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Master's Thesis  
Academic Year 2022

The Storytelling Potential of Non-diegetic Scent



Keio University  
Graduate School of Media Design

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A Master's Thesis  
submitted to Keio University Graduate School of Media Design  
in partial fulfillment of the requirements for the degree of  
Master of Media Design

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Abstract of Master's Thesis of Academic Year 2022

## The Storytelling Potential of Non-diegetic Scent

Category: Design

### Summary

Scent is a tool that is greatly under utilised in storytelling, despite its unique capacity to elicit powerful emotions and quickly bring memories to the surface. This research project explores how best we can implement scent into a narrative with regards to its strengths in emotion evocation, and explore its technical and biological limitations as a medium, through the idea of non-diegetic scent. Non-diegetic scent is a concept where the aroma conveys emotional, thematic or motif information, rather than reflecting what could be smelt within the world of the story. When making a film, writing a novel, composing a song or drawing a comic there are clear parameters for how one can wield that medium to craft an effective narrative, however there is a porosity of information for scent based storytelling, and creators are mostly in the dark as to what is achievable and even the validity of using scent in storytelling. This study is the first of its kind to examine this particular intersection of non-diegetic scent as a method of emotional storytelling.

In order to investigate this, three studies were undertaken. Study 1 showed the importance of scent congruence for immersion and Study 2 demonstrated that scent information would be integrated into narrative interpretation by the audience. Then in the Proof of Concept Study, participants listened to a short audio horror story adventure that used scents to evoke first calming then anxiety inducing emotional reactions. Through this study, when compared to those who did not have any accompanying scent, the non-diegetic scent gave the listener a significantly more intimate and visceral narrative experience. These studies show that scent has a powerful effect on the impact a story has on the participant and that non-diegetic scent is a new tool in storytelling.



Keywords:

storytelling, scent, internet of senses, emotion, immersion, memory

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# Chapter 1

## Introduction

This thesis aims to explore the concept of using scent as a tool in storytelling to convey more emotionally affecting and memorable narratives. Scent is deeply intertwined with our memories and emotions, and this powerful ability that scent has to elicit emotional reactions and memory recall is hardwired into humans [1], and yet scent is rarely used as a storytelling medium [2]. Smell as a sense is processed more directly through memory and emotion parts of the brain, meaning it has the potential to give a unique experience to the story consumer when compared to other sensory inputs. Until now scent has primarily been used in a diegetic way in stories, meaning that the scents that the audience consumes are the scents that exist within the world of the story [2]. For example, during a scene set in a bakery, the audience would smell freshly baked bread, or they could smell cut grass and wildflowers during a different scene set in a park. A non-diegetic scent however, would be one that could not be smelt in the story environment but is smelt by the audience to play a different role, conveying emotional, thematic or motif information [3]. The audience could smell a soothing lavender aroma [4] during a relaxing scene, even if there are no flowers present, or a unique scent could be vapourised whenever a particular character appears in the story. This approach to the utilisation of scent in stories is one that has not been explored much creatively through individual media outputs or one that has been researched for its actual validity as a storytelling medium. As a result there are few resources for storytellers to access and as such creatives must experiment on their own without knowing if their approach is a valuable one to the experience they are trying to create, or what kinds of parameters exist when attempting to effectively employ non-diegetic scent. This research is the first of its kind to investigate this particular intersection and thus has little to compare to directly, but will hopefully lead to further pursuit of this creative medium and mode of expression. Through

conducting a study where participants consumed a story experience with a non-diegetic scent score that matched the emotional content, and without a scent component, it was able to be found that using a scent that induces the desired emotional response in the audience, increased to a large effect their emotional engagement with the story as well as a medium effect on some factors of immersion.

