agreed that their main value lies in the fact that they can take away fear and build up excitement.
The creation process of the stories was described differently by **E1** and **E2**. **E1** explained that the theatre usually provides the material (pictures and/or videos of the venue, characters and performance) which is then used by the schools as part of the preparation process. In this process the pictures or videos are sometimes projected onto a wall or visual stories are created and read to the children. They also have a story teller who goes into the schools and uses story telling material or a flip book with pictures to let the children know what will happen during the theatre visit. **E1** added that repeated exposure to the story or material is usually seen as important.
E2 explained that the visual stories are usually created in several meetings, involving the director of the performance, the stage management, the production team and the actors. In the stories, they usually present the venue and the performance. This

includes information about the characters, a simplified summary of the plot and warnings about possible triggers during the performance. As individuals can have very different triggers, **E3** underlined that creating the warnings can be challenging. After having created the visual stories they usually make them available online. They have also observed that some children bring the visual stories with them to the performance, thereby using them as an anchor.

Aim 3: Determine whether there is a demand for a visual story tool and how the tool could support theatres/practitioners/children with ASC.

All three experts could see how such a tool could be beneficial. **E1** felt that there was "definitely a demand for a visual story tool, 100%" as they considered it a valuable support mechanism for individuals who wanted to attend any of the relaxed performances. **E3** also mentioned that they generally received very positive feedback regarding Social Stories that were created to reinforce positive behaviour. **E3** added that Social Stories are generally a good support as most children generally enjoy reading stories and as they take the short attention span of the children into account.
E2 described the tool as a valuable resource that could help the venue reflect on their performances. However, **E3** pointed out that as there is no generally valid definition or standardization for relaxed performances, it could be difficult to create an output that would be suitable for all the different venues and performances.

Aim 4: Gather further ideas for the design of the tool and obtain feedback on some general design ideas.

All three experts agreed that it would useful to be given an option to integrate sound and/or short video sequences into the visual stories. **E3** added that it could help the children to be better prepared for the specific sounds that they will hear during the performance, such as sounds made by a specific character. **E2** pointed out that providing audio information could be helpful as children with ASC often respond very differently to sound (some prefer to wear ear defenders during the performance). However, **E2** also argued that it would be important to raise awareness that the sounds might be perceived differently in the venue to not build up any wrong expectations.
With regard to the structure of the visual stories, **E1** considered the venue, the characters and the production to be important elements. **E2** agreed that it is crucial to introduce the characters. **E2** added that it could be helpful to divide the warnings or surprises into three types: visual, auditory and sensory. Contentwise, **E3** suggested that the visual stories should answer the following questions: 'Where are you going?', 'What are you going to see?' and 'What is expected of you?'. **E3** added that it would be helpful to provide an example story and default options for the different parts of the story as they themselves have often used templates and examples when building their Social Stories. Other aspects of visual stories that were considered important by **E3** were a repetitive, simple and literal language, a focus on visual supports and to avoid replacement pictures.

E1 suggested that it would be useful to see how other users have used the tool. **E2** proposed that it could be helpful if the tool supported pictorial and plain text versions of the pages and the use of Makaton symbol. **E2** also encouraged us to think about how the tool and its output could be best be incorporated with existing devices like tablets. **E2** emphasised that it is crucial to give agency to the individual and to make the interface as accessible as possible.

3.3.4 **Discussion**

The design workshop with neurotypical children and the interviews with experts have both contributed to a deeper understanding of how visual stories can support relaxed theatre performances. While it should be taken into account that the number of participants was limited in both activities, the results provided us with a solid basis for the further stages of the project.

During the design workshop, the children provided valuable insight into which parts of a theatre visit they felt most emotional about. As part of the second activity, the children were also able to show which of the stages that they associated with theatre visits were easily representable as still images and which needed sounds or movements to be made clear. This information was highly relevant for the content of potential visual stories. When asking the children to think about possible features of relaxed theatre performances, many children presented tools similar to visual stories. This confirmed that visual stories can be seen as an intuitive concept for children of our target age group.

During the expert interviews, we gathered valuable information as to how relaxed performances are currently implemented and what challenges are associated with their implementation. The experts were also able to tell us about the current use and creation process of visual stories and which aspects they considered to be particularly important when creating visual stories for children with ASC.

The contributions from both experts and workshop participants have led to the following requirements for the visual story tool:

1. It supports the creation of visual stories that are highly visual
2. It supports the ‘story character’ of the visual stories
3. It supports the creation of individualized visual stories for different children
4. It provides a possibility to integrate audio and video files
5. It provides a space to describe the characters of each performance
6. It provides a space to describe the potential triggers of each performance
7. It provides a visual story ‘template’ that is easy to fill in
8. It provides one or more examples of visual stories
9. It provides a possibility to print and download the visual stories

4. Design

4.1 Design Principles

The following set of design principles was used to guide the design of the tool's interface. This was done to ensure that the tool was easy to learn and use and enjoyable for the user to interact with. The principles described below are adapted from Preece, Rogers, and Sharp (2015).

Visibility

The more visible the functions and features of a system are, the easier it is for the user to find them and to know what to do next. In turn, if these functions are invisible, the user might find it difficult to use the system and become frustrated.

Feedback

Feedback involves providing information to the user about which actions have been performed and what has been accomplished. This includes audio, tactile, verbal and visual information. Providing appropriate feedback can help to provide the necessary visibility for user interaction.

Constraints

The principle of constraints refers to determining ways of restricting the possible user interactions that can be performed at a given moment. Introducing such constraints can prevent the user from selecting incorrect options and narrow down the user's interpretation of a problem or information space.

Consistency

Consistent interfaces have similar operations and use similar elements for achieving similar tasks. This makes it easier for the user to learn and use the system and reduces the likelihood of errors.

Affordance

Affordances are attributes of objects that let the user infer how to use them. Graphical elements like buttons, icons, links and scroll bars for example should be designed in a way that makes it obvious how they can be used. Some of these affordances fall under the category of learned conventions.

4.2 Design Requirements

Based on the reviewed literature, the design principles listed above and the initial set of design requirements that resulted from the design-informing activities, we established this updated set of design requirement for the visual story tool:

1. It is intended to be used by theatre professionals or practitioners
2. It provides a possibility to create visual stories for different performances
3. It provides a possibility to save the visual stories and edit them later on
4. It supports the creation of visual stories that are highly visual
5. It supports the 'story character' of the visual stories
6. It supports the creation of individualized stories for different children
7. It provides a possibility to integrate audio and video files
8. It provides a space to describe the context of each performance
9. It provides a space to describe the characters of each performance
10. It provides a space to describe the potential triggers of each performance
11. It provides a space to describe the plot of each performance
12. It provides a visual story 'template' that is easy to fill in
13. It provides one or more examples of visual stories
14. It provides a possibility to print and download the visual stories
15. It provides a possibility for collaboration
16. It provides an explanation for each of its features
17. It provides information on visual stories and design for ASC
18. It provides a possibility to import parts from existing visual stories

This set of design requirements laid the foundation for the design of the initial low-fidelity prototype. In the process of improving the initial low-fidelity prototype, it was also used as an anchor to which the suggested changes made by the experts in the evaluation sessions were related. Throughout the design process this set of design requirements were frequently referred back and used as guidance in design decisions.

4.3 Low-Fidelity Prototypes

4.3.1 Development Process

Based on the design principles and design requirements an initial low-fidelity prototype of the visual story tool was developed. This was done by creating paper mock-ups for the different parts of the tool. The initial low-fidelity prototype was presented to an expert who suggested changes in the design. After having analysed the

expert's suggestions, we incorporated those changes that were consistent with our findings from the literature, the design principles and design requirements. The updated low-fidelity prototype was then presented to another expert who again suggested changes and so on. This development process is represented in Figure 7.

The background of the experts and the evaluation process is described in 4.3.2. All their suggestions are presented in Table 5.

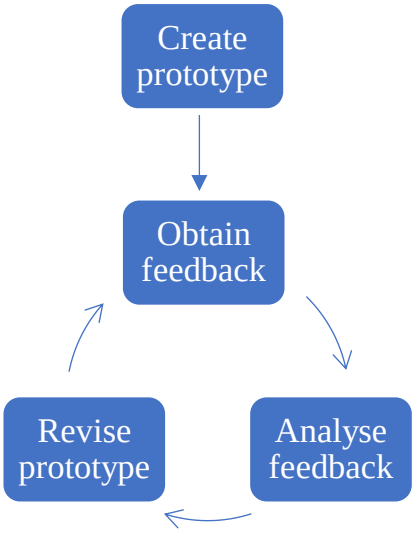


Figure 7. The prototyping process

4.3.2 Expert Evaluation

Aims

The expert evaluations of the low-fidelity prototypes were intended to help us achieve the following three aims:

- **Aim 1**: Evaluate the usability of the design with regard to the target users.
- **Aim 2**: Determine any changes in the design that would improve the tool's usability and reduce potential inconsistencies.
- **Aim 3**: Obtain suggestions for how the content of the tool could be improved.

Method

Participants

Five participants took part in the evaluation study. They were fulfilling two roles – being an expert in their respective field and a proxy of the target audience of theatre

professionals and practitioners. The participants' positions and areas of expertise are presented in Table 4.

Expert	Position	Areas of expertise
E4	Personal Chair in Interactive Learning Environments at the University of Edinburgh	Educational Technology, Special Education, Interface Design, User Experience, Autism
E5	Postdoctoral Fellow at the Institute for Advanced Studies in the Humanities at the University of Edinburgh	Relaxed performances, Linkages between Theatre, Education and Technology
E6	Research Postgraduate Student at the University of Edinburgh	Human-Computer-Interaction, Technology Enhanced Learning, Interaction Design
E7	Usability Testing Service Assistant at the University of Edinburgh	Usability Testing, User Experience, Autism
E8	Research Associate at the University of Edinburgh	Assistive Technologies, Educational Technology, Technology for Autism, Social Story Interventions

Table 4. Details about the experts who provided feedback on the low-fidelity prototypes

Procedure

The participants were given a summary of the project and asked – in person or via email – whether they would agree to provide feedback on a low-fidelity prototype. If they agreed, a suitable date and time was arranged. On the day of each of the evaluation sessions, the respective participant was asked whether they had any questions and whether they would be comfortable with us recording their feedback. If they agreed, the evaluation session was conducted with a voice recorder. They were also reminded that they could leave at any point without having to give a reason. During each of the evaluation sessions, we presented the low-fidelity prototype to the respective participant and explained the ideas behind its structure and design. The participant was invited to ask questions and comment on anything they considered good or bad in terms of the usability and content of the tool.

E4 and **E5** provided feedback in a combined session.

Results

All the experts responded positively to the idea of the visual story tool and provided us with valuable feedback on the content and the different design aspects of the tool. The suggestions made by the experts and their analyses are shown in Table 5.

Expert	Suggestion	Done?	Justification of the Decision
E4	Add a 'welcome' page that specifies the purpose of the tool	YES	Helps the user to decide whether the tool suits their needs
E4	Add a progress bar for the story creation process	NO	Unnecessary as the process was later reduced to two pages
E4	Delete the 'Reset the website' option	YES	The users might accidentally delete all their visual stories
E4	Add a link to a database of current and previous performances	FUTURE WORK	A useful function which lies outside the scope of the project
E4	Add an 'explanation' page for the story creation process	YES	The page could help the user to know what to expect/which material they will need
E4	Make the section names visible throughout the editing process	YES	Helps the user to orient themselves in the visual story creation process
E5	Suggest a default text for some of the slides	YES	Simplifies the process and guides the user
E5	Present a list of possible triggers as checkboxes	YES	Simplifies the process and helps the user to not forget any triggers
E5	Implement an option to add additional material	YES	Helps to individualize the stories and to incorporate existing material
E5	Shorten some of the user prompts	YES	Makes it easier for the user to know what they are asked to do
E5	Implement a character limit for the text boxes	NO	Takes away the user's flexibility to decide how much detail they want to provide

E5	Add an option to add several images to one page	FUTURE WORK	Adds a lot of complexity to the page structure – but could be a useful extension for the future
E5	Provide an option to crop the pictures before inserting them	NO	A useful function which lies outside the scope of the project
E6	Replace 'All Visual Stories' with 'Existing Visual Stories' in the menu	YES	Helps the user to understand the function of the visual story library
E6	Connect a database with example stories	FUTURE WORK	A useful function which lies outside the scope of the project
E6	Provide an option for the user to give feedback	YES	Could be helpful to determine possible improvements
E6	Avoid having three buttons under each stories in the visual story library	YES	Helps to reduce amount of information the user needs to process at once
E6	Avoid having two different menus	YES	Avoids confusion and makes it easier for the user to use the tool
E6/E8	Provide a voice-over for the stories (automatically or by recording one's own voice)	FUTURE WORK	A useful function which lies outside the scope of the project
E7	Replace the heading 'Surprises' with 'Triggers'	YES	'Triggers' is easier to understand for the target audience of the tool
E7	Encourage the user to mention the timing of the performance in the story	YES	Timing can be very important for children with ASC
E7	Avoid imprecise timing options for the triggers	YES	Imprecise timing options could confuse or upset children with ASC
E7	Add the kiosk/bar to the default venue slides	YES	It is very common that venues have a theatre or bar
E7	Change the heading of the section that is called 'Play'	YES	The word play does not include other types of performances

E8	Label the arrows that point to the previous and/or following page	YES	Labelling the arrows helps the user to orient themselves
E8	Provide information on the sections when hoovering over the navigation bar	NO	The already implemented information button was considered to be more visible
E8	Make the printing/saving options available in the last section (not from the beginning)	YES	These options would not be useful for a user who has not completed the story yet; they might click on it by accident
E8	Reduce the number of buttons on each page of the visual story	YES	Makes it easier for the user to learn and use the tool
E8	Change 'Report a problem' to 'Report a problem with this website' in the settings	YES	Helps the user to understand that the section is intended for problems relating to the tool

Table 5. Overview of the suggestions made by the experts to improve the design of the low-fidelity prototypes

4.3.3 System Structure and Features

The development process that is presented in Figure 7 resulted in a final low-fidelity prototype of a web-based visual story tool that was called RePeAT your ViSIT (an acronym for **Re**laxed **Pe**rformances for **A**utism in **T**heatres – **your Vi**sual **S**tory and **I**nformation **T**ool). It was intended to be used by theatre professionals or practitioners (**design requirement 1**). To aid collaboration, we used a web-based login approach where users could create an account and later access it by using their email address and a password. Sharing an account would thereby allow several users to work together on a visual story (**design requirement 15**).

Structure

The basic structure of the tool can be seen in Figure 8. It consisted of three main functions: 1. to create a new visual story 2. to access the already created visual stories and 3. to obtain information on the functionality of the tool and on good practises when creating visual stories for children with ASC. This allowed the user to create visual stories for different performances (**design requirement 2**) and edit already created visual stories later on (**design requirement 3**). It also provided a space to present some guidelines for creating visual stories for children with ASC (**design requirement 17**) and explanations about the different features of the tool (**design requirement 16**).

This structure had been proposed in the initial low-fidelity prototype and was considered suitable by all five experts.

Figure 8. The menu screen of the final low-fidelity prototype

Settings

The settings, that were intended to be accessible through the icon in the upper right corner of the menu screen (see Figure 8), were modified several times during the development process. **E4** pointed out that the 'Reset the website' option that was initially included could lead to users accidentally deleting all their visual stories. So we removed it from the settings. Following a suggestion made by **E8**, we also changed 'Report a problem' to 'Report a problem with this website' to clarify that the problem should be related to the tool and not to the visual stories. We used the word 'website' instead of 'tool' as we assumed that 'tool' could be misinterpreted by the user. In the final low-fidelity prototype, we divided the settings into 1. settings that concern the tool itself and 2. setting that concern the visual stories. While the general settings remained accessible from the menu (see Figure 8), the story settings were made accessible from the creation page of each individual visual story (see Figure 9). This change was introduced to increase the visibility of the story-related settings during the visual story creation process (related to **design principle 1**).

In the final low-fidelity prototype, the settings allowed the user to set the background colour of the tool, report a problem with the tool and change the font, the font colour and the background colour of each visual story. These options were intended to improve the user experience and cater for the aversion of some children with ASC against certain colours.

Visual Story Creation Process

The visual story creation process started when a user clicked on ‘Create new Visual Story’ in the menu. It was restructured after the feedback session with **E6**. The initial prototype had separate pages for the story title and the cover picture and a menu with sections that the user could access one at a time. **E6** pointed out that having this second level of menu items next to the main menu was too complex so we transformed the section menu into a navigation bar. This process can be seen in Figure 9. Following advice from **E4**, we also added an explanation page at the beginning of the story creation process. It contained information about the material that was likely to be needed when creating a visual story (so that the user could check that they had access to all this material before they started the actual creation process) and on how the user could obtain more information about each section of the visual story to all this material before they started the actual creation process) and on how the user could obtain more information about each section of the visual story.

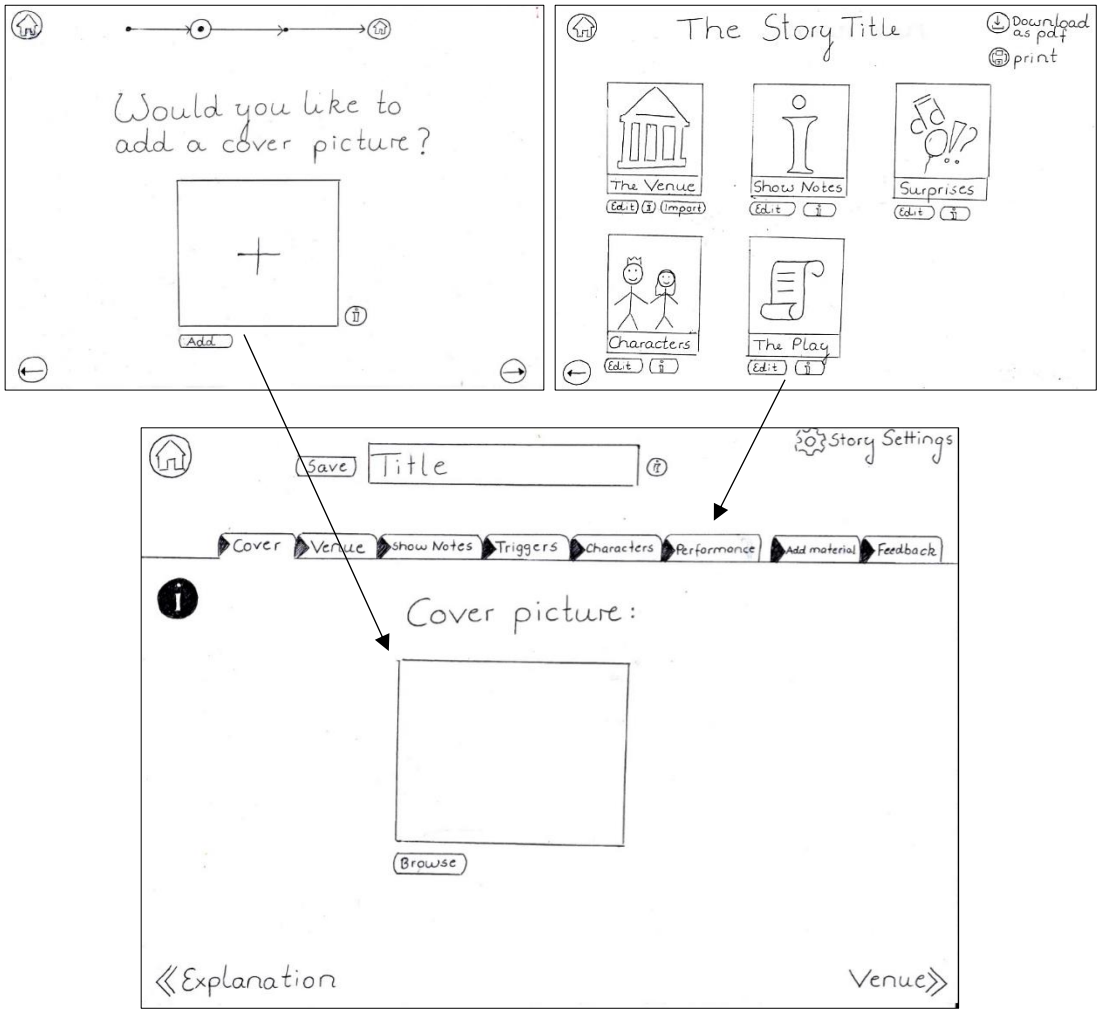


Figure 9. The development of the visual story creation process interface

In each section, the tool would present default pages to the user that they could edit or delete. An example of a section with different default pages can be seen in Figure 10.