There are some key challenges when it comes to using aroma in stories, both biological and technological. When reflecting on scent in stories it may seem like a fairly obvious path to go down to evoke or enhance emotion from the story as many of us are familiar with the experience of smelling a dish from our hometown, the laundry detergent used as a child, or the flowers grown in the family garden, and immediately being brought back to that time and place, thus we can imagine how scent could be a powerful emotional evoker. These experiences however create a set of challenges to those wishing to build narratives using scent, as these powerful triggers often are unique to each individual person and even if a scent has a particular emotional effect on a population as a whole, one cannot account for how each individual story consumer will respond to each scent [5]. This autobiographical odour memory is something that every storyteller wanting to use scent will have to wrangle at a base level as it would be impossible to know and account for every single audience members' own memories and associations with every possible scent one could use [6]. This can be tackled in part by understanding the cultural background of the audience you are presenting the narrative to [7]. Another method would be using blended odours that may not have been encountered before - so that there would be no chance for one to build an associated memory with that particular scent. As well as using generic, very common aromas that people would encounter in a variety of situations and therefore not able to build a single association [8]. Technological challenges to scent based storytelling come in the form of both the delivery and the dissipation of the scent [9]. It is difficult to get a scent to clear out of an area once it has been deployed, and therefore it would be challenging to change the scent from scene to scene, creating a barrier to using scent diegetically in any story that uses more than one location. It is possible to have an individual device that deploys the scent; this is however not feasible for many storytellers as it would require specialised equipment that is not available to the general public [10]. Most devices or systems used for personal scent delivery



use Vape liquid as the means of aroma dispersion [11], meaning that a lot of these devices are not available for purchase in many regions around the world where Vape technology and Vape based products are restricted for sale [12]. As a result, dispersing a scent into the wider environment is a more accessible and practical way for most storytellers to have their audience experience scent as part of their story, so we must reframe the purpose of the scent in the storytelling as according to the limitations of the medium. This problem would not be encountered if scent is used in a non-diegetic way, where it is used to influence emotion and follows the gradual up and down of the tension map throughout a story.

When considering the strength of scent as a sense when compared to other sensory inputs [13] in its ability to elicit an emotional reaction from the consumer, and also taking into account the limitations of the medium as a whole, using scent non-diegetically could be a powerful tool in crafting emotionally engaging and affecting stories. Non-diegetic scent potentially makes a significant difference in an audience's emotional reaction to a story, boosting some factors of immersion and increasing a consumer's physiological response. Using scent in this way opens up new creative avenues for storytellers to explore and takes scent based storytelling to another level beyond that of the novelty of 'smellovision' or just commercial applications [14].

# Chapter 2

## Related Works

### 2.1. Literature Review

To better understand how scent could be used as a storytelling medium, first, an understanding of how scent functions as a sense must be gained. Looking at how odour is processed in the brain, and how that is different to other senses gives insight into the mediums potential strengths and weaknesses and paves the way forward in terms of what kinds of roles or functions scent could perform, and what kind of unique angle or experience it could give to the story consumer. These potential weaknesses may also give an important view into why scent has remained an underutilised format for storytelling; what makes scent a challenging element to work with, what kind of hidden pitfalls exist that limit what can be expressed by scent, or could unknowingly damage the narrative experience through odour misuse. By collating this information, effective studies and story experiences can be designed that test unexplored aspects of scent based storytelling that help build the foundation from which further creative endeavours can be launched.

#### 2.1.1 ODOUR PROCESSING, MEMORY AND EMOTION

Odour is processed in a very different manner to how other senses are in the brain, and this gives scent a unique quality in its connection to memory and emotion [15]. For senses such as vision and hearing, both the intensity and emotional valence of the material being consumed correlate to increased brain activity, but for scent the emotional valence is the key factor in eliciting a response in the brain [16]. In a Yale University study, brain activity of subjects exposed to unpleasant, neutral, and pleasant smells at varying levels of intensity was measured by fMRI. Greater brain activity was found with participants exposed to odours with either

a strong positive or negative association, independent of intensity and a neutral scent induced little activity [17]. Emotions that are elicited by odour are often stronger than those elicited by other modalities due to the ease of emotional recall associated with scent, through the dedicated parts of the amygdala for odour emotional processing [18].

Scent not only plays an important role in our emotion regulation, but also our social lives. Odour has such an effect that people with dysosmia have higher rates of anxiety and depression than those that do not. A lack of, or disordered scent perception leads to stressors in daily life from reduced awareness and the inability to pick up subtle social cues that are conveyed through scent [19]. As storytelling is an inherently social activity, scent has a great potential for socially engaging the story consumer [20].

### **2.1.2 AUTOBIOGRAPHICAL ODOUR MEMORY**

From our beginnings in the womb and for the rest of our smelly lives, we are laying down autobiographical odour memory. The scents of the foods that a pregnant person eats influence the kinds of scents and foods the baby will like [21]. This effect is powerful enough that scents that young children may find otherwise challenging are enjoyed or are appetitive if the association with that odour and their mother has been built. With children enjoying the scents of anise, fish, strong cheeses, mustard greens and even alcohol if it was consumed while they were in the womb or being breastfed [22], whereas children who would not be exposed to these scents from an early age were more often than not averse to the aromas [23]. The ability that scent has to call forth particular memories is stronger than that of visual inputs. In a study done by Tilburg University, it was found that scent was a more powerful and immediate trigger for bringing back childhood memories [24], eliciting more vibrant and detailed accounts of events, items and locations from their pasts. In another study done by Stockholm University, it was found that scent stimuli brought forth a stronger emotional memory response in people than even having the events described [25].

### 2.1.3 SCENT AND EMOTION

Scent has the ability to elicit emotions outside of the ones developed through autobiographical odour memory, they are however restricted to certain categories of function: well-being, social interaction, danger prevention, arousal or relaxation sensations, and conscious recollection of emotional memories [26]. This can be seen in innate fear reactions to predator scents or babies drawing comfort from human milk scent [27]. Aroma influence on emotion can happen without the person being consciously aware that they are being influenced. Through a study where women wore perfume of different odours over the course of several days it was found that there were trends among the women's emotional affect according to each different scent. The *woody citrus coniferous* perfume induced higher rates of hostility and tension, whereas the *floral chypre citrus* scent saw a decrease in anger and confusion [28]. This effect scent has on our emotion is one that is commonly understood, as seen in the rise in popularity of scent based anxiety treatments like aromatherapy [29]. The power scent has to alter mood has been seen in some clinical applications as well, like the reduction in depressive mood states experienced by those who were regularly exposed to citrus scents [30], or the lessened of anxiety felt by patients who waited in a dental office with an orange or lavender aroma dispersed [4]. These general reactions to scents, both positive and negative, could be used to elicit those reactions in an audience, in a similar way to how emotionally stirring film scores move a film audience [31].

### 2.1.4 SCENT AND STORYTELLING

Storytelling is a powerful tool for conveying emotion and building empathy [32]. In a study by the University of Hertfordshire, they found that exposing mid-wifery nursing students to patient stories had a profound effect on their ability to empathise with patients in the future [33]. Congruous scent has been shown to increase immersion amongst story consumers; experiencing scent eases the imagination burden and allows the consumer to engage more fully with the story itself [34]. Multi-sensory stories are more memorable and evoke greater emotional responses, which works in tandem with emotionally engaging content boosting memorability [35]. Although there have been many proposed ways for scent to

be integrated into mainstream storytelling and many innovative devices on the market for aroma diffusion, it has yet to break out of novelty.

When we are presented with visual stimuli of another person emoting, we find it easier to recognise that emotion when paired with a scent that elicits the same emotion in us [36]. This creates a key opportunity for creating greater emotional engagement in stories, by using scent that matches the emotional tone of the action. If the scent is able to help the audience recognise emotional reactions in the characters faster, it may in turn help them connect to the characters and narrative faster and on a deeper level. In his lecture series ‘*What an Audience Feels*’, film producer, script editor and film scholar Stephen Cleary posited that when consuming a narrative an audience member runs through a series of questions internally to contextualise and process the media in front of them. The questions begin intellectual - *where are we in time, where are we in the world, what is happening now*, before moving towards less concrete factors *how do I contextualise it, who or what motivated it, who are the characters involved*, then finally to the emotional core of the scene *how do they feel, how do I feel* [37]. Being able to get through these questions quickly leads to more emotionally affecting narratives as the audience gets to begin processing their own feelings, approval or disapproval of the characters and their actions. If scent is able to speed emotion recognition and processing, it gives the story consumer more tools and time to build a strong emotional connection.