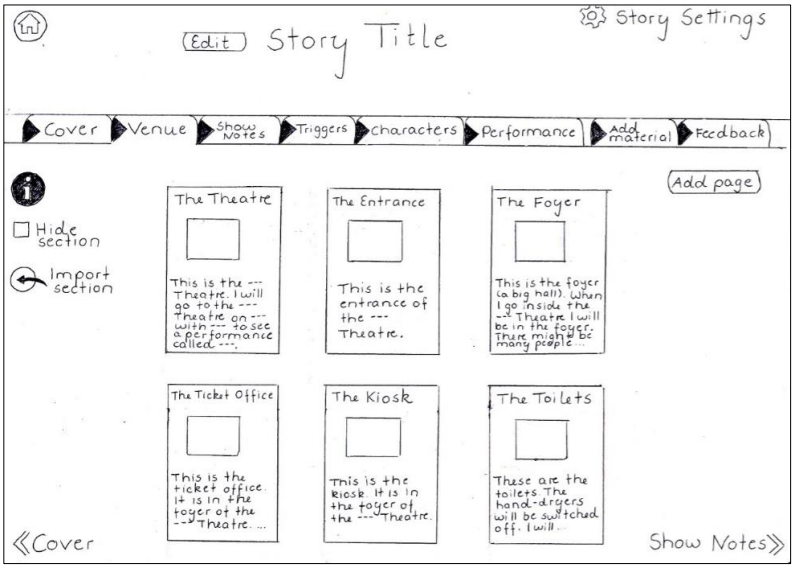


Figure 10. An example of a section screen with default pages in the final low-fidelity prototype

The user would be able to add pages to each of the sections by clicking on the 'Add page' button and choosing the position of the new page with regard to the already existing pages in the section. The idea of predefining the most common pages for each section was already present in the original low-fidelity prototype. However, initially these pages only contained a heading and no default descriptions. As indicated by **E5**, adding default descriptions to the pages would greatly simplify the story creation process. We carefully weighed the advantage of simplifying the story creation process against the disadvantage of presenting default descriptions to the user that could possibly be inaccurate for their performance and decided to add some basic descriptions to each page. Providing these descriptions also supported the idea of a visual story template (**design requirement 12**) that had been proposed by **E3**.

An example of a page that could be edited by the user is shown in Figure 11. The buttons for the elements (picture/video, audio file, symbols and textbox) that could be added to or removed from the page are shown on the left-hand side. Allowing the user to add or remove these elements was intended to allow the user to individualize each page as much as possible (**design requirement 6**). The 'audio' and 'video' options were integrated based on the results of the design workshop (**design requirement 7**). The picture and symbol options were integrated to support the visual character of the visual stories (**design requirement 4**). The symbols were also intended to support the written descriptions (many children with ASC use a symbol system.

The right-hand side of the pages was transformed after the feedback session with **E8** to include a 'View page' and a 'Delete page' option. Before the transformation, the pages could have been deleted from the section screen The 'Save' option was removed and any changes would be saved automatically when the user returned to the section screen. It was intended to reduce the number of buttons on the page and to give the user the possibility to see how the page would look in the printed version of the visual story. Any editing that was done to a page would be displayed small-scale on the corresponding page in the section screen.

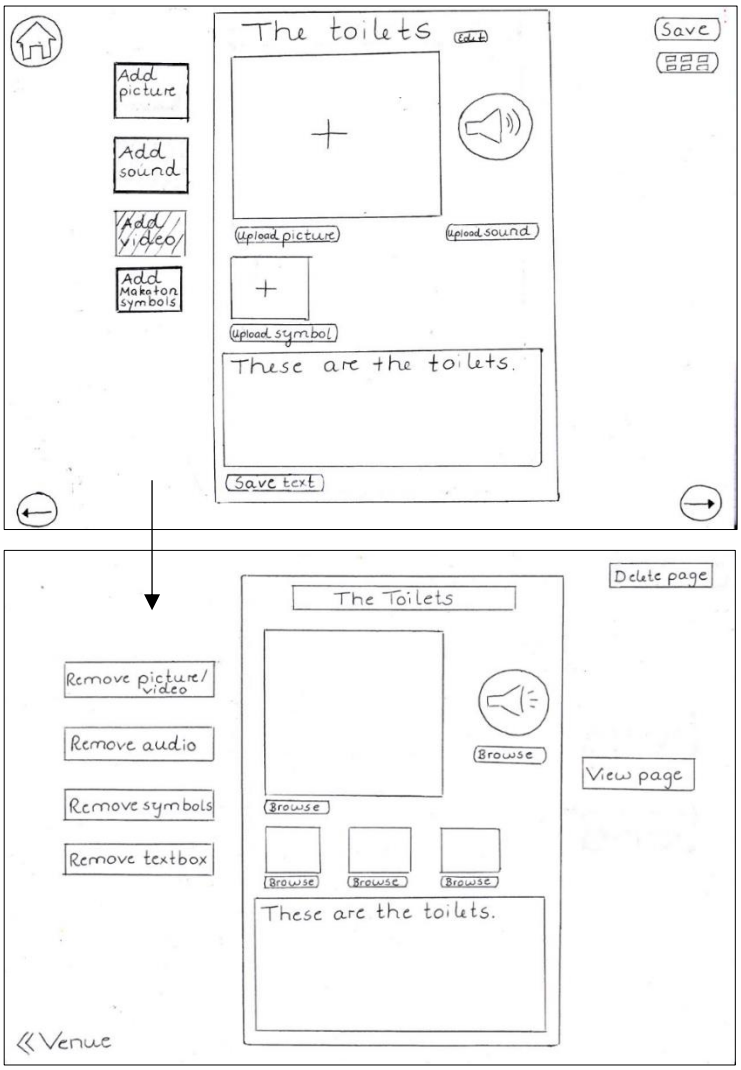


Figure 11. The development of one of the page editing screens

The Sections

Introducing the six different sections (cover, venue, show notes, triggers, characters and performance) that can be seen in Figure 9 was intended to help the user structure their visual story in an intuitive way. As the tool was designed to create visual stories

especially for relaxed theatre performances, the sections would help the user to remember all important elements that were associated with the performances. The sections also worked as an aid to orientation in the visual story creation process and supported the story character of the visual stories by presenting the information in a structured and chronological way (**design requirement 5**).

The cover section was intended to provide a space for the user to decide on an image that would represent their visual story (see Figure 9). This image would then be shown on the first page of the printed visual story and also represent the story in the visual story library. If the user decided not to upload an image, the space would be left blank.

The venue section was intended to provide a space for the user to present the theatre, including the foyer, the ticket office, the toilets and the auditorium (**design requirement 8**). This has been considered as a key element in the existing literature. The default structure for a page in the venue section was a picture and a text box but the user could also add videos, symbols and/or audio files.

The show notes section was intended to provide a space for the user to add any information about the timing and organization of the performance (**design requirement 8**). This includes the interval, the start time and length of the performance and whether it was possible to access a quiet area during the performance.

The show notes section was introduced as a space for the user to help the child with ASC better predict the context of the performance (**design requirement 8**). The pages in the show notes sections only supported text and symbols to be in line with what information should be provide in this section.

The triggers section was intended to provide a space for the user to mention any events or objects that the child with ASC would see during the performance and which might cause anxiety (**design requirement 10**). It was integrated based on the results from the expert interviews and design workshop. Following a suggestion made by **E2**, we divided the triggers into visual, auditory and tactile. As it was difficult for the user to remember all possible triggers, we followed **E5**'s advice to provide check lists with the most common triggers. To increase predictability, we also provided a space for the user to indicate when or how often a trigger would occur during the performance. As some performances might have very specific triggers, the user could add those to the list as well. The pages in the triggers section consisted of checklists and an optional textbox. Added pages would support text and symbols.

The characters section was intended to provide a space for the user to describe the characters that would appear during the performance and how they were related to each other (**design requirement 9**). Providing these information was considered important by the participants of the expert interviews and design workshop. The characters section was also intended as a space for the user to explain the difference between the actors and the characters which can be difficult understand for children with ASC. Its default pages included a picture and a textbox but the user could also add videos, symbols and/or audio files.

The performance section was intended to provide a space for the user to present the actual performance (**design requirement 11**). This could be done in as little or as much detail as the user considered it to be helpful for their specific performance. It was specified that providing descriptions of the plot and the most important scenes are usually helpful for children with ASC. Following feedback provided by **E7**, we changed the name of this section from 'Play' to 'Performance' to include all types of theatre performances. The default structure for a page in the performance section was a picture and a text box but the user could also add videos, symbols and/or audio files.

After feedback given by **E5** and **E6** we also added an add material and a feedback section. Both of these sections were optional. The add material section was intended to allow the user to incorporate a map or song lyrics into the visual story. The feedback section was intended for us to receive feedback on how helpful the tool was for the users.

If the user felt that any of the sections (apart from the cover section) did not apply to their visual story, they could tick a 'Hide section' box. The section would then be shaded and not appear in the printed visual story. This was introduced to allow the creation of individualized visual stories (**design requirement 6**). The user was also given the option to import the venue, show notes, triggers, characters and performance sections from any other visual story in their visual story library (**design requirement 16**). For the venue section this was considered a useful approach to simplify the visual story creation process as many relaxed performances would take place in the same theatre. For the other sections, it was considered helpful as it allowed users to easily create individualized stories for different children for the same performance (**design requirement 6**).

Accessing the Visual Stories

To be able to access and edit any visual stories that the user had previously created, we added a visual story library (see Figure 12). When the user first created an account, only one example story would be displayed in the visual story library (**design requirement 11**) but as soon as the user started the visual story creation process, the new visual story would appear in the library as well. The stories in the library would be ordered chronologically. The example story was intended as a guide for users who would be interested in it. When a user clicked on a story, they were given the options to open, download, print (**design requirement 12**) or delete the visual story. If they indicated that they wanted to delete a visual story, they were asked to reconfirm this.

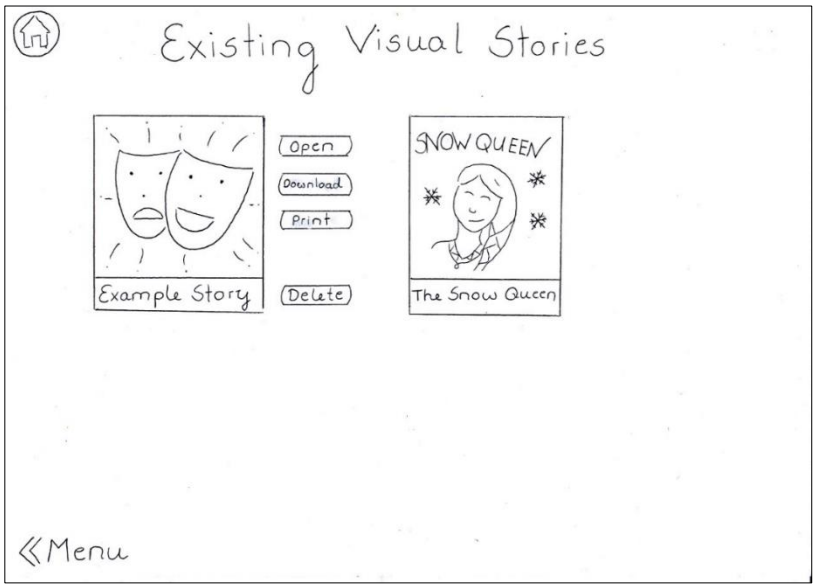


Figure 12. The visual library screen of the final low-fidelity prototype

Help and Guidance

If the user was unsure which information they should provide in each section, they could click on the information button on the left-hand side of each section screen. To obtain more in-depth information about creating visual stories for children with ASC, visual stories for relaxed theatre performances (**design requirement 15**) and the different features of the tool (**design requirement 14**) the user could look in the visual story guide that was accessible through the menu.

The visual story guide was structured in different sections. The user could work through the sections one by one or choose which of the sections they were most interested. The sections were:

- **Basics -** which summarized the most important elements from all the other sections in 11 points.
- **Writing** – which provided guidance on the choice of language when writing visual stories.
- **Material** – which introduced the different kinds of material that the user could integrate into their visual stories and provided guidance as to which material would be most suitable for which parts of the visual stories.
- **Sections** – which introduced the different sections of the visual stories and the information that each section was intended to provide.
- **Saving & Printing** – which provided guidance to the user as to how they could save and print the visual stories that they had created.

- **Settings** – which introduced the different settings of the tool and how they could be accessed by the user.

The sections were informed by the literature and the design of the tool itself. The information provided within each section was intended as a summary of the most important information rather than an exhaustive guide. The information about the content of the visual stories were loosely based on the Social Story criteria that were created by Carol Gray and presented in 2.3.1. For the sections that referred to other parts of the tool, screenshots were provided.

4.4 High-Fidelity prototype

On the basis of the final low-fidelity prototype, we designed a high-fidelity prototype. Its main aim was to conduct summative evaluations of the design and to provide a basis for further implementation. The interface of the high-fidelity prototype is presented below.

4.4.1 Login and Welcome Screen

To create a new account, a user could use the 'Sign up' function on the initial screen. To do so they would need to provide an email address and choose a password. They could later use the email address and password to log into their previously created account by using the 'Login' function (see Figure 13). These functions were fully implemented.

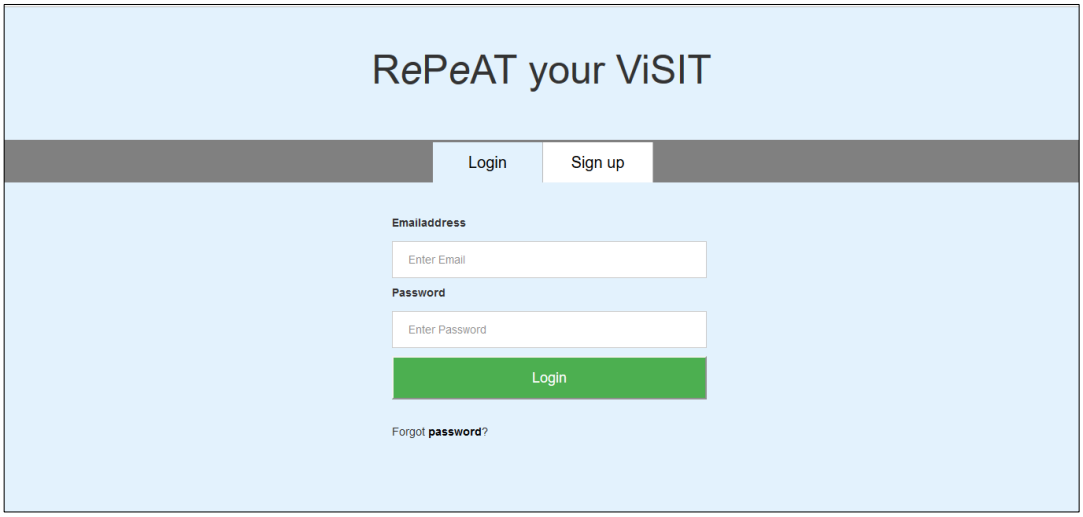


Figure 13. The login screen

After having signed up or logged into their account, the user was presented with a welcome page that would provide a quick overview over the purpose of the tool (see Figure 14). At this point the user could decide to logout and would then be redirected to the login screen.

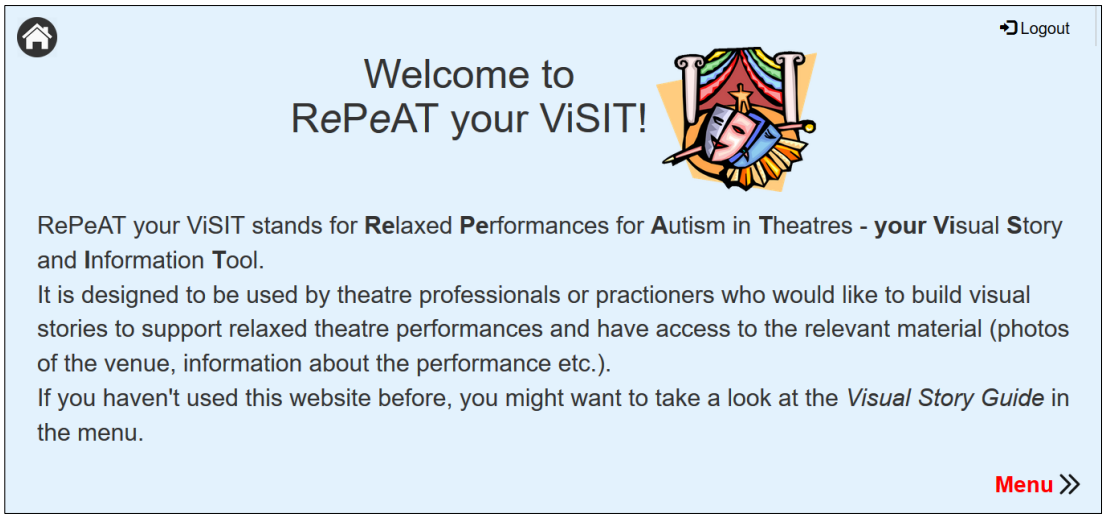


Figure 14. The welcome screen

4.4.2 **Menu and Settings**

From the welcome screen, the user could access the menu (see Figure 15). The user could always go back to the menu from any other screen by clicking on the home button in the upper left corner.