### 2.1.5 MEASURING IMMERSION

A way to measure immersion through subjective means rather than physiological sensors in VR game experiences was developed by the University College London and the University of York in 2008 [38]. This study defined immersion as a quantifiable experience and then determined a way to measure that experience. The factors that were used as a base for game immersion were cognitive involvement, real world dissociation, emotional involvement, challenge, and control. Using these factors, they were able to produce the Immersive Experience Questionnaire (IEQ), that consistently matched physiological immersion data. When adapting the IEQ for other mediums, the nature of how the medium is consumed and immersive outcomes must be considered. The Film IEQ created by the University

College of London and the University of Birmingham in 2019, adapted the IEQ by shifting the wording of questions to suit a non-interactive visual medium, as well as changing the factors to ones that better encapsulate an immersive film experience [39]. These factors were captivation, real-world dissociation, comprehension and transportation. Using this shifted focus for the core of what each question was trying to measure, they were able to produce a new questionnaire that also consistently measured immersion.

## 2.2. Prior Works

Scent based storytelling has been used in the past as a novelty experience in various media productions, however it has not been able to break out of its novelty perception on a wider scale. There is little research into the intersection between scent and storytelling; many odour narrative experiences use scent in a way that could negatively impact the audience perception. Although this may create a memorable experience for the story consumer, it does not lay the foundation for establishing scent as a sustainable narrative medium. As a result, these singular productions stay as stand-alone talking pieces that people may remember fondly but do not ultimately deem a repeatable experience.

### 2.2.1 SPY KIDS: ALL THE TIME IN THE WORLD

The fourth Spy Kids film – Spy Kids: All the Time in the World (2011, directed by Robert Rodriguez), utilised a scent element dubbed “Aroma-scope”. Before entering the cinema, audience members were given a card that had numbers on it that could be scratched in order to release an aroma. During the film, numbers would appear on screen to prompt the audience to scratch the corresponding number, releasing a scent diegetic to the current scene. Although audiences found the scratch and sniff component to the film novel and interesting, it was simultaneously reported to be an unpleasant experience both from the mechanics of how it was implemented and the scents chosen. With each number on the card being so close to each other, it meant that as more parts were scratched the odours became muddled and harder to discern from each other. Additionally with every person scratching the card in the theatre the scent could become overwhelming

and would not clear by the time the next number would appear on screen. This became especially problematic as many of the scents were unpleasant ones; the odour of faeces or vomit overwhelming the other scents [40]. As previously discussed, using negative scents in a story reduces the perceived quality of the media being consumed, therefore the usage of unpleasant or disgusting odours may have damaged the audience perception of the film itself. This style of scent based storytelling has not been implemented on a similarly large scale since.

### **2.2.2 NEKO BOSHI YA**

Neko Boshi Ya was a planetarium show created by Hiromi Nishizaka, and aired at Konica Minolta Planetariums in Tokyo, Japan in 2022. The show combined scent and storytelling in a novel way. During the show two different scents would be dispersed into the planetarium via a humidifier. Both scents were diegetic to an extent, the first of which being a forest scent to match the forest scenes in the narrative, and the second being a more abstract with a scent that was meant to evoke the feeling of a cat's paw and remind the audience of cats [41]. Although the scents were not explicitly non-diegetic, the intention behind using aroma in the story was to relax the audience – matching the relaxing story. This work moves in the direction that scent could best be utilised, by harnessing its ability to elicit emotional reactions. The response to it was generally positive and people reported enjoying the scent [42].

# Chapter 3

## Concept Design

### 3.1. Solution

Scent comes with many technological limitations as a medium in storytelling, a key one being the difficulty of dispersing an aroma from an area after it has been deployed. If a second scent were to be released into the environment before the first can clear, the aromas can become muddled and indistinct [43]. Thus it would be hard to have scents change as the location setting changes from scene to scene. A potential solution to this is to have scent perform the role of an emotional motif rather than an informational scene setting one. This would allow for a more gradient shift between scents rather than a hard cut. Employing scent in this capacity also directly plays into the strengths of scent as a sensory input. This method is termed a non-diegetic scent approach to storytelling.