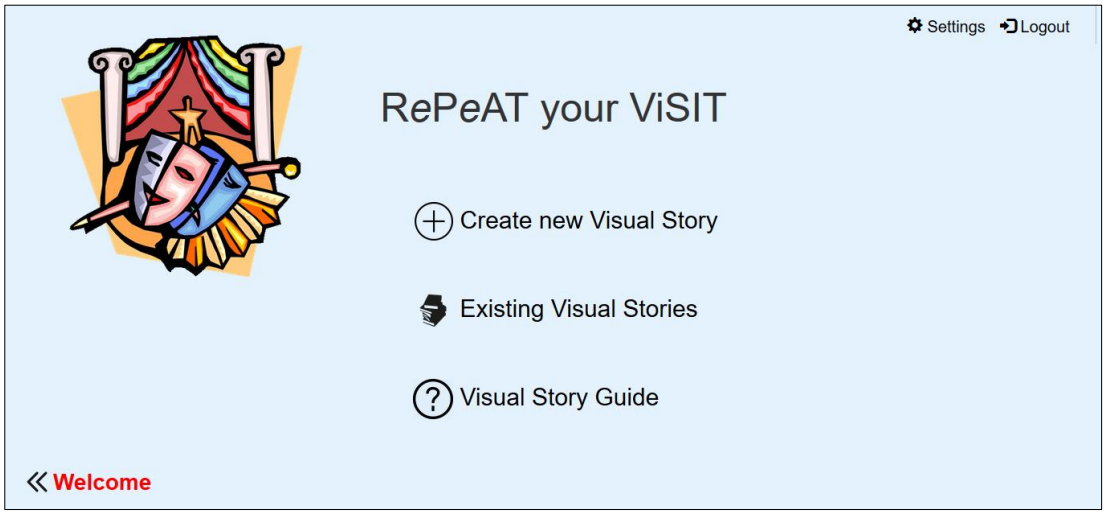


Figure 15. The menu screen

The general settings could be accessed by clicking on the settings icon in the upper right corner of the menu screen. The general settings are presented in Figure 16 and the two general setting options in Figures 17 and 18. The settings that concerned each individual visual story could be accessed during the visual story creation process by clicking on the story settings icon in the upper right corner. The story settings are presented in Figure 19. Neither the general nor the story setting options were fully implemented.

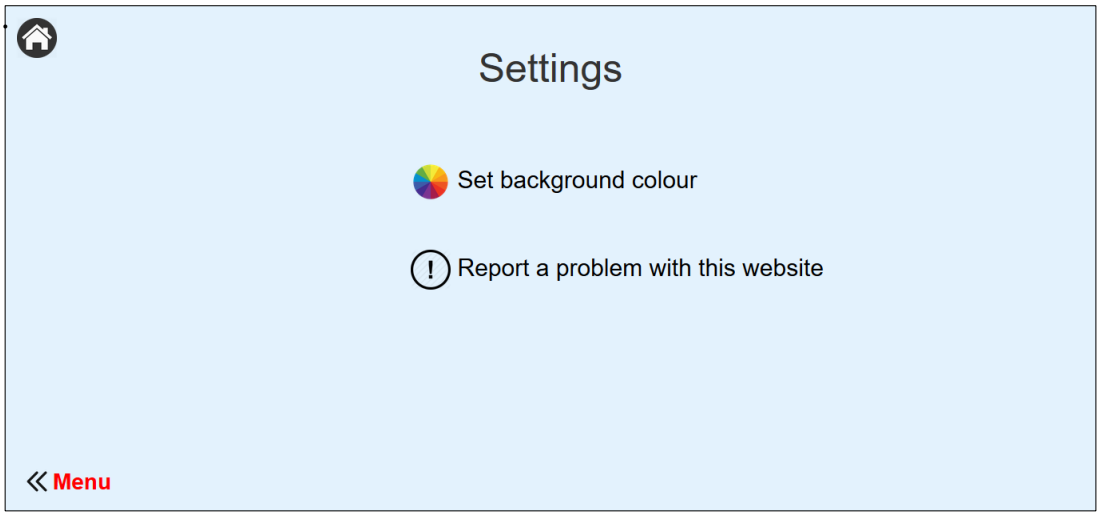


Figure 16. The settings screen

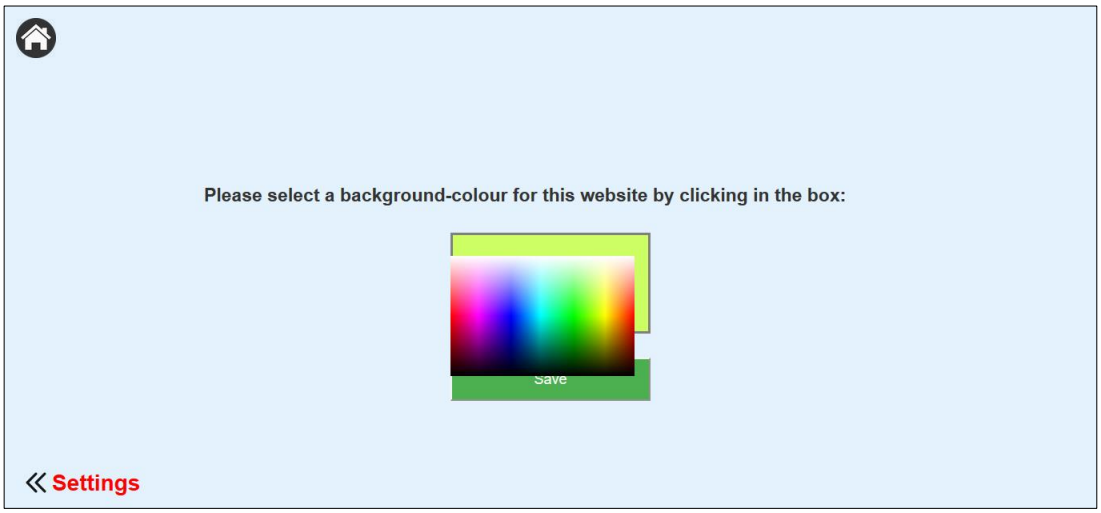


Figure 17. The set-background-colour screen

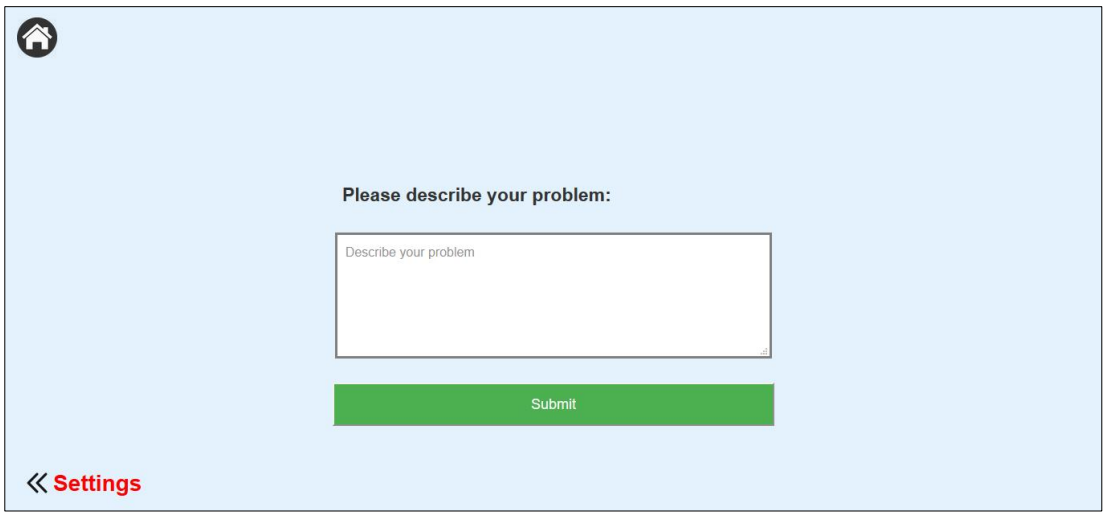


Figure 18. The report-a-problem screen

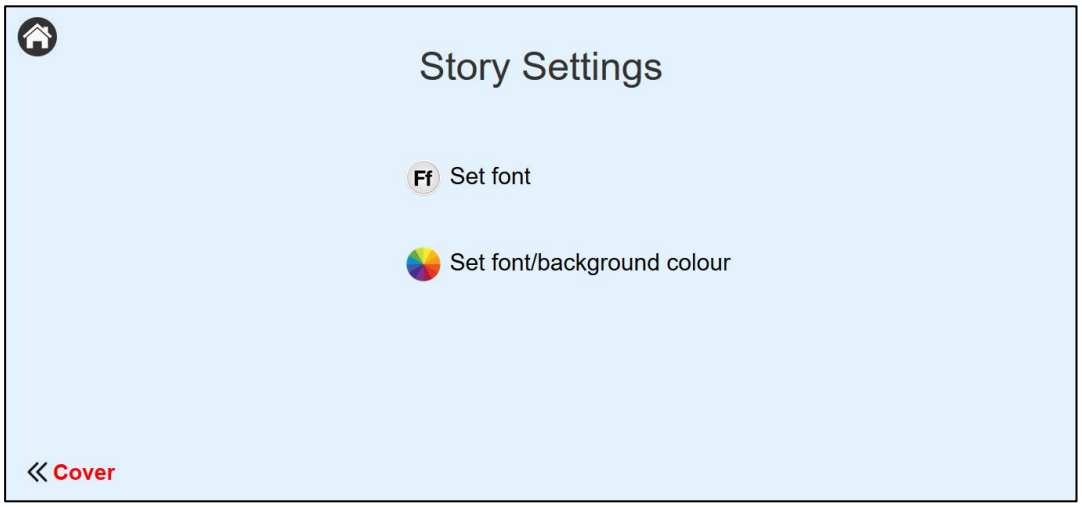


Figure 19. The story settings screen

4.4.3 **Visual Story Guide**

The visual story guide could be accessed by clicking on 'Visual Story Guide' in the menu. An example of a section in the visual story guide can be seen in Figure 20.

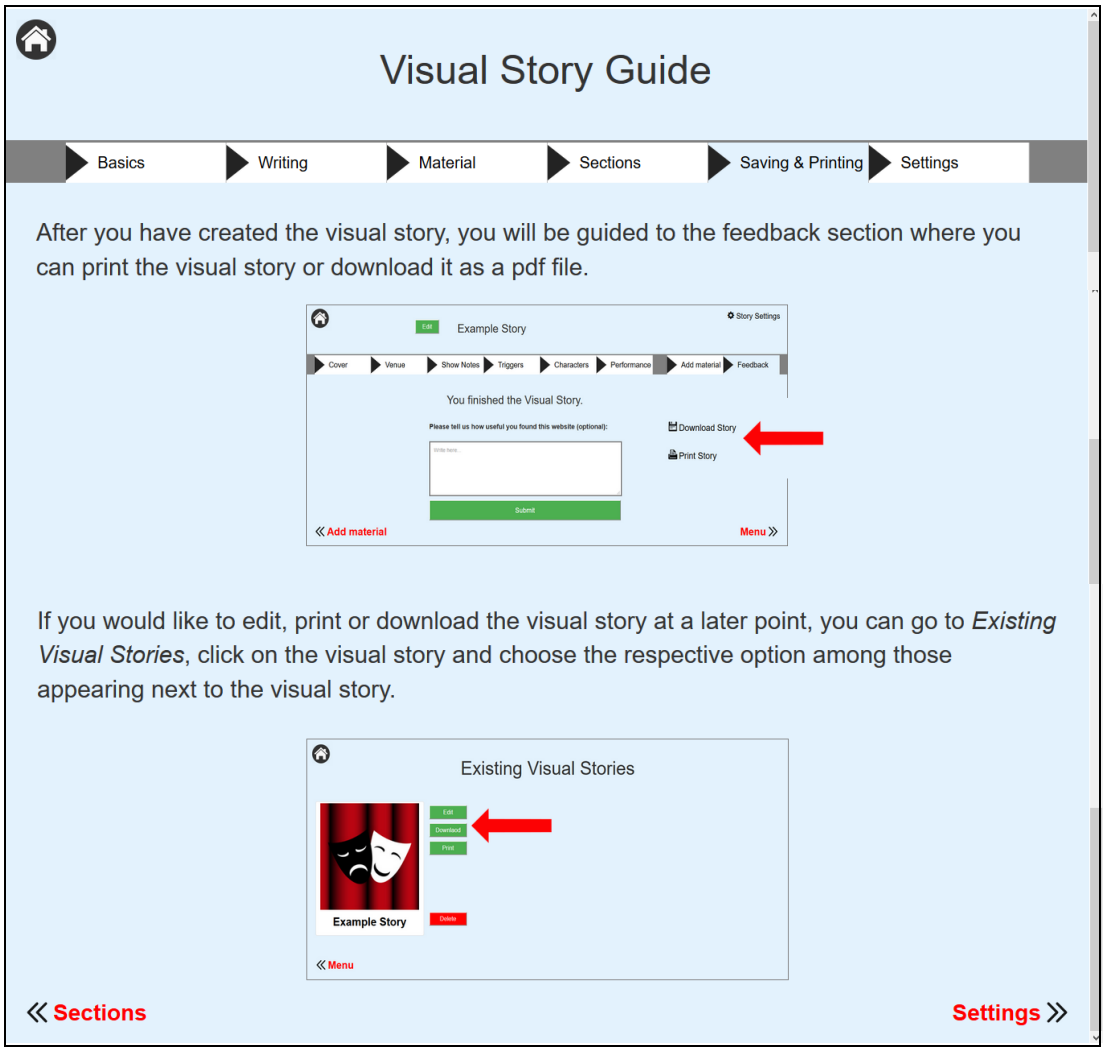


Figure 20. An example of a visual story guide section screen

4.4.4 Creating a Visual Story

To create a new visual story, the user could click on 'Create new Visual Story' in the menu. The user would then be presented with an explanation page which provided information on the material that the user was very likely going to use during the visual story creation process and on how the user could obtain further information about the different sections of the visual story they there were asked to complete (see Figure 21).

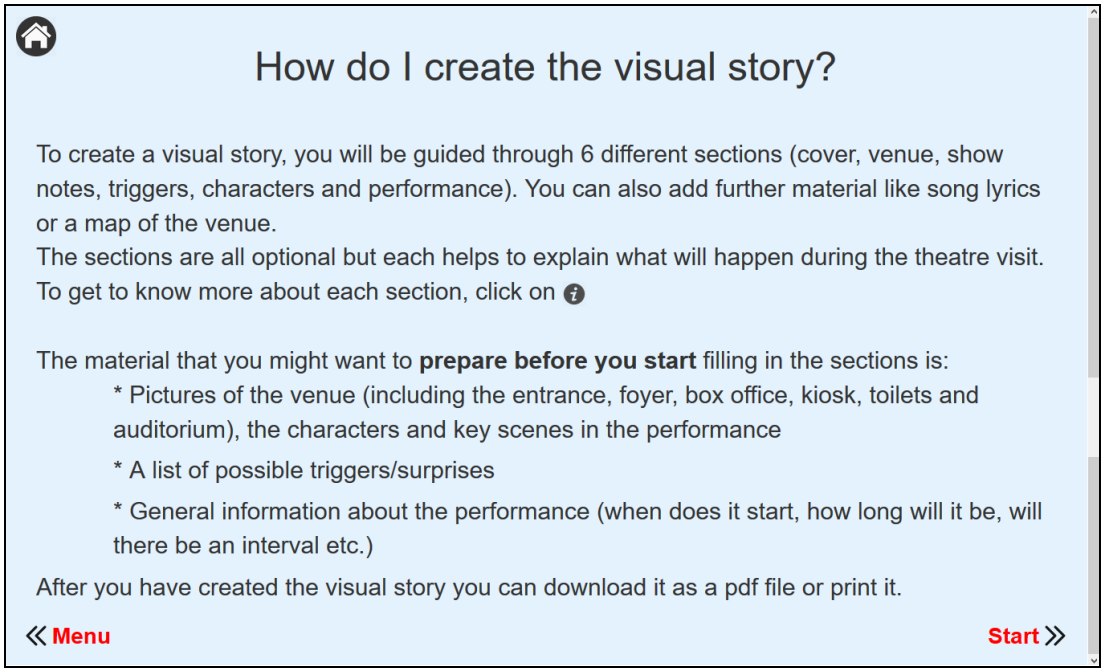


Figure 21. The explanation screen

When the user clicked on ‘Start’ on the explanation screen, they would be redirected to the cover section where they could add a title and upload a cover picture for their visual story (see Figures 22 and 23). Both of these functions were implemented but the content would not be saved.

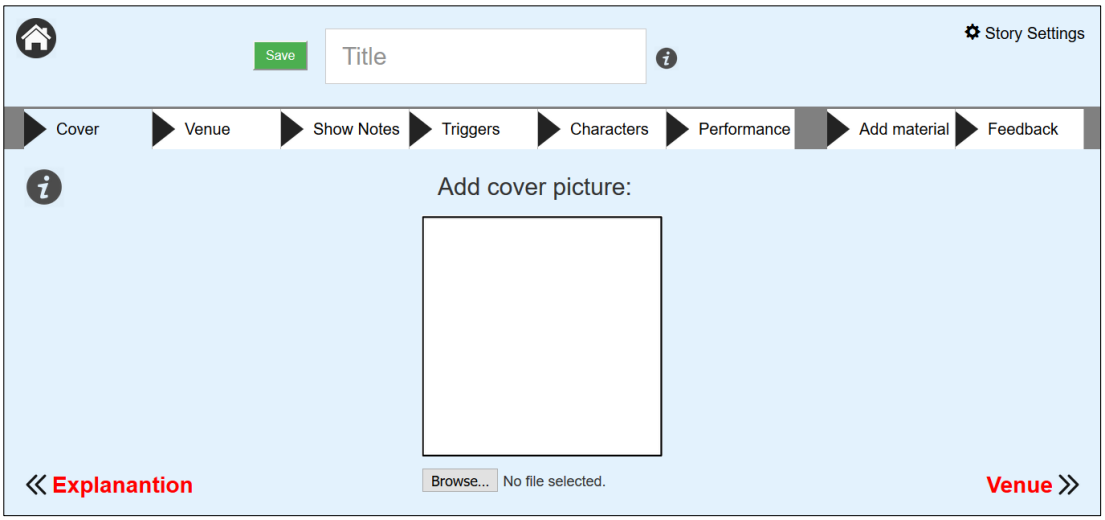


Figure 22. The cover section screen (default)

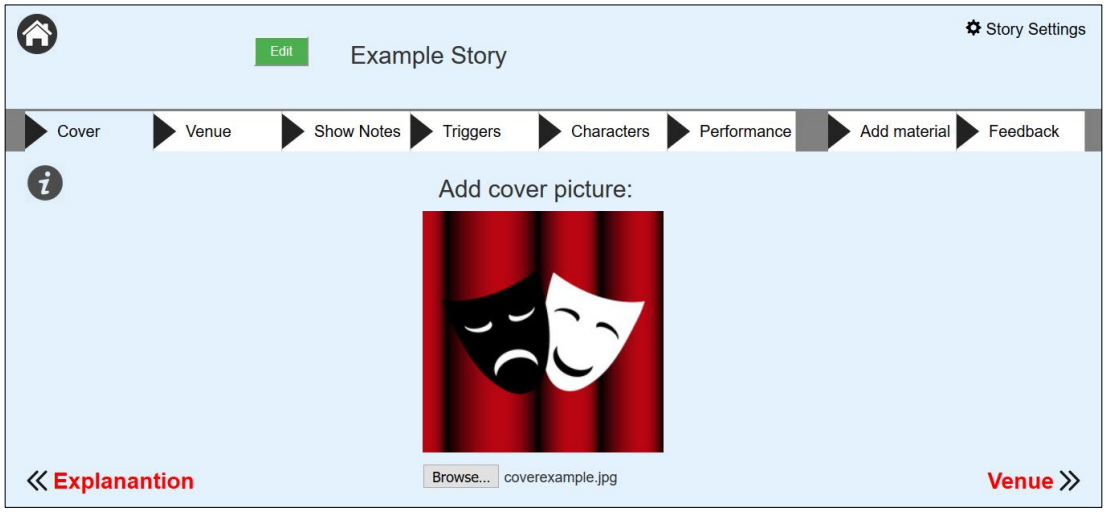


Figure 23. The cover section screen (individualized)

From the cover section, the user would be guided to the venue section but could also access any of the other sections.

The venue section screen is presented in Figure 24. In this figure, the first page of the venue section has been individualized through the editing process that is presented in Figures 25 and 26. The editing process was accessed by clicking on the first page of the venue section. In Figure 25, all possible elements are included in the page and can be edited. In Figure 26, the page only includes a picture and a text box and is presented as it would look in the printed visual story. These functions were fully implemented for the first page of the venue section. The edited page would be presented small-scale on the first page of the venue section but its content would not be saved.

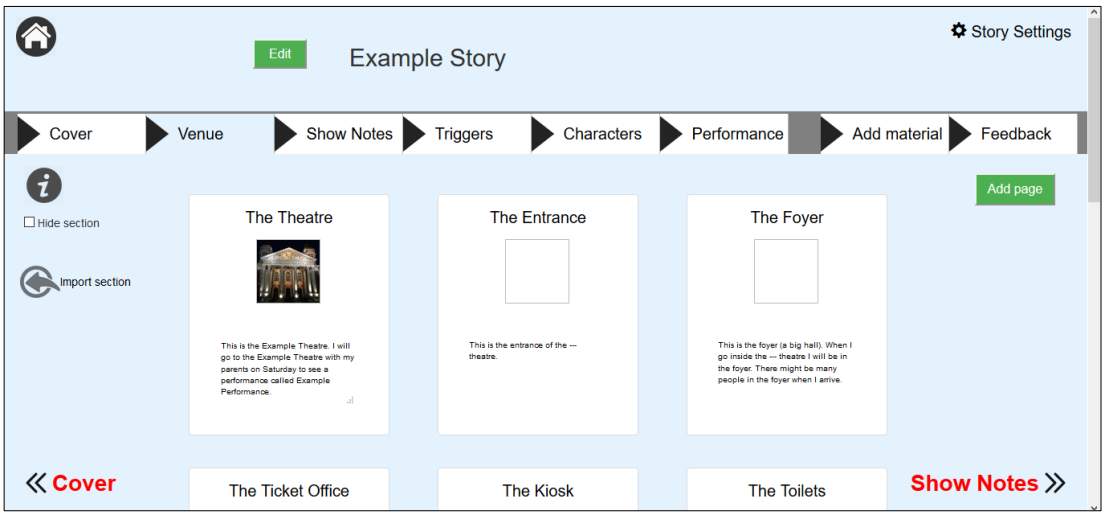


Figure 24. The venue section screen

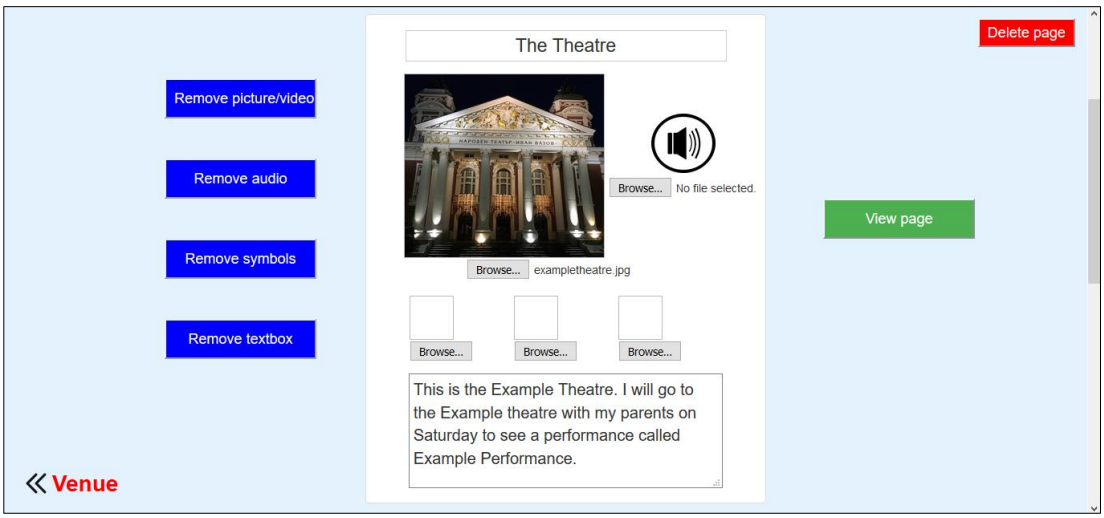


Figure 25. The editing screen of the first page in the venue section (1)

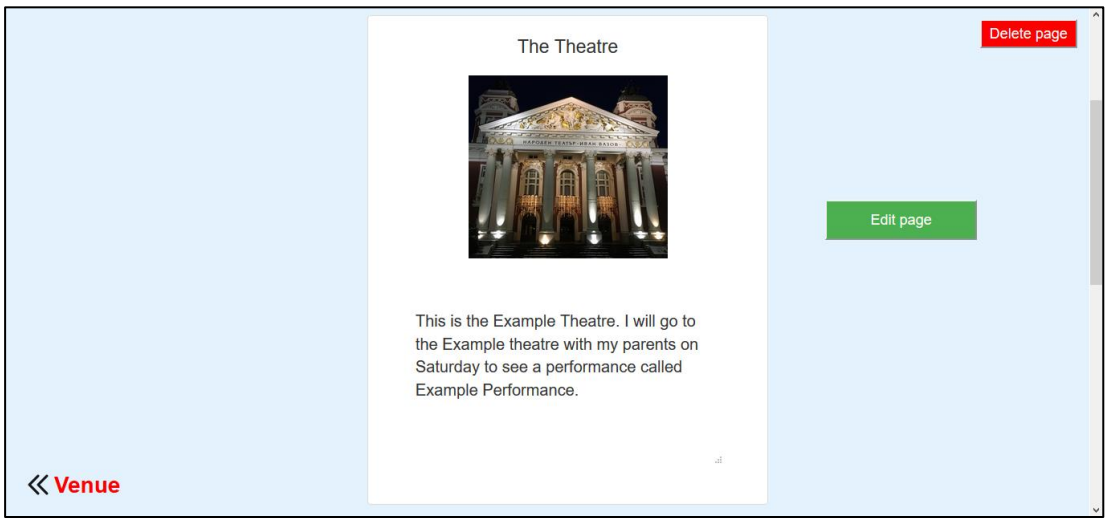


Figure 26. The editing screen of the first page in the venue section (2)

The section that the user would be guided to after the venue section was the show notes section (see Figure 27). The pages in the show notes section only contained a textbox and/or symbols. The first page of the show notes section was editable but the content would not be saved.

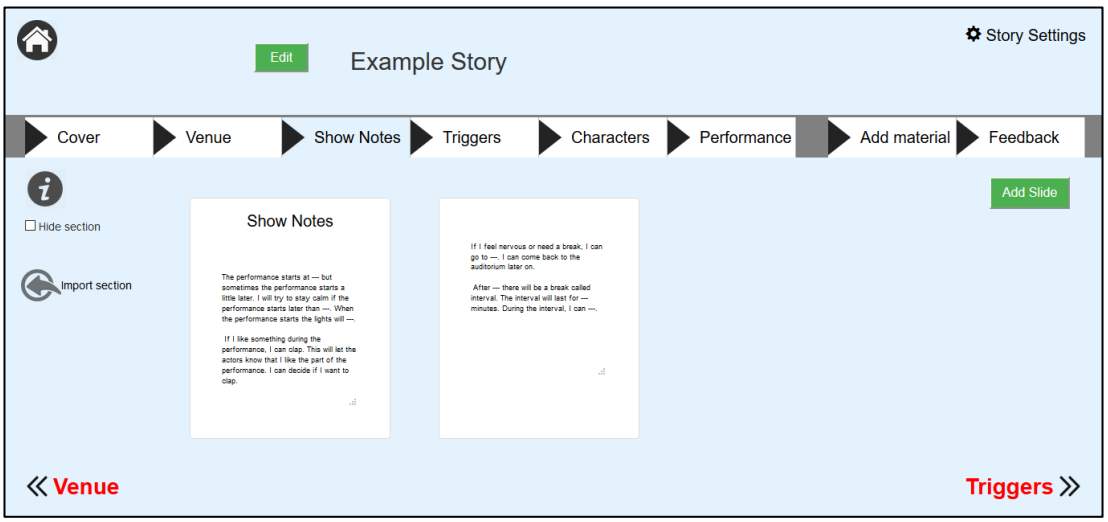


Figure 27. The show notes section screen

The section that the user would be guided to after the show notes section was the triggers section. The three default pages in the triggers section contained lists of visual, auditory and tactile triggers. When a user indicated that a trigger was present in the performance, a text field appeared for the user to specify the timing of the trigger in the performance. The first page of the triggers section was editable (see Figure 28) but the content would not be saved.

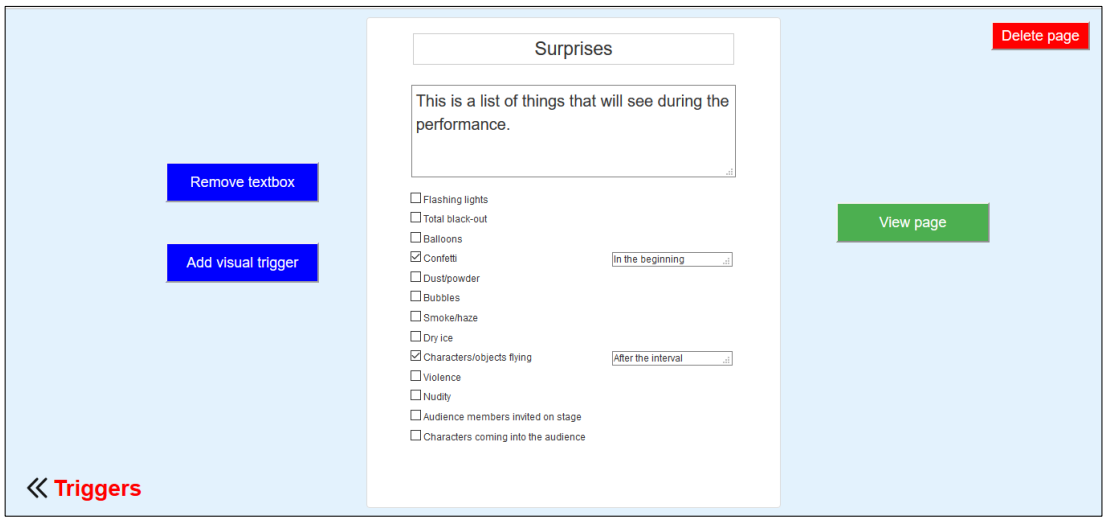


Figure 28. The editing screen of the first page in the triggers section

The last two sections were the characters section (see Figure 29) and the performance section (see Figure 30). In the high-fidelity prototype, the se sections contained some default pages but were not editable.

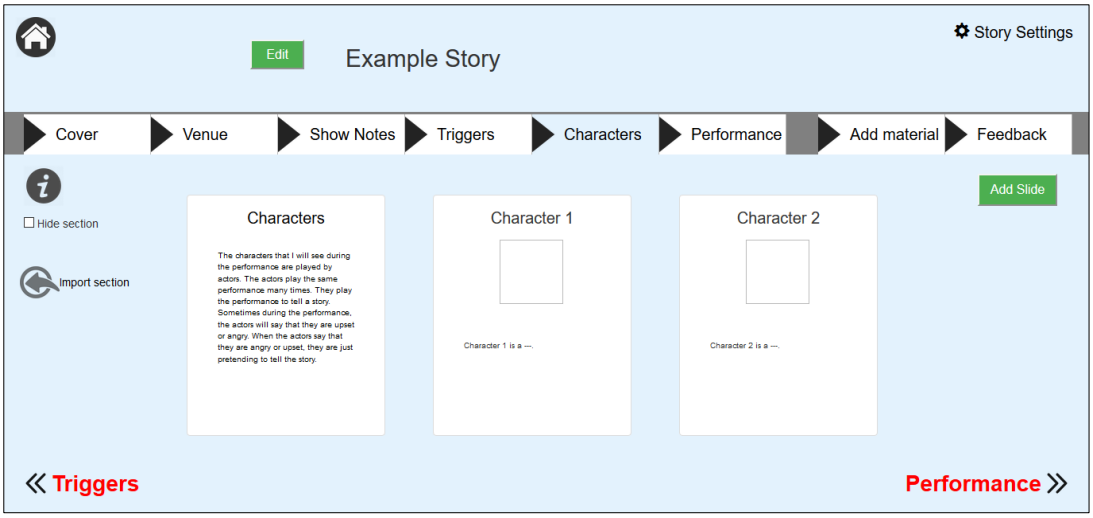


Figure 29. The characters section screen

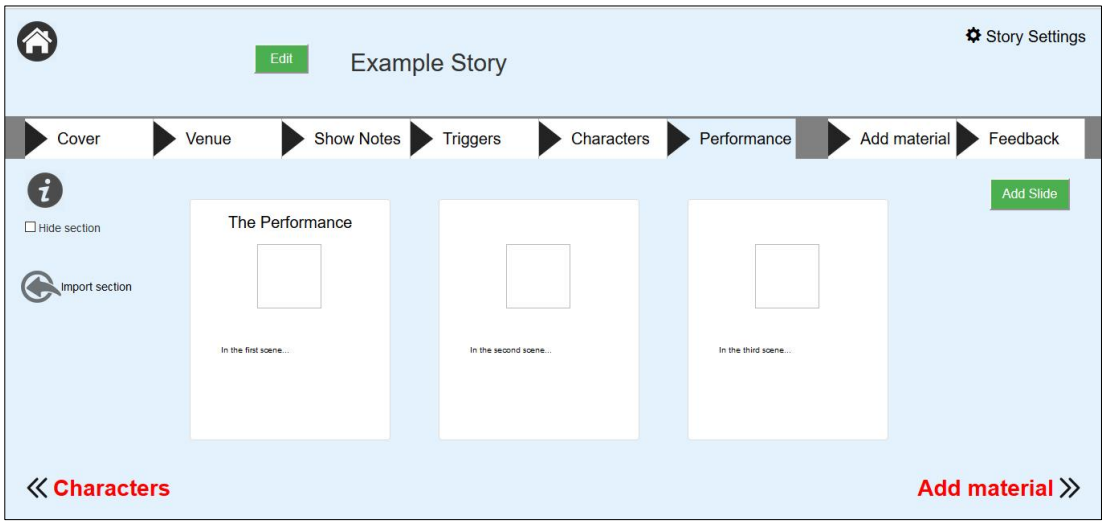


Figure 30. The performance section screen

If the user needed more information about any of the presented sections, they could click on the information button on the left-hand side of the screen and would be presented with a pop-up window that contained information about the respective section. This function was fully implemented.

If the user did not want to have one or more of the presented sections included in their visual story, they could tick the 'Hide section' box on the left-hand side of the screen and the section would become shaded. This function was fully implemented.

If the user wanted to import the section from a previously created visual story, they could click on 'Import section' icon on the left-hand side of the screen. They would then have to choose from which of the visual stories in the visual story library they wanted to import the section. This function was not fully implemented.

The section that followed next was the add material section (see Figure 31). In this section the user could upload any additional material. In the high-fidelity prototype a file could be selected and the file name would be displayed the content of the file would not be saved.

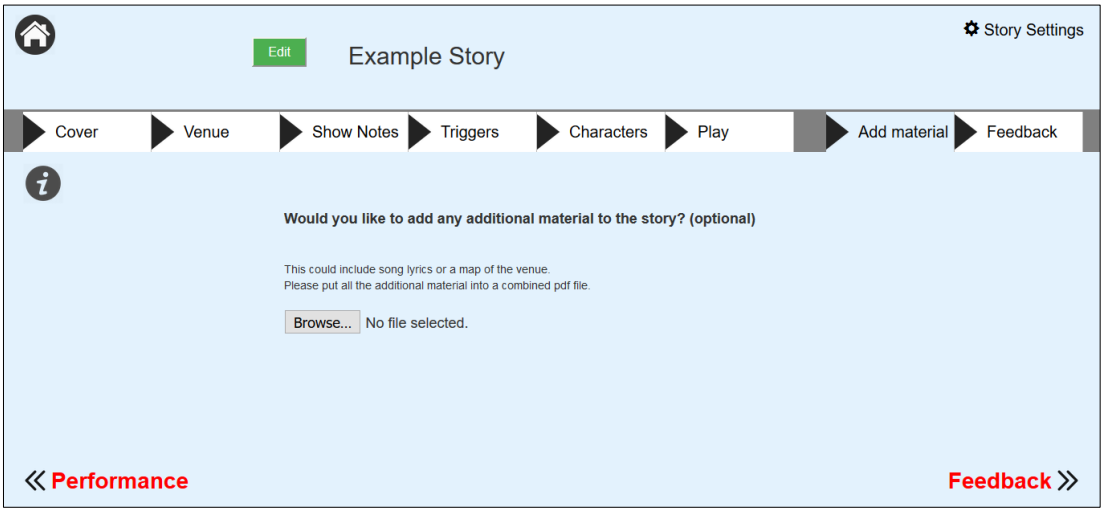


Figure 31. The add material section screen

The last section was the feedback section (see Figure 32). In this section the user could provide feedback about how useful they had found the tool and download or print the created visual story. These functions were not fully implemented.