In order to investigate the validity of non-diegetic scent as a storytelling medium there are several steps that must be taken beforehand to understand how scent interacts with storytelling as a whole. Although it is sparingly used in storytelling, scent up until now has been primarily used in a diegetic way, however it has not been investigated fully for its actual immersion impact. The use of diegetic sound in media is known to increase immersion for the consumer [44] [45], and it could be natural to conclude that the same could be said for scent. However direct research addressing this question has yet to be done. To investigate this Study 1 was designed and conducted to validate that using a scent which would appear in the environment the story is taking place increases a sense of realism and draws the audience into the story - thus fostering immersion.

Study 2 is designed to investigate the use of non-diegetic scent, to ensure that there was some interaction between scent that elicits emotion and storytelling



imagination. Study 2 found that emotional data construed from odour would affect perceived narratives in the story consumer.

## 3.2. Study 1

### 3.2.1 DESIGN

This study was designed to establish if scent used in its most common narrative enhancing form, i.e. diegetically, does have a positive immersive impact, and to show that scent paired with a story was perceived and processed in tandem by the story consumer in a noticeable way. Further, the importance of the scent's congruence with the narrative needed to be measured, in this case in a diegetic, scene establishing way. This was to ensure that the novelty of a scent present was not the determining factor in the story becoming more engaging, but the kind of scent being also key to creating a more immersive experience [46]. A short study was conducted that examined the immersiveness and memorability of an audio story with no scent, an incongruous scent and a congruous scent. The purpose of this study was to establish whether the impact that a scent has on immersion is dependent on the odour's congruence with the story being told. The study also sought to investigate whether memorability is improved by the scent matching the story, or if just the presence of odour was enough to enhance recall. In the study participants listened to an abridged version of the opening chapter of Oscar Wilde's *The Picture of Dorian Gray* (appendix A), which has rich description of the floral aroma that surrounds the characters. The 15 participants were separated into three groups of five, where each group had one of the aroma experiences that they smelt whilst listening to the story; no scent, incongruous – tea tree, congruous – rose. Immediately after listening to the audio file, they would fill out a three-part questionnaire (appendix B).

1. Demographics – Age, nationality, gender, whether English is one of their native languages, and whether they were familiar with *The Picture of Dorian Gray*.
2. Immersion – Using a modified version of the Film IEQ that focussed on the same four factors of immersion, but the questions were edited to be

appropriate for an audio only medium.

3. Recall – Ten questions that asked participants to remember plot settings and events, and character emotions and motivations.

### 3.2.2 FINDINGS

#### Demographics

The participants in each group were gender balanced, age matched (age range 26-30), one participant in each group did not have English as one of their native languages, 70 percent of the participants knew of the story with 50 percent having read the book.

#### Immersion

For each question in the questionnaire, participants were asked to rate how much they agreed with the statement on a 10 point Likert scale. The data from the answers of each group was then collated and averaged according to the immersion factor the question addressed. Then all numbers were averaged to give an overall immersion rating, with a higher number indicative of a more immersive experience. Data shown as mean  $\pm$  standard deviation and Effect size ( $d$ ; 0-0.2 = small, 0.2-0.5 = medium,  $\geq$ 0.8 = large effect). Data analysed using Students T test: \* =  $p < 0.05$  compared to No scent, \*\* =  $p < 0.05$  compared to Incongruous.

	No Scent	Incongruous	Congruous
Captivation	5.56 $\pm$ 2.21	5.72 $\pm$ 1.61 ( $d=0.07$ )	6.51 $\pm$ 1.89 ( $d=0.43, 0.49$ )
Real-world dissociation	3.44 $\pm$ 1.08	4.29 $\pm$ 1.61 ( $d=0.79$ )	6.46 $\pm$ 0.81 <sup>*,**</sup> ( $d=2.8, 1.35$ )
Comprehension	6.94 $\pm$ 0.44	7.60 $\pm$ 0.4 <sup>*</sup> ( $d=1.5$ )	7.4 $\pm$ 1.0 ( $d=1.05, -0.5$ )
Transportation	2.38 $\pm$ 1.04	3.60 $\pm$ 1.54 ( $d=1.17$ )	6.50 $\pm$ 0.41 <sup>*,**</sup> ( $d=3.96, 1.88$ )
OVERALL	4.5 $\pm$ 1.19	5.30 $\pm$ 1.29 ( $d=0.67$ )	6.72 $\pm$ 1.03 <sup>*</sup> ( $d=1.87, 1.1$ )