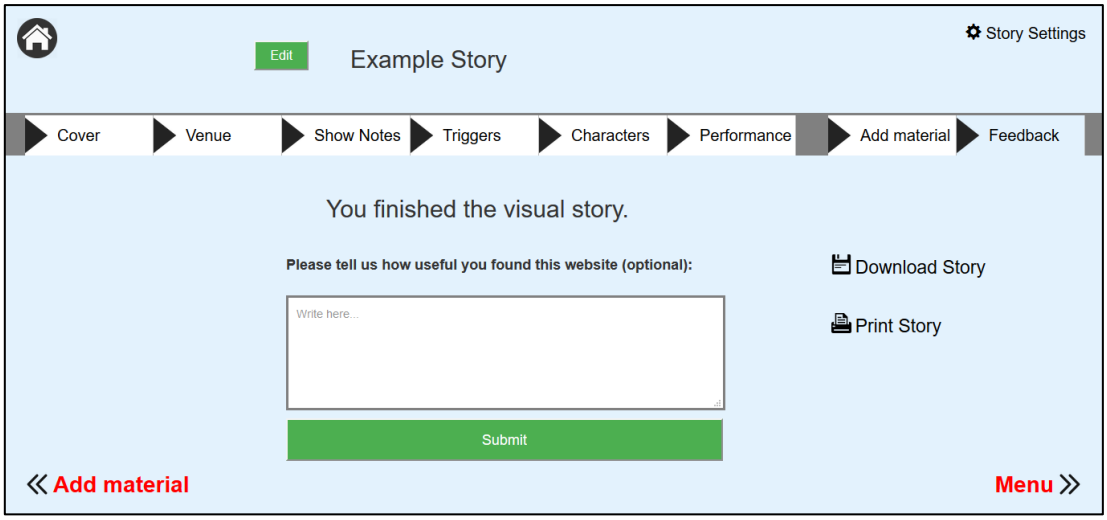


Figure 32. The feedback section screen

4.4.5 **Visual Story Library**

To access the example story or any previously created visual stories, the user could click on 'Existing Visual Stories' in the menu and would be redirected to the visual

story library (see Figure 33). When clicking on a visual story in the visual story library, the user would be given the options to edit, print, save or delete the visual story.

If the user clicked on the 'Edit' button, they would be redirected to the cover section of the visual story. All the sections of the visual story would contain the information and material that the user had previously added. The user could then edit one or more of the sections.

If the user clicked on the 'Print' button, a window would appear in which the user could specify the printer they wanted to use and any further options for the printing tasks. The visual story would then be printed by the specified printer.

If the user clicked on the 'Download' button, a window would appear in which the user had to specify a location and title for the PDF file that would contain the visual story. The story would then be saved as a PDF file in this location.

If the user clicked on the 'Delete' button, the system would ask them to confirm that it was indeed their intention to delete the visual story. If the user confirmed this, the visual story would be deleted from the visual story library.

The buttons appeared when the user clicked on the example story but neither of the functions described above was fully implemented.

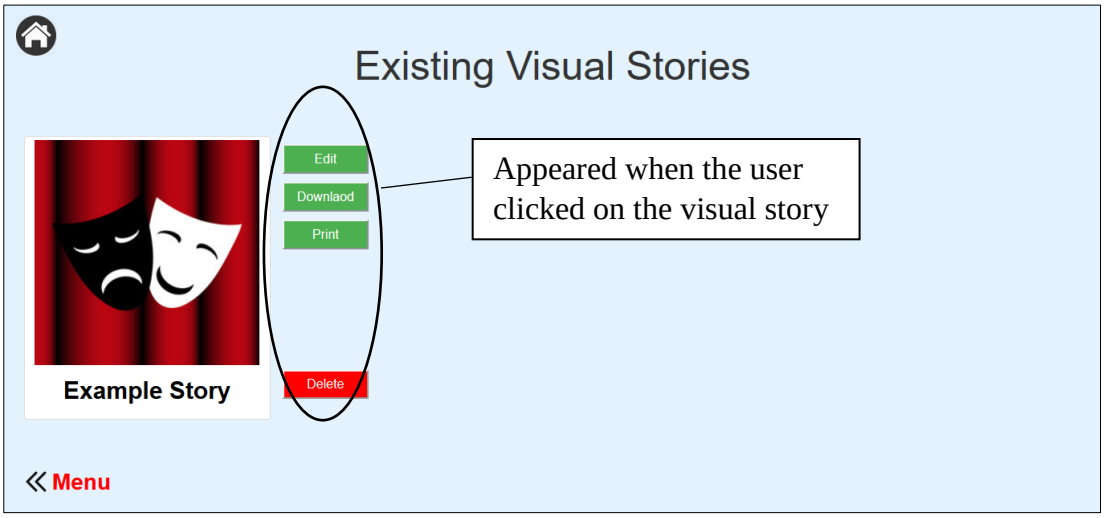


Figure 33. The visual-story-library screen

4.5 Implementation

The high-fidelity prototype was designed using HTML and CSS. Apart from some small exceptions in which Bootstrap was used, we created the design from scratch. For the interactive parts, JavaScript functions were added. Some of these functions were written without relying on outside resources while others were based on examples that were freely available on the Internet. Most of the examples were taken from

w3schools.com and adapted to fit the purpose of the prototype. To store content a Google Firebase database was used.

The advantages of a web-based approach were the login/logout systems for an easy collaboration and the fact that it could run on a desktop device on which it would be easy to store material like pictures and video files.

4.6 Discussion

Based on the existing literature, the results from the design-informing activities and a set of design principles, a set of design requirements was established. These design requirements built the foundation for the design of an initial low-fidelity prototype and the following prototyping process. During this process, five experts provided feedback on the design and content of the different versions of the low-fidelity prototype. Each expert's feedback was analysed and potentially incorporated before the updated low-fidelity prototype would be presented to another expert.

This prototyping process resulted in a continuous sequence of improvements. As the experts' feedback built on one another, the process helped us to evaluate our implementation of their suggestions and in several cases further improve it. Apart from several minor issues, the experts pointed out three main aspects in the initial low-fidelity prototype that were suboptimal. These were the structure of the visual story creation process, an insufficiently composed visual story 'template' and missing guidance for first-time users about the functionality of the tool and what they could expect when using the tool. These aspects were all revised, resulting in a final low-fidelity prototype of a visual story tool that was called RePeAT your ViSIT.

Based on the final low-fidelity prototype, a high-fidelity prototype was designed. Its main purpose was to create a solid foundation for further evaluation and implementation. The high-fidelity prototype used a web-based login system and was designed with HTML, CSS and JavaScript. While the design was complete, many of its functions were not fully implemented. This provided a sufficient basis for the summative evaluation process, provided that we would be able to comment on some of not implemented functions when presenting the high-fidelity prototype to potential users.

5. Evaluation

5.1 Feedback Survey

The first evaluation method we used was a feedback survey. This survey was handed out to Informatics students and staff of the University of Edinburgh as part of a project feedback event. It was intended to provide us with some general feedback on the usability of the visual story tool and whether first-time users would find it easy or difficult to learn and use.

5.1.1 Aims

The feedback survey was intended to help us achieve the following two aims.

- **Aim 1**: Evaluate how easy or difficult it is for first-time users to understand the different features of the tool.
- **Aim 2**: Determine the users' impressions of the tool when they interact with it for the first time.

5.1.2 Method

Participants

The participants were students and staff members of the University of Edinburgh who attended a project feedback event that was organised by the School of Informatics. Details about the participants are presented in Table 6. In the table, the following abbreviations are used: UG2 – Second year undergraduate student, UG3 – Third year undergraduate student, UG4/MInf – Fourth year undergraduate student or student in their final year of a five-year Informatics degree.

Participant	**Gender**	**Year of Studies**
P1	Male	UG2
P2	Male	UG3
P3	Female	UG3
P4	Male	UG4/MInf
P5	Male	UG4/MInf
P6	Female	UG4/MInf
P7	Female	UG4/MInf
P8	Female	UG4/MInf
P9	Female	UG4/MInf
P10	Female	UG4/MInf
P11	Male	Staff
P12	Female	Staff

Table 6. Details about the participants who filled in the feedback survey

Procedure

The project feedback event was organized by the School of Informatics of the University of Edinburgh. All undergraduate Informatics students who were working on their final year projects were invited to present their progress and results at the event. For their presentations, the participating students were provided with a poster space and, if necessary, table space for a demonstration. The event was advertised to students and staff in the School of Informatics but there were no restrictions on who could attend. The event took place in a room of the university and the visitors were able to move around freely and decide which of the presenting students they wanted to approach. Each of the presented projects was summarized on a poster which helped the visitors decide which of projects they wanted to learn more about.

All the visitors that were interested in learning more about the visual story tool were given a short summary of the research and presented with the most advanced version of the high-fidelity prototype that was implemented at that time. In this version all the different parts and sections were labelled and clickable but some of the content for the visual story guide and the sections was still missing. The visitors were also offered to take a look at the final version of the low-fidelity prototype, to ask any questions they had and to provide oral feedback on the tool. Afterwards, the visitors were asked whether they would agree to fill in the feedback survey. If they agreed they were given

the survey, told that they could leave any of the items blank and to put the completed survey upside down on the pile of filled-in surveys.

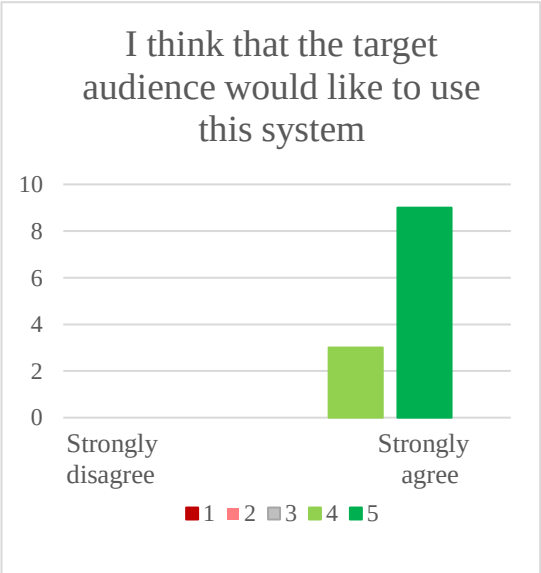
Material

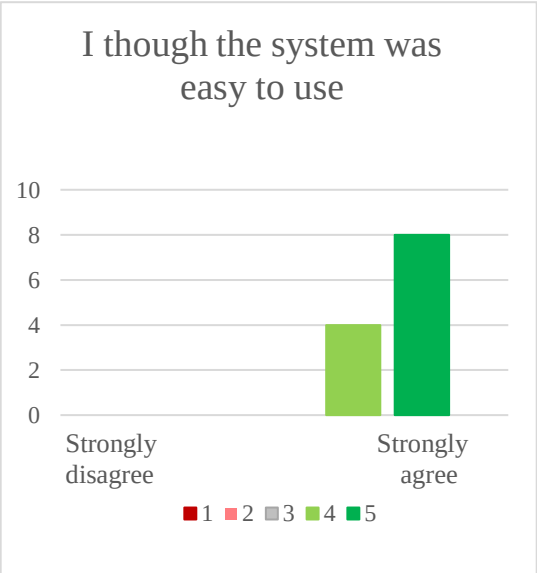
The survey we used had been created by an expert in the field of usability and Human-Computer Interaction. They offered that we could use the survey to obtain feedback at the project feedback day. It was anonymous and included 5 positively and 5 negatively worded items about the design and usability of the tool. The survey can be found in Appendix C.

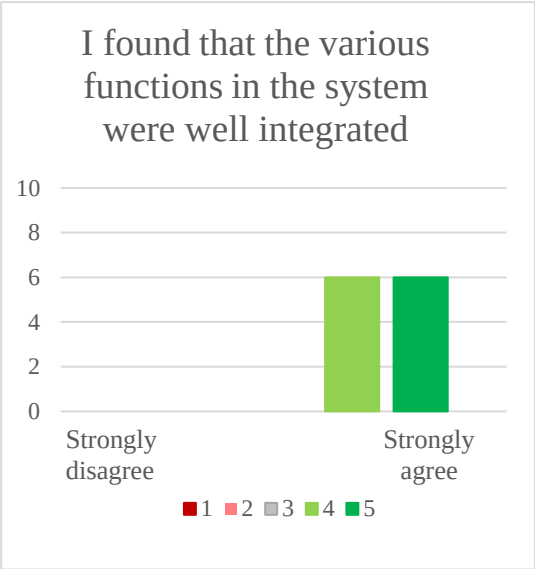
5.1.3 Results

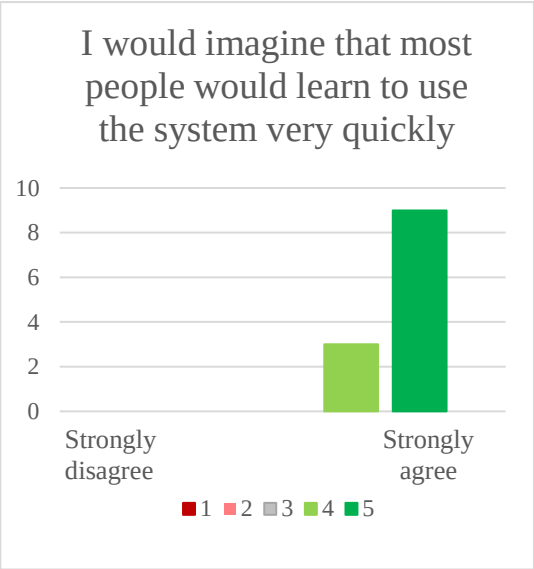
The survey results are presented in Figure 34. It needs to be noted that not all of the participants completed all of the survey items. The numbers on the left show how many of the participants indicated which level of agreement/disagreement.

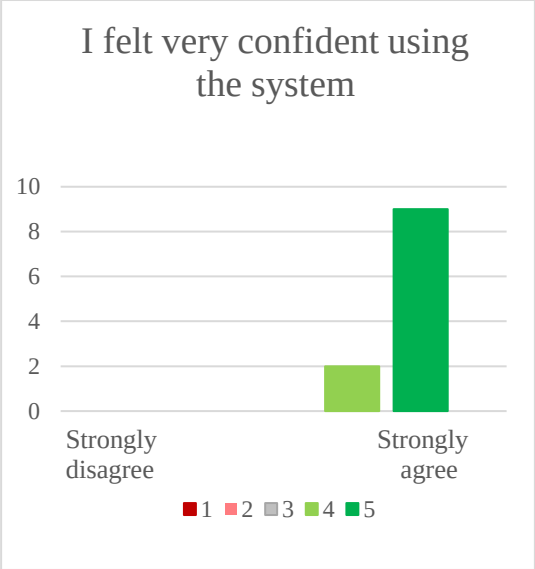
The results show that a majority of the participants considered the tool to be suitable for the target audience, easy to learn and use and felt confident using it. For the negatively worded items, a majority of the participants strongly disagreed that there was too much inconsistency in the tool, that they would need the support of a technical person to be able to use the tool, that the tool was cumbersome to use and that they had to learn a lot of things before they could use the tool. All participants stringly diagreed that the tool was unneccessarily complex.
The survey item that fewer particpants srtongly agreed to stated that "the various functions in the system were well integrated". Six participants strongly agreed while six other particpants agreed less strongly (4 out of 5 where 5 was equal to 'strongly agree' and 1 was equal to 'strongly disagree'). This indicates that there is room for improvement with regard to the intgegration of the tool's various functions.

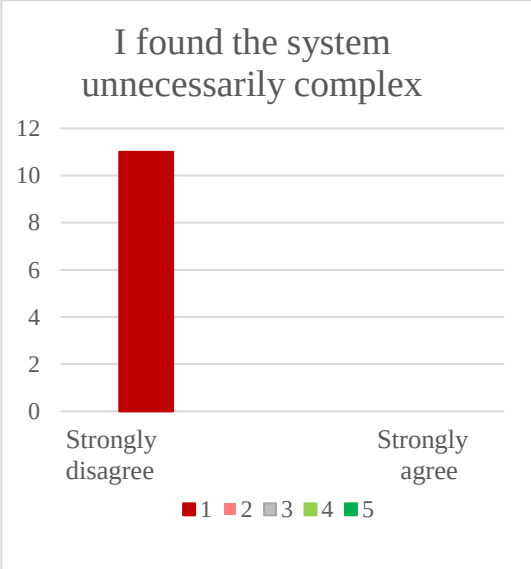


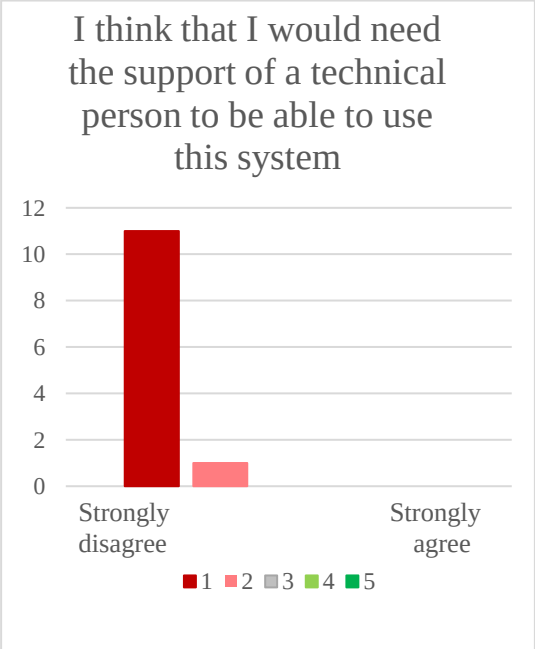


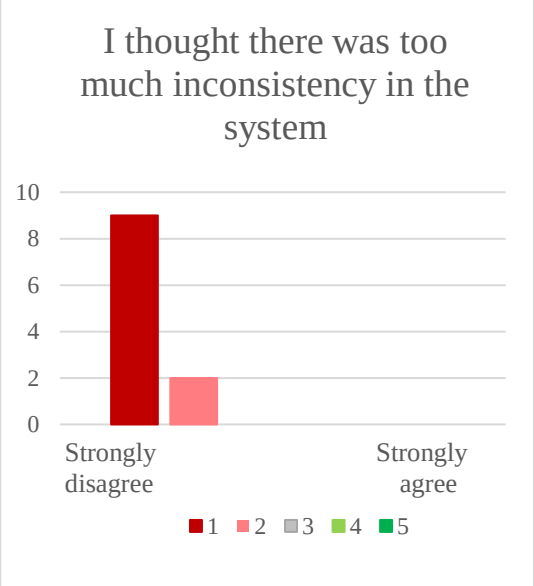

I found that the various functions in the system were well integrated
10
8
6
4
2
0
Strongly disagree
Strongly agree
1 2 3 4 5


I would imagine that most people would learn to use the system very quickly
10
8
6
4
2
0
Strongly disagree
Strongly agree
1 2 3 4 5


I felt very confident using the system
10
8
6
4
2
0
Strongly disagree
Strongly agree
1 2 3 4 5


I found the system unnecessarily complex
12
10
8
6
4
2
0
Strongly disagree
Strongly agree
1 2 3 4 5


I think that I would need the support of a technical person to be able to use this system
12
10
8
6
4
2
0
Strongly disagree
Strongly agree
1 2 3 4 5


I thought there was too much inconsistency in the system
10
8
6
4
2
0
Strongly disagree
Strongly agree
1 2 3 4 5

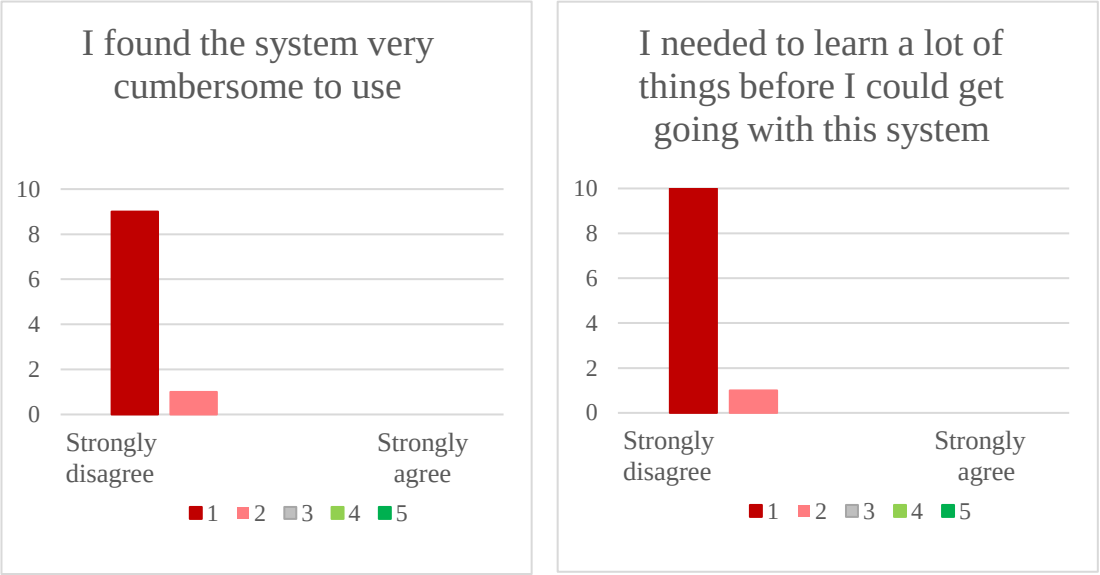


Figure 34. The results of the feedback survey

5.2 Evaluation Workshop with Neurotypical Children

To gather feedback on the design and content of the visual stories that users would be able to create with a fully implemented version of the tool, we conducted an evaluation workshop with neurotypical children. These children acted as proxies for our target audience of children with ASC and were asked provide feedback on an example visual story of 'The Snow Queen'.

5.2.1 Aims

We had set three main aims set for the workshop.

- **Aim 1**: Determine whether the design of the visual stories is suitable for children of our target age group.
- **Aim 2**: Determine if any parts of the example visual story are unclear or difficult to understand for children of our target age group.
- **Aim 3**: Determine if children of our target age group feel that any important aspects are missing from the example visual story.

5.2.2 Method

Participants

The participants were 10 typically developing children and young teenagers (7 girls and 3 boys) between the age of 7 and 12. Most of the participants had already taken

part in the design workshop and agreed to be contacted again for the evaluation workshop. The other participants were contacted through the university. The workshop was divided into three sessions.

- **Session 1 and 2**. The participants of sessions 1 and 2 were members of a Brownie group. The sessions were run at their usual meeting place, a church hall, and in parallel with five other workshop sessions.
- **Session 3**. The participants of session 3 were children of Informatics staff. The session was run in a room within the university that was separate from the rooms where other workshops were conducted.

Session	**Participant**	**Gender**	**Age**
Session 1	P1	Female	8
	P2	Female	7
	P3	Female	7
Session 2	P4	Female	10
	P5	Female	9
Session 3	P6	Female	11
	P7	Female	12
	P8	Male	8
	P9	Male	9
	P10	Male	7

Table 7. Details about the participants of the evaluation workshop

Material

For the workshop sessions we used a printed version of a visual story about a fictional relaxed performance (see Appendix A). The performance was called 'The Snow Queen' (based on a fairy tale by Hans Christian Andersen) and had been chosen as it was considered a typical example. It was assumed that some but not all of the participants would be familiar with its storyline which would have allowed for a greater variety of perspectives. The visual story was created in a way that it contained a majority of the tool's default descriptions that could be edited by the user. It contained information about the venue, the characters, the performance and possible triggers. Whenever possible, the described information where presented together with a picture.

The venue was fictional and the pictures that we used to present the venue were parts of venues from outside the UK. This was done to avoid any of the participants recognizing the venue and using previous knowledge to fill in any missing parts. The descriptions of the performance, the characters and the triggers were also fictional. However, the pictures we used were pictures from an actual relaxed performance of 'The Snow Queen' that had been conducted by an English theatre.

To encourage the children to think about positive or negative aspects of the different pages of the visual stories, we provided them with red and green stickers.

Procedure

Before each workshop session took place, we sent out information sheets and consent forms to the participants and their parents/guardians and encouraged them to ask questions if anything was unclear. Those participants that had not participated in the design workshop session, as well as their parents/guardians, were asked to fill in and return the consent forms to use before the workshop.
On the day of the workshop, all participants were reminded that they could leave or take a break at any given time without having to give a reason and asked to confirm that they felt confident with us audio recording the workshop sessions. As all participants confirmed that they felt comfortable to get recorded, we used a voice recorder to capture what was said during the session. We then started with the activity.

Activity 1: Providing feedback on a visual story

The activity started by explaining the purpose of the website and by making the participants aware that the aim of the visual story was to help children who are afraid to go to the theatre because they do not know what to expect. We told the participants that while they themselves might not be afraid to go to the theatre, their feedback and help would be very valuable to determine whether the story was easy to understand or whether anything in the story had to be changed.

The visual story was then read to the participants (and the pages with the pictures were shown to them), one page at a time. After each page, the participants were asked whether they considered the page helpful and understandable. They were encouraged to point out if anything was unclear or confusing – this included the pictures, descriptions and the design. To get an overall impression of the participants' opinions, the participants were provided with red and green stickers. They were told that they could use the stickers to indicate any positive or negative aspects of each page by putting a green (positive) or red (negative) sticker next to it. When a participants put a sticker, they were asked whether they would be willing to share their thoughts on why they had put the sticker on the page. This was intended to help us better understand their reasoning.

5.2.3 **Results**

All the participants confirmed that they considered the visual story to be helpful and suitable for a child who is afraid to go to the theatre. During all three sessions, the participants engaged well with the visual story and provided valuable feedback. Two examples of pages that were commented on by the participants are shown in Figure 35.

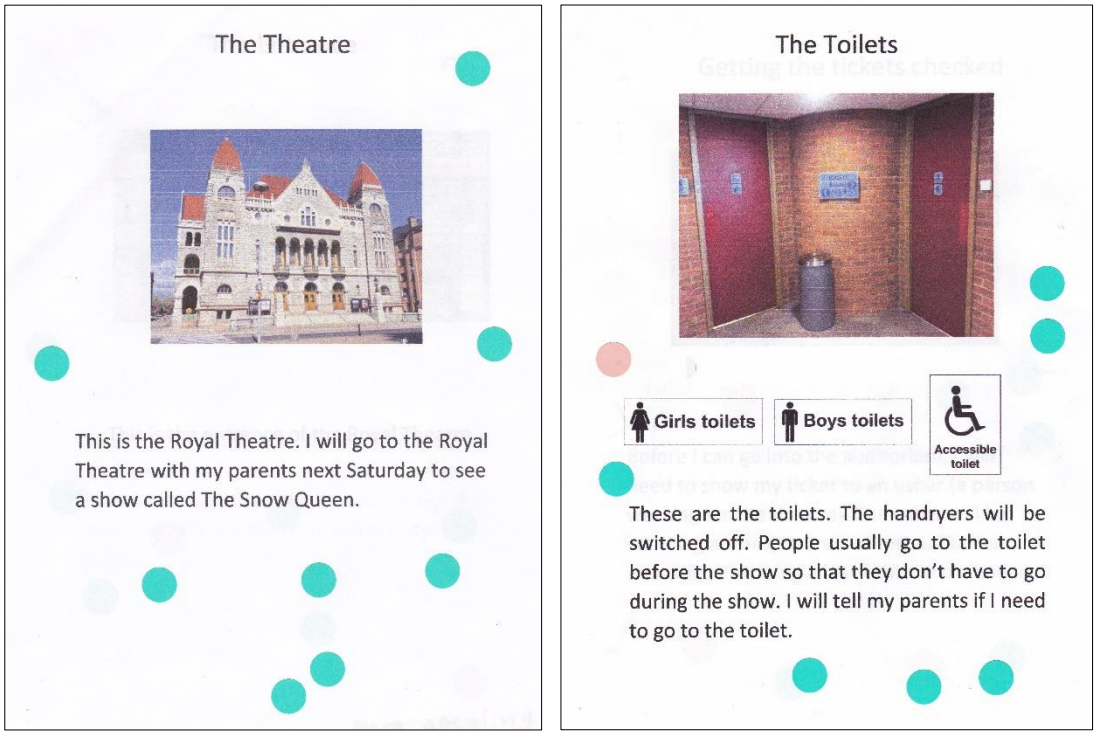


Figure 35. Two pages of the visual story that the participants provided feedback on during the evaluation workshop

One very important aspect that was raised in sessions 1 and 3 was with regard to the list of (visual and auditory) triggers. **P1, P2, P6** and **P7** agreed that depending on the description of the triggers, they sound a bit scary and might increase the child's anxiety rather than reduce it. Two examples from the story that they referred to were 'People are pretending to fight' and 'It will be very dark on stage'. When discussing this point, the participants agreed that it could be helpful to use more positive wordings or to add more guidance as to how the child could deal with the situation in which the trigger occurs. **P1** also mentioned that it should be highlighted, rather than just mentioned in the text, which list refers to the visual and which refers to the auditory triggers.

Related to this notion was the feedback that **P8** provided on the pictures as they felt that some of the pictures did not look welcoming and appealing enough and might therefore not help the child to build up excitement before the performance. **P6** and **P7** also stated that it should be made very clear that the ushers who are working for the

theatre are very friendly and there to help the theatre visitors. In general, they pointed out that it is important for the child to know whom they could ask if they need help. **P4** emphasized the particular case that when a child gets lost in theatre, the visual story should explain to them whom they could ask for help or how they should react.

In all three sessions the participants provided feedback on some words that they felt might be difficult to understand. These words included 'to pretend', 'to be confused' and 'handryers'. The majority of the more difficult words that were specific to theatre performances and that were explained in the story were evaluated by the participants as being too difficult and therefore hard to remember. These words included 'auditorium', 'foyer', 'usher' and 'interval'. In the following discussion the participants all agreed that it would be helpful to use easier words like 'stage' or 'break'.

Several other points were raised by the participants. **P7** pointed out that it should be made clear in the story that it is possible to go to the toilet at any given time during the performance. **P5** considered a map of the theatre to be very helpful. **P4** and **P5** agreed that it would be useful for the children to know when exactly they will need earplugs. During the discussion, they both thought that it would be good to provide warnings during the performance as to when the earplugs will be needed. **P1** mentioned that the story should specifically address the question if the child will be able to eat popcorn or sweets during the theatre visit.

P7 emphasized that it should be made clear in the visual story which of its elements generally apply to theatre performances and which only apply to one specific performance.

5.3 Interviews with Experts

To gather feedback on the design and content of the high-fidelity prototype, we conducted three expert interviews. One of the experts was a theatre professional who had conducted relaxed performances for several years and the other two experts had a background in usability, design for ASC and Social Stories. All the experts were presented with the high-fidelity prototype and asked to comment on its design and content.

5.3.1 Aims

We had set three main aims set for the evaluation interviews.

- **Aim 1**: Evaluate the design of the tool with regard to the target audience.
    - Are there any aspects of the design that would make the tool difficult to use or easily lead to errors?

- **Aim 2**: Evaluate the suitability of the tool's content with regard to the target audience.
- **Aim 3**: Determine useful future extensions for the tool.

5.3.2 Method

Participants

An overview of the participants and their areas of expertise is presented in Table 8. All three experts had already contributed to the project by either informing the design (E1) or by providing feedback on one of the low-fidelity prototypes (E6 and E8).

Expert	Position	Areas of expertise
E1	Head of Creativity and Diversity at a theatre in the UK	Relaxed performances, accessibility, inclusive arts practice
E6	Research Postgraduate Student at the University of Edinburgh	Human-Computer-Interaction, Technology Enhanced Learning, Interaction Design
E8	Research Associate at the University of Edinburgh	Assistive Technologies, Educational Technology, Technology for Autism, Social Story Interventions

Table 8. Details about the participants of the expert evaluation interviews

Procedure

The participants were contacted via email and asked whether they would agree to take part in an interview to help evaluate the high-fidelity prototype. If so, a suitable date and time for the interview was arranged. If the participants had not previously done so, they were asked filled in a consent form, that they were given together with an information sheet about the project (both can be seen in Appendix B). On the day of the interview the participants were encouraged to ask any questions they had and reminded that they could end the interview at any point without having to give a reason. As all participants agreed, we audio recorded the interviews with a voice recorder.
E6 and **E8** provided feedback in a combined session.

Interview Structure

During the interviews, the participants were presented with the high-fidelity prototype. They were asked to comment on anything that they considered good or bad in terms

of its usability and content. They were also asked whether they considered the design of the high-fidelity prototype to be generally suitable for the target audience.

5.3.3 **Results**

All three experts confirmed that the tool had a lot of potential and that the design was suitable for the target audience of theatre professionals and practitioners. **E1**, who was a theatre professional themselves stated that they "really liked" the tool and that they would like to invite several other theatre professionals and practitioners to present it to them as soon as it would be fully functioning. **E1** considered it "tremendous as a tool for [the practitioners] to save time". **E8** stated that "it's easy to work with this tool" and **E6** agreed that the tool "is simple and well-structured".

The experts pointed out several aspects that they considered to be particularly well designed or helpful for the target audience. **E1** commented positively on the font size, the presence of the information buttons and some of the default descriptions and headings. **E8** also considered the option to set the font/background colour of the visual stories as very helpful. **E6** and **E8** agreed that providing guidance and information about the sections was a helpful feature for the target audience. The confirmation window that appeared when a user wanted to delete a visual story or a page in a visual story was also considered as helpful by **E6** and **E8**.

The experts pointed out some elements of the tool that could be changed or built on in the future. **E1** suggested some small changes in the wording. This included changing 'song texts' to 'song lyrics' and 'where the seats are' to 'auditorium'. These changes were incorporated directly after the evaluation interview. **E1** also suggested to encourage the users to present some parts of the venue with and without theatre visitors, to add more examples to the visual story guide and to dedicate a new section or one or more pages in an existing section to the journey to and from the venue. These changes were left as future extensions to the tool.

E6 and **E8** suggested several extensions and modifications for the visual story guide. One idea was to make the visual story guide more interactive, constructing it as a tutorial with sections to complete and a progress bar, rather than just a platform to provide information. They also pointed out that the current visual story guide contained a lot of text and that it would be more appealing to the users to be presented with more pictures or short explanatory videos. **E8** suggested to refer to the different buttons and icons by pictures or by pointing to them in a screenshot. This suggestion was incorporated into some parts of the visual story guide after the interview.

E6 and **E8** pointed out that the welcome page and the explanation page (at the beginning of the visual story creation process) could be incorporated differently. **E6** suggested to add the welcome page as an option to the menu and **E8** suggested pop-ups throughout the visual story creation process instead of the explanation page. **E8** also suggested to provide the information about the sections by hoovering over the section names rather than by clicking on the information buttons. As these suggestions

would not affect the informational content, we would argue that more feedback from the target audience has to be obtained to know which design they prefer. Obtaining this feedback and incorporating potential changes was left as a future extension.

E8 pointed out that the position of the 'Add visual trigger' button was inconsistent with the position of the other buttons so we relocated it after the interview. **E8** further proposed to save the story title automatically without clicking on a button, to name the arrows at the bottom 'back' and 'next' instead of after the page they point to, to replace the 'Delete page' button and to highlight the visual story that is currently selected in the visual story library. **E6** also pointed out that the colour scheme for the buttons might not be ideal. However, we consider these to be design decisions that should be made based on the preference of the target audience.

5.4 Discussion

To evaluate the design and content of the high-fidelity prototype we used three different evaluation methods. To get an impression of how usable the tool was for first-time users, we handed out a feedback survey to Informatics staff and students at a project feedback event. We then organized an evaluation workshop with neurotypical children to learn about the helpfulness of the visual stories that could be created with the tool and whether the stories were engaging and fully understandable. Finally, we conducted three expert interviews to obtain feedback on the suitability of the tool for the target audience.

The results of the feedback survey showed that none of the participants did not have any major problems to understand the structure or the different functions of the visual story tool. The majority of the participants strongly agreed that they considered the tool to be easy to learn and use and that target audience would like to use the system. The only survey item that significantly fewer participants agreed strongly with was 'I found that the various functions in the tool were well integrated'. This outcome is consistent with our results from the expert interviews. The experts unanimously agreed that the tool was easy to use and suitable for the target audience but suggested several changes to the design that also concerned the integration of the different functions. It can therefore be assumed that current design provides a solid foundation but still contains elements that need to be further refined and adjusted. Ideally, these refinements would be chosen based on the preference of the target audience.

During the evaluation workshop, the children engaged well with the printed visual story that was created to support a fictional relaxed performance of 'The Snow Queen'. All children agreed that the visual story would be a helpful aid for children who are afraid of going to the theatre. They also provided valuable feedback on the content and language used in the visual story. This helped us to determine some changes that should be made to the default descriptions in the tool.

6. Discussion

6.1 Significance and Conclusion

The presented project was centred around the design of a web-based visual story tool to support relaxed theatre performances for children with ASC. The design of the tool was informed by the existing literature, interviews with experts and the results from a design workshop with neurotypical children who acted as proxies for children with ASC. Several low-fidelity prototypes and one high-fidelity prototype of the tool were designed and evaluated with the intention to develop a final design for the tool that would guide the user in terms of the functionality of the tool and the design of the visual stories, simplify the creation process of the visuals stories but still allow the user to create individualized visual stories for different performances and children.

The results from the feedback survey and evaluation interviews with experts indicated that the design of the tool was considered suitable for the target audience of theatre professionals and practitioners and that the tool was easy to learn and use. The experts also agreed that the tool would allow the target audience to create visual stories that were helpful for children with ASC. The theatre professional in particular emphasised the potential of the tool as an information source and time saving device.