Table 3.1 Immersion Ratings

Overall, participants receiving the congruous scent had a significantly ( $p < 0.05$ ) more immersive and positive experience than the no scent group, and a more immersive experience (large effect size) than the incongruous scent group. The incongruous scent had a medium positive, but not significant effect on immersion as compared to the no scent group. The congruous scent group had a significantly more immersive story experience as compared to the no scent and incongruous groups for real-world dissociation and transportation. Congruous scent induced a small feeling of captivation of the story and also had a large positive effect on story comprehension. The incongruous scent had a medium and large positive immersive effect compared to the no scent group with only comprehension being significantly higher. Interestingly, the congruous scent had a small negative effect on comprehension compared to the incongruous scent group. Taken together, scent either incongruous or congruous had a positive effect on immersive experience as compared to no scent, but a congruous scent induced a greater immersive story experience.

### Recall

Participants were asked ten short questions about the content of the story. Participants from each group's correct answers were tallied and averaged.

	No Scent	Incongruous	Congruous
Average Correct Responses	4.8/10	6.4/10	7/10

Table 3.2 Recall Scores

There was a slight increase in performance from no scent to incongruous, to congruous, but no large difference between each group. Within the no scent group there were two participants each with a high and low outlying score, but for the scent groups, all participants scored close to the average. Scent perhaps has an effect on recall for story events, but further study with more extensive questions and a look at long term recall is necessary.

## 3.3. Study 2

### 3.3.1 DESIGN

From the information gathered from Study 1 it was clear that diegetic scent had a significant impact on immersion. To expand on these findings a second study was designed to investigate whether non-diegetic scents have an impact on story engagement and to evaluate its potential use as a storytelling medium. It is known that particular scents are able to elicit reactions [47], however, it is unknown whether this will work in tandem with a narrative. In Study 2 participants were asked to watch footage of a person walking through a snowy forest environment, shot from a first-person point of view<sup>1</sup>, while experiencing a soothing scent, an arousing scent, or no scent at all. The calming scent used was sandalwood, as sandalwood has been shown to have calming and uplifting effects on people when worn as a perfume [48]. The second scent was peppermint which is a physiologically arousing scent that increases alertness [49], [50].

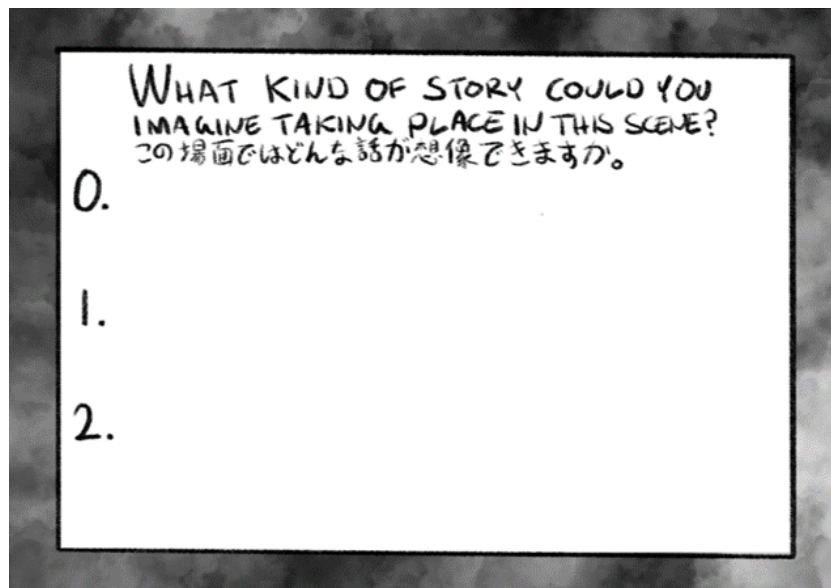
Participants watched the footage while smelling one of the three options, then asked what kind of story they could imagine taking place in this environment. The order in which each participant experienced each option was changed each time. The following form was filled out to collect the responses.