However, the results from the feedback survey and evaluation interviews indicated that some functions would need to be integrated differently into the structure of the tool. As stated by the experts, this was in particular related to how the information about the functionality of the tool and the visual story creation process were presented to the user. The expert suggested different possible solutions to this problem. To determine which of these solutions would be the most appropriate one, we considered it to be necessary for the target audience to provide feedback on the proposed solutions. As such a feedback study was not within the scope of the project, we consider it to be an important aspect of future work.

The results from the evaluation workshop showed that a visual story that contained many of the proposed default descriptions for the tool was received well by neurotypical children of our target age group. The children engaged well with the visual story and critically reflected on the content and language. All children confirmed that they considered the visual story to be helpful for children who are afraid to go to the theatre. Their feedback was also considered as valuable guidance for improvements to the default descriptions for the pages in the tool and the guidance that it offered to the user to support the visual story creation process.
Due to the limited scope of the project and as we intentionally focused on the design of the visual story tool rather than its implementation, many functions that were integrated into the high-fidelity prototype were not fully implemented. While none of

the participants in our studies indicated that this posed a problem to their evaluations, it needs to be taken into consideration when analysing their suggestions. A full implementation of the tool would create the basis for a variety of further studies and methods of evaluation.

6.2 Future Work

One major area of future work is to conduct further research as to how the different functions that were proposed for the tool could best be integrated into its structure. The final solutions would need to take into account that the relevant information need to be available to the user at any given time and that it is clearly visible for the user how they could obtain these information. However, the solution needs to avoid to repeatedly present information to the user they do not require, adding cognitive load and possibly decreasing the user's enthusiasm to use the tool. A good starting point for this research are the suggestions made by the experts in the evaluation interviews.

Another area of future work would be to extent and refine the visual story guide. While it currently offers some general guidance for the content of the visual stories, only a small number of examples were be provided. It could therefore be useful to add further information, potentially also about the benefits and challenges that are associated with relaxed theatre performances. As suggested in the evaluation interviews, the users might benefit from further interactive elements or short explanatory videos. With more information added, it could be helpful to restructure the visual story guide or to add a search function. Another suggestion was to incorporate parts of the visual story guide as pop-ups into the visual story creation process. Here it could be researched whether potential users would find this feature helpful. If so, it can be considered as a valuable extension to the tool.
After having refined the visual story guide, an evaluation study with theatre professionals and practitioners could help to determine the helpfulness of the provided information and features in the visual story guide. The study could also help to determine further extensions or areas of improvement.

After the integration of the functions has been refined, we consider a full implementation of the visual story tool to be an important next step. This includes the implementation of several additional features that were suggested by the experts throughout the design and evaluation process. This is a list of those suggestions that were considered as beneficial but were lying outside the scope of the project:

- **Suggestion 1**: Add setting options to change the font size of the tool and of the visual stories.
- **Suggestion 2**: Add an option to change the number of pictures that can be added to each page of a visual story.
- **Suggestion 3**: Provide a link to a database of current and previous relaxed performances.

- **Suggestion 4**: Provide a link to a database of visual stories that have previously been created for relaxed theatre performances.
- **Suggestion 5**: Provide an option for the user to edit and resize their pictures before uploading them.
- **Suggestion 6**: Add a possibility to create a voice-over for the visual stories.
- **Suggestion 7**: Highlight a visual story in the visual story library when a user clicks on it.

Building on the full implementation, we propose to conduct another evaluation study in which theatre professionals or practitioners were asked to use the tool to create a visual story for a relaxed performance. Such a study is considered useful as it would provide further insight into the usability of the tool and potential new areas of improvement. If the theatre professionals or practitioners would decide to use one or more of the visual stories that they have created with the tool to support a relaxed performance, it would also be helpful to obtain feedback from the children with ASC that have used the visual stories and/or their parents/guardians. Their feedback could concern the usefulness or the design of the tool as well as any missing or redundant elements. It could be gathered through interviews or a feedback survey.

Bibliography

Access London Theatre (n.b.). *Your Guide to Putting on an Assisted Performance*. London: n.b.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. American Psychiatric Pub.

Autism: a guide for theatres. (2016, January 22). Retrieved from http://www.autism.org.uk/professionals/others/theatre.aspx

Baird, G., Simonoff, E., Pickles, A., Chandler, S., Loucas, T., Meldrum, D., & Charman, T. (2006). Prevalence of disorders of the autism spectrum in a population cohort of children in South Thames: the Special Needs and Autism Project (SNAP). *The Lancet*, 368(9531), 210-215.

Brugha, T. S., McManus, S., Bankart, J., Scott, F., Purdon, S., Smith, J., Bebbington, P., Jenkins, R., & Meltzer, H. (2011). Epidemiology of autism spectrum disorders in adults in the community in England. *Archives of General Psychiatry*, 68(5), 459-465.

Charman, T., & Stone, W. (Eds.). (2008). *Social and communication development in autism spectrum disorders: Early identification, diagnosis, and intervention*. Guilford Press.

Circus Starr 'Show and Tell' App. (2014). Retrieved from http://showandtell.circus-starr.org.uk/the-app/

Corbett, B. A. (2016). Autism, Art, and Accessibility to Theater. *AMA Journal of Ethics*, 18(12), 1232.

Dawson, G. (2013). Dramatic increase in autism prevalence parallels explosion of research into its biology and causes. *JAMA Psychiatry*, 70(1), 9-10.

Fletcher-Watson, S. (2014). A targeted review of computer-assisted learning for people with autism spectrum disorder: Towards a consistent methodology. *Review Journal of Autism and Developmental Disorders*, 1(2), 87-100.

Fletcher-Watson, B. (2015). Relaxed performance: audiences with autism in mainstream theatre. *Scottish Journal of Performance*, 2(2), 61-89.

Frith, U. (2003). Autism: Explaining the Enigma. 2 ed. *Oxford: Blackwell Publishing*.

Gray, C. (2015a). *Comparison of Social Stories™ 10. - 10.2 Criteria* (p. 1). Retrieved from http://carolgraysocialstories.com/wp-content/uploads/2015/09/Social-Stories-10.0-10.2-Comparison-Chart.pdf

Gray, C. (2015b). *It's NOT a Social Story if... A screening instrument* (p. 1-3). Retrieved from http://carolgraysocialstories.com/wp-content/uploads/2015/09/It-is-NOT-a-Social-Story-if....pdf

Gray, C. (2012). What are Social StoriesTM. *Using storytelling to support children and adults with special needs: Transforming lives through telling tales*, 95-101.

Gray, C. A., & Garand, J. D. (1993). Social stories: Improving responses of students with autism with accurate social information. *Focus on Autistic Behavior*, 8(1), 1-10.

Grynszpan, O., Weiss, P. L., Perez-Diaz, F., & Gal, E. (2014). Innovative technology-based interventions for autism spectrum disorders: a meta-analysis. *Autism*, 18(4), 346-361.

Ideishi, R. I., Cohn, E. S., Orsmond, G. I., Wintrol, J., Whalen, M. L., Nickolaus, S., Swanson, J., Siegel, B. (2013). Sensory Friendly Programming For People with Social & Cognitive Disabilities.

Karkhaneh, M., Clark, B., Ospina, M. B., Seida, J. C., Smith, V., & Hartling, L. (2010). Social Stories™ to improve social skills in children with autism spectrum disorder: A systematic review. *Autism*, 14(6), 641-662.

Kempe, A. (2014). Developing social skills in autistic children through 'Relaxed Performances'. *Support for Learning*, 29(3), 261-274.

Kempe, A. J. (2015). Widening participation in theatre through 'relaxed performances'. *New Theatre Quarterly*, 31(01), 59-69.

Kokina, A., & Kern, L. (2010). Social Story™ interventions for students with autism spectrum disorders: A meta-analysis. *Journal of Autism and Developmental Disorders*, 40(7), 812-826.

Levy, S. E., Mandell, D. S., & Schultz, R. T. (2009). Autism. *Lancet*, 374(9701), 1627.

Logan, C. (2014, September 26). *How we made the Show and Tell circus app for children with autism*. Retrieved from https://www.theguardian.com/culture-professionals-network/culture-professionals-blog/2014/sep/26/show-and-tell-circus-app-autism

Matson, J. L., & Shoemaker, M. (2009). Intellectual disability and its relationship to autism spectrum disorders. *Research in Developmental Disabilities*, 30(6), 1107-1114.

Parsons, S., & Cobb, S. (2011). State-of-the-art of virtual reality technologies for children on the autism spectrum. *European Journal of Special Needs Education*, 26(3), 355-366.

Pellicano, E., Dinsmore, A., & Charman, T. (2014). What should autism research focus upon? Community views and priorities from the United Kingdom. *Autism*, 18(7), 756-770.

Perko, S., & McLaughlin, T. F. (2002). Autism: Characteristics, causes and some educational interventions. *International Journal of Special Education*, 17(2), 59-68.

Potter, S. (2013, August). *Relaxed Performance Project 2012/13: Evaluation Report*. Retrieved from http://www.includearts.com/wp-content/uploads/2015/10/Relaxed-Performance-Pilot-Project-Evaluation-September-2013.pdf

Preece, J., Rogers, Y., & Sharp, H. (2015). *Interaction Design: Beyond Human-Computer Interaction* (Fourth ed.). John Wiley & Sons Ltd.

Rapin, I., & Tuchman, R. F. (2008). Autism: definition, neurobiology, screening, diagnosis. *Paediatric Clinics of North America*, 55(5), 1129-1146.

Roberts, R., Beadle-Brown, J., & Youell, D. (2011). Promoting social inclusion for children and adults on the autism spectrum-reflections on policy and practice. *Tizard Learning Disability Review*, 16(4), 45-52.

Scaife, M., & Rogers, Y. (2001). Informing the design of a virtual environment to support learning in children. *International Journal of Human-Computer Studies*, 55(2), 115-143.

Social Stories Creator & Library. (n.d.). Retrieved from http://touchautism.com/app/social-stories-creator-library/

StoryMaker. (n.d.). Retrieved from http://www.handholdadaptive.com/StoryMaker.html

Tomchek, S. D., & Dunn, W. (2007). Sensory processing in children with and without autism: a comparative study using the short sensory profile. *American Journal of Occupational Therapy*, 61(2), 190-200.

United Nations (2007). *Convention on the Rights of Persons with Disabilities*. New York, NY: UN.

Welcome to Inside the Magic!. (2015). Retrieved from http://www.digitalopps.co.uk/insidethemagic/

Wing, L. (1996). The Autistic Spectrum: A Guide for Parents and Professionals. *London: Constable.*

Wing, L., & Gould, J. (1979). Severe impairments of social interaction and associated abnormalities in children: Epidemiology and classification. *Journal of Autism and Developmental Disorders*, 9(1), 11-29.

Appendix A – Design/Evaluation Workshop Content

The information sheets and consent forms that were given to the participants of the design workshop and their parents/guardians. The workshops of four other students were run in parallel so the documents contain the combined information of all five projects.

The documents that were handed out before the evaluation workshop were identical with some slight adjustments to the wording being made, making the participants aware that they could decide to be ‘games testers’ rather than ‘games/web designers’ as in the previous workshop.

The visual story was presented to the participants during the evaluation workshop.

APPENDIX A1 – Parent/Guardian Information Sheet

Orisa's workshop explores children engage with object props combined with augmented reality, using a tablet computer. To improve the game environment in order to inspire pretend play, she will see what factors ignite the child's imagination and enthusiasm to play. The amount of pretend play as a result of introducing different augmented objects will be assessed. The object design and play of the game will be informed by the children's ideas, and their interaction with the augmented reality system, and designs of objects and characters, will provide design insight and ideas from a user's perspective.

Lucy's workshop aims to find out what children think an educational app should be like. She has prepared fictional characters for the children to make apps for. There are two different activities prepared so that children with a range of ages and abilities can participate. Each child will work with a partner, within a small group of children. They will take part in a group brainstorming activity, and in a design activity using art materials. Their participation will inform the design of the application and will highlight areas for further research.

What happens during a workshop session? We will introduce ourselves to the children and explain what we will be doing in the workshops. We will check that we have their consent to participate, and remind them that they can stop at any time, without having to give a reason. Each workshop will have a variety of activities, and will last about 30 minutes. They can choose to participate in one or more workshops. At the end of each workshop we will offer them a break, and juice and a snack (raisins or a naked bar). We will stop at the time you request, or when they choose to, whichever is sooner.

Video recording: We would like to video and audio record each workshop, to provide a record for later analysis and allow us to freely interact with your child without worrying about taking notes. If you prefer that we do not use videos or pictures of your child for publications, presentations or teaching purposes, you can indicate this on the permission form. In that case, the video will only be seen by the research team during the analysis. If you are not comfortable with your child being videoed at all, then your child should not participate in this particular study.

Additional study information

Will this project teach my child new skills? This project is not a type of therapy or intervention, and will not teach children new skills or improve existing skills. However, what we learn may be used in future games or apps that could help children with ASC.

What happens when the project is over? After the study has finished and we have analysed the information we collected, it will be used to inform the design of the game or website, and eventually presented in a final report. This report along with the data

and recordings may be shared or presented in scientific journals or conferences. We never share children's names, schools or other personal information.

How will personal information be protected? Confidentiality is extremely important to us. Recordings and other information (e.g. forms with children's names and DoB) will be stored safely on password-protected computers or in locked cabinets. Access will be limited to the research team (listed above). All information will be identified by participant codes or pseudonyms, and will be separated from identifying information.

Can I have a copy of the games? The final games developed will be 'proof of concept', designed to answer specific questions. They do not have the same functionality, amount of content, or documentation as commercial games. They may be made available online, for free unlimited use. If so, we will send you a link and instructions for use.

Who paid for this research? This study is part of the undergraduate work for the main researchers, paid for, indirectly, by the University of Edinburgh. Conducting this research brings no financial benefit to the researchers or to the university.

Would you like to participate?

We ask parents to read this information sheet so you can decide whether you think it is a good idea for your child to participate as a games designer.

If you say "yes" on the consent form, we will explain the game designer role to your child, and ask if they want to help. We will remind them that they can stop at any time, without giving a reason, and that we will always listen to them. We will check that they agree to be video/audio recorded. We feel strongly that children should be given a real choice about whether to participate. Even if you say "yes", your child may still say "no" if they do not want to be a game designer. We will respect your child's decision.

If you say "no", we will not contact you again about this study and will not speak to your child about being a games/web designer.

This study is *completely voluntary* and you and your child are under no obligation to take part. You may withdraw your child from the study *at any time and for any reason* by contacting us. Your child may also withdraw at any time by saying that they does not want to be a game designer any more.

Thank you for taking the time to read this.

If you would like to know more about this research and/or if you have questions, please contact one of the main researchers listed above.

Designing games and websites for children with ASC:

Information sheet for parents and guardians

This information sheet is for parents and guardians. It describes a research project at the University of Edinburgh in which we would like your child to participate. It gives information about the project in the form of questions you might have and their answers. If you have further questions, we are happy to discuss them and give you more information.

The student researchers on this project and their contact details are as follows:
Mr. Karel Kuzmiak (s1334628@sms.ed.ac.uk; 07393617563)
Mr.Javin Singh (s1241857@sms.ed.ac.uk ; 07568329878)
Ms.Christina Bremer (s1341598@sms.ed.ac.uk; 07754080251)
Ms. Orisa Ngampakdeepanich (s1309783@sms.ed.ac.uk; 07895863725)
Ms. Lucy Parker (s1103154@sms.ed.ac.uk; 07508813933)
Prof. Helen Pain, research advisor (helen@inf.ed.ac.uk)

University of Edinburgh, School of Informatics
Informatics Forum
10 Crichton Street
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EH8 9AB

Please return the parent consent form to one of the researchers if you give permission for your child to participate in the project.

An overview of this project, and how you can help

What are the project research goals?

Charles is investigating how tablet games might help children with Autism Spectrum Conditions (ASC) improve their communication and cooperation skills, since they often have trouble initiating interactions and communicating with others. Various methods exist that help improve their communication skills and interaction frequency that use either music or puzzles, but almost none that combine both. We are interested in finding out if using a combination of these in a game can have a positive effect on the communication quality and interaction frequency.

Christina is investigating how to design a website with social stories for children with ASC who want to attend a theatre performance. Social stories are written to describe social interactions, situations, behaviours, skills or concepts. Theatres can use these to support 'relaxed performances' that are especially adapted to the needs of children with ASC (e.g. that have reduced lighting and sound). The research is conducted to inform the design of the website as well as the content of the social stories.

Javin is examining how tablet games might help children with ASC improve their problem solving and social empathy, since these are skills they often have trouble with. There are currently many graphic adventure games that teach either problem solving or social empathy, but very few that combine both in a setting children may find themselves in. We are exploring the merits of combining these two attributes to improve problem solving skills and social empathy.

Orisa: Lack of imagination has been identified as one of the main ASC characteristics. Specifically, pretend play is a significant diagnostic indicator of childhood autism and is closely related to critical developments such as symbolic thinking, language and social interaction. Pretend play is also linked to the ability to understand other's mind. To encourage more spontaneous pretend play in children with ASC, augmented reality will be incorporated into a tablet game to help expand their imagination and creativity.

Lucy: People of all ages with ASC often have difficulty with planning (breaking a task down into smaller steps and putting them in order) and self-monitoring (evaluating whether or not their actions are helping them reach a goal). The aim of this project is to create an app or game which helps primary-age children improve their skills in these areas, and that is motivating to play.

What is the goal of each workshop and how can my child help?

Charles: Through research and interviews with teachers and other experts, we have created an initial design for a tablet game that uses music in combination with puzzle elements, to encourage children to interact and communicate with others more. We want to explore how it might work and how the design could be improved. We would like your child to play with the game prototype as a "Game Designer". We will observe them play, and interact with the prototype, and then ask them for their opinions.

Christina aims to find out what children find important when they go to the theatre and how they would describe a theatre visit to someone who has never been to the theatre. To do this, we have prepared three activities that involve a fictional character who does not know anything about theatre visits. We would like your child to take part in activities which will mainly involve sharing ideas, building still images and drawing.

Javin's design workshop aims to evaluate children's reaction to interactive problem solving activities in existing games. They will be invited to play parts of games which involve problem solving of varying difficulty. Through observation, numerical data and verbal feedback, the appealing and unappealing mechanics of current games will be isolated. Children's opinions, as game designers, on the appeal of the settings, characters and puzzle styles, will enable a better game to be developed.

APPENDIX A2 – Parent/Guardian Consent Form

Research permission form (for parents)

	Please circle
Have you read the information sheets?	YES / NO
Have you received enough information about the study?	YES / NO
Do you understand that participation is completely voluntary and your child can leave the study at any time, without having to give a reason?	YES / NO

Please sign this page to indicate that you understand and accept the conditions of this study, including audio and video recording. By signing, you agree that the researchers may explain the study to your child and invite him or her to take part as a game/web designer.