### 3.3.2 FINDINGS

There were 21 respondents collected at the KMD Plenary Meeting as part of the PLAY Project booth. Responses were fairly consistent within each group, with all participants describing a different story for a scent option but with similar story themes within each scent group. Autobiographical odour memory seemed to affect participants who associated the peppermint aroma with Christmas.

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<sup>1</sup> *A Snowy Forest* footage courtesy of I Am Sorin <https://www.pexels.com/video/a-snowy-forest-7106417/>



WHAT KIND OF STORY COULD YOU  
IMAGINE TAKING PLACE IN THIS SCENE?  
この場面ではどんな話が想像できますか。

0.

1.

2.

Figure 3.1 Study 2 Response Sheet

### Tone

Responses for each option were evaluated for whether it was a positive, neutral or negatively toned story. Positive stories were ones that described happy emotions or enjoyable experiences, like hiking with friends, excitedly returning home or describing fanciful, fairytale-like experiences. Neutral stories were ones that were neither happy nor frightening, for example coming home after school, going to work or a bland hike. Negative stories often described frightening or melancholic scenarios, like being chased by wolves, being stalked through the forest or feeling isolated in the wilderness.

66.67% of the people described a positive story while smelling the sandalwood scent. This is in stark contrast to the no scent where only 14.29% of participants described a positive story and 19.05% when peppermint scent was used. All groups saw a similar amount of neutral stories, with the two scent options both having 28.57% and the no scent just slightly above at 33.33%. Both no scent and peppermint had similar amounts of negative stories with 47.62% and 52.38% respectively. Sandalwood however had only one respondent recount a negative story. Overall scent saw a small reduction in neutral stories, but it was found



Photo by Alaa AlMaliki

Figure 3.2 Exhibition Set-up

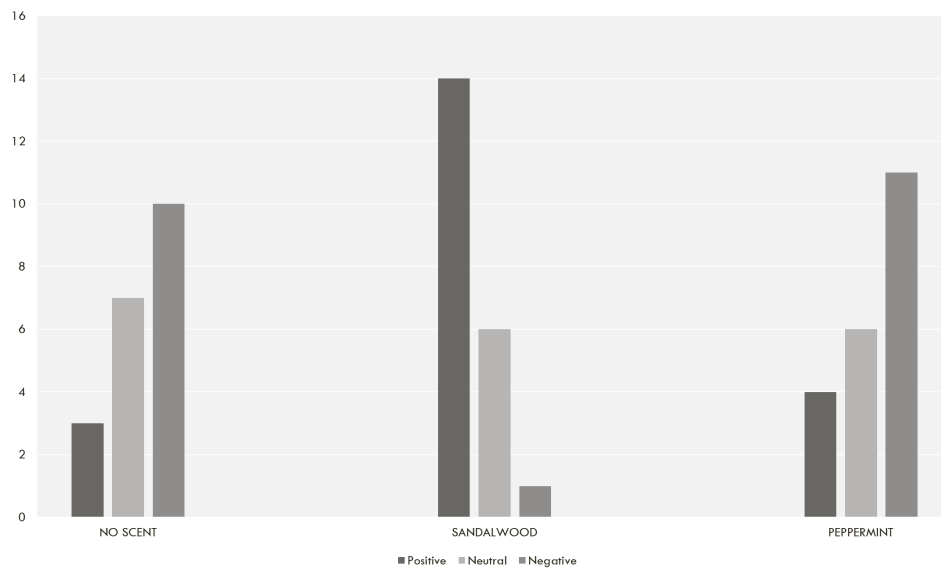


Figure 3.3 Tone of Narratives by Scent Experience

that scent had a great increase towards positively toned narratives when paired with the uplifting scent.