With reference to further anonymous use of photographic,audio or video data, please circle yes or no in response to the following:

I AGREE that short videos/images of my child can be used as examples in documents and presentations for research and/or teaching purposes.
YES / NO

If you give permission for this study, please return this form to the researchers.

If you DO NOT wish to give permission, you do not need to this. We will not ask your child to participate.

Full name of participating child:

Child's date of birth (DD/MM/YYYY): _____/_____/_____

Your relationship to the child:

Your name (please print clearly):

Contact telephone number: _____

E-mail address: _____

Preferred method to reach you?

Signature:

Date: _____/_____/_____

Parent design workshop permission form 1/1 November 2016

APPENDIX A3 – Child Information Sheet

Charles: Some children find it hard to talk to other children. You can help us design a 'music puzzle' game for them. To play the game, the players listen to a tune, which then breaks into smaller parts. The players work together to put the tune back together again. They have to talk about it and agree on which part goes where. You can help us decide what the game should look like and how it will be played.

Christina: Some children feel nervous about going to the theatre when they don't know what will happen there. To help these children, Christina and Helen want to build a website that shows them what will happen during their theatre visit. To build the website, they need to learn about what children find important when they go to theatre and how the website needs to look so that children find it interesting and easy to understand.

Jeff: Some children have difficulty recognising what others are feeling, and how they could help others. Jeff and Helen want you to help them design the best game possible, to help the players learn to help others. The game is a point and click adventure game. You will play as a character and move through an adventure world. Your character will find other characters who need different kinds of help.

Orisa: Some children find it hard to take part in 'pretend' play. Orisa and Helen are creating a game to help children to be more imaginative and creative when they are playing. As a games designer, you will try out an "augmented reality" game (this is a new type of game - we will show you this) and design new characters and objects for the game. You will help to develop stories for the children to explore in the game, and invent ways in which the characters can play, have adventures and solve problems.

Lucy: Some children find it hard to do things that have a lot of different steps, like baking a cake or going to the shops. They may not remember what to do next, or know what they have to do to solve a problem. Lucy and Helen are going to make a game to help these children learn to do this. The game will be set in a zoo and you can help us decide how to plan the day out, and what things children might want to do at the zoo. You can also help us decide what the game will look like.

All the games will be designed to be fun to play. No one wins or loses. Some children may find some of the design activities easy and some may find them harder - that is OK. Everyone can help - your ideas will help us to design better games.

What will happen if I help? You will either come to the workshop at the University of Edinburgh, or if you are in the Brownies we will come to where you meet. We will tell you more when we meet with you. You will get to do different activities in each workshop.

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You can tell Helen or one of the researchers if you want to stop doing any of the activities. You do not have to tell them why. Please tell them if you want to take a break (or if you need the toilet). You can also say if you do not want to be a game designer any more, and that is OK. They will always listen to you.

The researchers will ask if it is OK to record you in the workshop, and when you are answering questions. This is because it is too hard for them to write down everything that happens.

What will happen after I am finished helping?
When you finish a workshop, you will be asked if you want to do another one. You can stop whenever you like. After all the workshops have finished, the students will watch the recordings to help them understand what you said, and what happened when you took part in the workshop. They will write about what they have learned. Sometimes they will show other people the recordings of you taking part in the different activities, so they can see what happened and how you helped.

Your mum or dad said it is OK for you to help us.

Do you want to be a games designer? You can say "yes" or "no".
It is OK to say "no". It will not hurt the researchers' feelings.

Do you want to ask a question about being a games designer?
It is OK to have more questions. You can ask them as many questions as you want. Ask your mum or dad to help you call the researchers on the phone or write an email with your question.

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Designing new computer games and websites to help other children
(to be read aloud to the child)

This page is for you as a game designer.
Some student researchers are organising game design workshops through the University of Edinburgh.
This tells you who the researchers are, and what they will ask you to do during the workshops.
You can help them by doing different activities, such as drawing, thinking of stories, listening to music, suggesting your ideas and answering questions.
You can decide if you want to help by saying "yes" or "no", and you can change your mind at any time.

The students who are the lead researchers on this project are:
Mr. Karel (Charles) Kuzmiak, (s1334628@sms.ed.ac.uk; 07393617563)
Mr. Javin (Jeff) Singh, (s1241857@sms.ed.ac.uk ; 07568329878)
Ms. Christina Bremer, (s1341598@sms.ed.ac.uk; 07754080251)
Ms. Orisa Ngampakdeepanich, (s1309783@sms.ed.ac.uk; 07895863725)
Ms. Lucy Parker, (s1103154@sms.ed.ac.uk; 07508813933)
Their research advisor is Prof. Helen Pain, (helen@inf.ed.ac.uk)

Who is organising the workshops? This is Charles, Christina, Jeff, Orisa, Lucy and Helen. Their job is to learn about how children use computers, and how to make computer games and websites that can help them do some things more easily. They will ask you to help them design some new games.

Charles Christina Helen Orisa Jeff Lucy

Why are we organising these workshops, and what will I do?

Some children find it hard to do things that you may find easy. We want to design computer games to help them. We think you can help us, by being a games designer. We have 5 different design workshops (you do not have to do all of them).

APPENDIX A4 – Child Consent Form

Child Consent Form

To be used as a guide for securing consent or refusal, after the child has had a chance to get information about the study. The child may mark (or be helped to mark) this form, or the child's consent/refusal may be video-recorded.

I can choose to be a games/web designer.

I do not have to help if I don't want to.

I can decide to stop participating or take a break.

I do not have to say why.

It is OK if I change my mind later, and say I do not want to be a games/web designer any more.

It is OK if some parts of the game are hard for me!

There are no wrong answers to questions.

Anything I can do is helpful.

Do you want to be a games/web designer? **YES** ☐ **NO** ☐

Charles, Christina, Jeff, Orisa, Lucy and Helen will listen to and watch the recording later.

They will show it to other people who make games for children.

Is it OK to take an audio/video recording? **YES** ☐ **NO** ☐

Write your name: _____

THANK YOU!

AP PENDIX A4 – Visual Story for the Evaluation Workshop

Gerda rides on the reindeer and finally arrives at the palace of the Snow Queen. In the palace, all the rooms look very similar so it takes her a lot of time to find Kai and the Snow Queen. When she sees them, the Snow Queen is about to turn Kai into an ice statue. Gerda runs to Kai and saves him. This shows how strong the friendship between Gerda and Kai is and makes the Snow Queen disappear forever.

Gerda continues her search with the carriage but she gets kidnapped by some robbers. The robbers take away her carriage and lock her up in a room.

In the room, Gerda meets the robber girl and tells her that she is trying to find Kai. The robber girl helps Gerda to break free and gives Gerda a reindeer to get to the palace of the Snow Queen.

Then the Snow Queen comes and invites Kai to come with her to her kingdom. Kai joins the Snow Queen without telling Gerda or his parents about it. This is only because the piece of the magic mirror inside him made him stop caring about Gerda and his parents.

Gerda is very sad that Kai has gone away because she wants to play with him again.

Gerda waits for several months and then decides to search for Kai. She takes a boat and sails down the river.

After Gerda has sailed down the river for several days, she decides to walk through the dark forest.

Gerda then comes to a castle. A princess lives in the castle. She gives Gerda a map, food and a carriage. The princess knows the Snow Queen and tells Gerda to search for Kai in the Snow Queen's palace.

The Robber Girl

The robber girl lives with a group of robbers. She helps Gerda to escape after the group of robbers has kidnapped Gerda on her way to the Snow Queen's palace.

The Play

Gerda and Kai are very good friends. They go to school together and they often play together.

One day, Kai gets hit by a piece of a magic mirror and becomes very unfriendly. He also stops playing with Gerda. Gerda is very confused because she doesn't know why Kai doesn't want to play with her anymore.

The Snow Queen

The Snow Queen is an evil woman who brings Kai to her kingdom. When the Snow Queen sees how strong the friendship between Gerda and Kai is, she disappears forever.

The Princess

The princess lives in a castle close to the dark forest. When Gerda comes to her castle, the princess gives her a map, food and a carriage because she wants to help Gerda to find Kai.

Gerda

Gerda is Kai's best friend. When Kai gets hit by a piece of a magic mirror and taken away by the Snow Queen, Gerda tries to find him. During her search for Kai, Gerda meets the princess and the robber girl. In the end, Gerda finds Kai and saves him from the Snow Queen.

Kai

Kai is Gerda's best friend. He is usually very friendly but because he gets hit by a piece of a magic mirror he becomes unfriendly. He goes with the Snow Queen to her palace. In the end, Gerda saves Kai.

During the show I will hear some things that I might surprise me. This is a list of things that I will hear during the show that might surprise me. If I am nervous or scared, I can take my mum's or my dad's hand or ask them to go to the foyer with me. If the music or the actors' voices are too loud, I can cover my ears with my hands. If I want, I can bring earplugs with me to the show.

Surprise	**When will it happen?**
Loud music and singing	At many times during the show
People are screaming	When the Snow Queen appears When Gerda is in the Snow Queen's palace
Thunder sounds	When Gerda is in the dark forest

The Characters

The characters that I will see during the show are played by actors. The actors play the same show many times. They play the show to tell a story. Sometimes during the show the actors might say that they are upset or angry. When the actors say that they are upset or angry, they're just pretending. Sometimes during the show the actors might cry or fight against each other. When the actors cry or fight against each other, they are just pretending. This is because they want to tell a story.

This is a list of characters that I will see during the show.

After one hour, there will be a 20-minute-break, called interval. During the interval I can stay in my seat or go to the toilet. Some of ushers will offer ice cream to the people in the audience. I can decide if I want to eat ice cream. 5 minutes before the break ends, I will hear a sound. After the interval, everyone will come back into the auditorium and sit in their seats. It will get darker and quieter, like at the beginning of the show.

At the end of the show, all of the actors will come back on the stage and bow. Many people will clap so that the actors know how much they liked the show. I can clap to let the actors know that I liked the show. The lights will come back on, this means that the show is over. I will leave the theatre the same way that I came in. When I leave the theatre, I will try to stay close to my parents.

Surprises

During the show I will see some things that might surprise me. This is a list of things that I will see during the show and that might surprise me. These things have all been practised before and are safe. Nobody will get hurt. If I'm nervous or scared I can take my mum's or my dad's hand or ask them to go to the foyer with me.

Surprise	**When does it happen?**
Smoke from the chimneys	In the second scene
People are pretending to fight	When Gerda gets kidnapped by the robbers
It will be very dark on stage	Before the Snow Queen appears
There is a fake fire on stage	After Gerda was kidnapped by the robbers

The Auditorium

This is the auditorium. The number of my seat is printed on my ticket. I cannot choose a seat. If I can't find the number on the ticket or the seat, I will ask my parents for help.

When I have found my seat, I will sit down and try to stay in the seat until the show starts. I can talk to my parents if I feel bored or nervous.

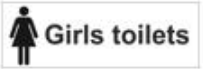
Show Notes

The show usually starts at 4pm but sometimes the show starts a little later. I will try to stay calm if the show starts later than 4pm. When the show starts, the lights will darken a little and the people in the auditorium will stop talking.

If I feel nervous or would like a break during the show, I can ask my parents to go to the foyer with me. I can come back to the auditorium later on.

If I like something during the show, I can clap. This will let the actors know that I like the part of the show. I can decide if I want to clap.

The Toilets



These are the toilets. The handryers will be switched off. People usually go to the toilet before the show so that they don't have to go during the show. I will tell my parents if I need to go to the toilet.

Getting the tickets checked

Before I can go into the auditorium, I will need to show my ticket to an usher (a person working for the theatre). The usher will be standing at the entrance of the auditorium and will be wearing a black shirt and a badge.

The Ticket Office

This is the ticket office. It is in the foyer of the Royal Theatre. With my parents, I may need to stand in line to collect our tickets. I will try to wait patiently when I stand in line to collect the tickets.

Getting to the stage

After my parents and I have collected the tickets, we will go through this door. It is next to the ticket office. Behind the door to the left are the toilets. Behind the door to the right is the auditorium (where the seats are).

The Entrance

This is the entrance of the Royal Theatre.

The Foyer

This is the foyer of the Royal Theatre. When I go inside the Royal Theatre I will be in the foyer. In the foyer on the left-hand side is the ticket office. There might be many people in the foyer when I arrive.

Visual Story for

The Snow Queen

The Theatre

This is the Royal Theatre. I will go to the Royal Theatre with my parents next Saturday to see a show called The Snow Queen.

Appendix B - Expert Interview Content

The information sheet and consent form that were given to the experts before the interviews. The paragraph called ‘Purpose of the interview’ in the information sheet was slightly adjusted based on the background of the respective expert and whether the interview was intended for design-informing or evaluation purposes.

APPENDIX B1 – Expert Information Sheet

THE UNIVERSITY of EDINBURGH
informatics

Interview Information sheet

Research project: **Designing a Web-Based Visual Story Tool to Support Relaxed Theatre Performances for Children with Autism** (UG final year project)

Leading researcher: Christina Bremer

Research supervisors: Prof Helen Pain and Dr Ben Fletcher-Watson

Research participant: xxx

Purpose of the Research
As for children with autism, crowds of people, loud noises, unfamiliar spaces and dimmed lighting can be very difficult to deal with, they have traditionally been excluded from mainstream theatre performances. To give these children a possibility to enjoy a live performance in a safe and non-judgmental atmosphere, some theatres have recently started to implement relaxed performances. These performances can, for example, include reduced intensity of lighting and sound, trained staff and a reduced audience size. To familiarise the children with the venue and production, some theatres have also circulated visual stories in advance of the performance. A visual story can be described as a short story that describes a situation, concept, or social skill in simple words. For theatre visits, visual stories can include character guides, song lists, photographs of the theatre, Makaton symbols and a 'list of surprises'.
The purpose of the project is to design a web-based tool that would allow schools or theatres to easily build a visual story for children with autism who would like to attend a relaxed performance. This would allow the children to better predict what will happen when they attend. It could also be used to help the theatres themselves to better understand the needs of theatregoers with autism.

Purpose of the Interview
To inform the design of the visual story tool, we would like to gather information about the content and design of visual or Social Stories that are currently used by practitioners. We would also like to find out how these stories are created and if there are any features that would be particularly useful to add to the visual story tool.

Procedures
If you agree to volunteer, you will be asked to participate in an interview which will take approximately 30 minutes. You will be asked several questions about your experience with the creation and use of visual or Social Stories as well as for advice on the design of the tool. With your permission, we will audio record the interviews in order to accurately capture what is said. The recordings will be transcribed, but your name will not be included in the transcriptions. The recording and transcription will be kept on a password-protected computer. Reports of study findings will not include any identifying information.

Risks
We do not anticipate any risks from your participation in this research.

Benefits
There are no direct benefits to participants in this research. We hope to learn more about how to best design a web-based visual story tool for children with autism who would like to attend a relaxed theatre performance.

Confidentiality
All information collected in this study, including your responses to interview questions, will be kept confidential. At no time will your actual identity be revealed. Recordings and other information will be stored safely on password-protected computers or in locked cabinets. Access will be limited to the research team (listed above). All information will be identified by participant codes or pseudonyms, and will be separated from identifying information. The data you give us will be used for the undergraduate project described above and may be used as the basis for articles or presentations in the future. We won't use your name or information that would identify you in audio recordings, publications or presentations.

Participation/Withdrawal
Your participation is completely voluntary, and you may withdraw from the study at any time. You may also skip any question during the interview, but continue to participate in the rest of the study.

Contact
If you have questions or concerns about this research, please contact:

Christina Bremer
University of Edinburgh, School of Informatics
Email: s1341598@sms.ed.ac.uk
Phone: 07754080251

You may also contact one of the research supervisors:

Prof Helen Pain
University of Edinburgh, School of Informatics
Email: helen@inf.ed.ac.uk
Phone: 0131 650 8485

Dr Ben Fletcher-Watson
University of Edinburgh, Institute for Advanced Studies in the Humanities
Email: ben.fletcherwatson@ed.ac.uk
Phone: 07184 842624

APPENDIX B2 – Expert Consent Form

Contact details of researcher:
Christina Bremer
University of Edinburgh, School of Informatics
Email: s1341598@sms.ed.ac.uk
Phone: 07754080251

Contact details of research supervisors:
Prof Helen Pain
University of Edinburgh, School of Informatics
Email: helen@staffmail.ed.ac.uk
Phone: 0131 650 8485

Dr Ben Fletcher-Watson
University of Edinburgh, Institute for Advanced Studies in the Humanities
Email: benfletcherwatson@gmail.com
Phone: 07184 842624

CONSENT FORM

Now that you have read the information sheet, and asked questions, it is up to you to decide whether you want to take part in the study. You are free to withdraw at any time, without giving a reason.

If you are happy to take part in this study, please complete the consent form below by ticking the boxes:

1. I have read and understood the information sheet. ☐
2. I have had all my questions about the study answered. ☐
3. I understand that my participation is voluntary, and I can withdraw from the study at any time without giving reasons. ☐
4. I am willing to take part in the project. ☐
5. I give permission for myself to be recorded with a voice-recorder during interviews. ☐
6. I understand that data from the interview will be recorded and I understand that all these data will be coded and stored confidentially and securely. ☐
7. I understand that any information which I give will be used solely for the purposes of research, which may include written publications. ☐
8. I give permission for the data recorded during this study to be used by members of the research team in future projects, for a period of up to ten years after the project is completed. ☐
9. I give permission for anonymized and non-sensitive data to be made available for access and re-use by other researchers. ☐
10. I consent to be approached about future research projects. ☐

....
(Signature of participant) (Date)

.....
(Printed name of participant)

One copy of this form will be kept by the participant; a second copy will be kept by the researcher.

Appendix C - Feedback Survey

The survey that was handed out to at the project feedback event.

APPENDIX C1 – Feedback Survey

Feedback Survey

	Strongly disagree				Strongly agree
1. I think that the target audience would like to use this system	1	2	3	4	5
2. I found the system unnecessarily complex	1	2	3	4	5
3. I thought the system was easy to use	1	2	3	4	5
4. I think that I would need the support of a technical person to be able to use this system	1	2	3	4	5
5. I found the various functions in this system were well integrated	1	2	3	4	5
6. I thought there was too much inconsistency in this system	1	2	3	4	5
7. I would imagine that most people would learn to use this system very quickly	1	2	3	4	5
8. I found the system very cumbersome to use	1	2	3	4	5
9. I felt very confident using the system	1	2	3	4	5
10. I needed to learn a lot of things before I could get going with this system	1	2	3	4	5

What is your gender?

☐ Male
☐ Female
☐ Prefer not to answer
☐ Other .....

What year are you?

☐ UG1
☐ UG2
☐ UG3
☐ UG4 / MInf
☐ MSc
☐ Other .....

1