### Key Words

Figures 3.3, 3.4 and 3.5 show the instances of particular words being used in the stories for each scent option. Although there were similar amounts of positive, neutral and negative stories across the no scent and peppermint groups, it can be seen through these keyword charts that the types of stories varied according to each option. Negative stories for the no scent group often dealt with themes of loneliness and isolation, with frightening stories being described in a fairly nondescript way with statements like ‘it just feels scary’. For the peppermint group however the exact calibre of negative story was described in greater detail, seeming as though the scent was evocative for the imagination. Participants would go into detail about the cold, the feeling of danger or the encroaching darkness.

As for sandalwood, the stories people imagined taking place in the environment stood in direct contrast to the winter scene. Participants would often describe

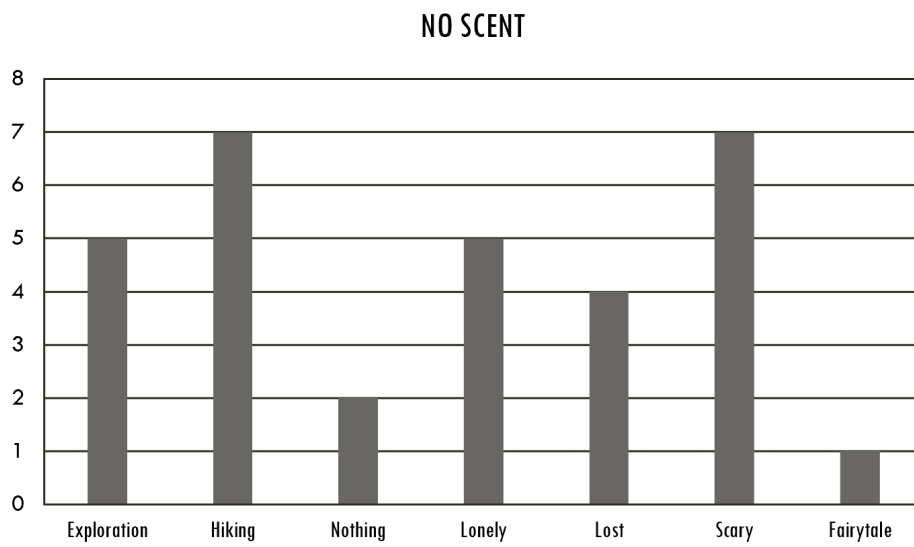


Figure 3.4 Key Words for No Scent Group

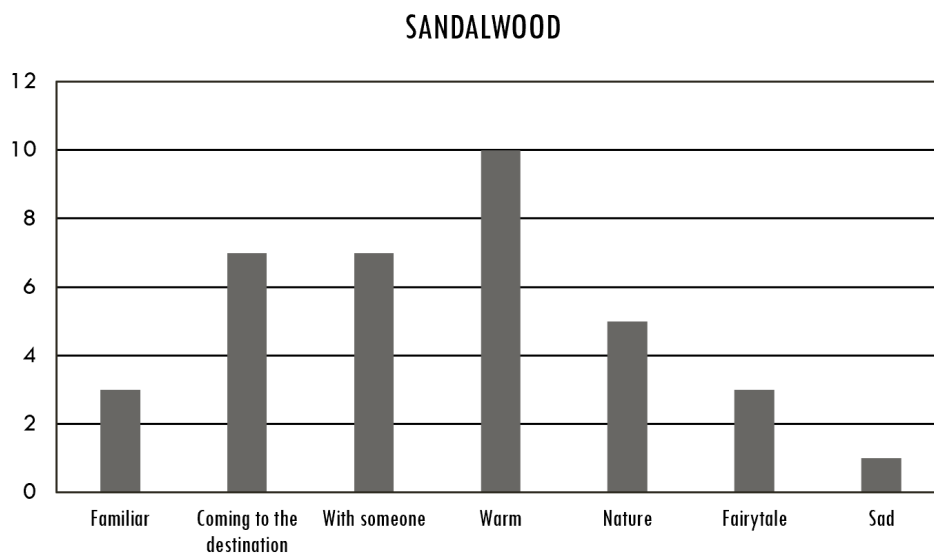


Figure 3.5 Key Words for Sandalwood Group



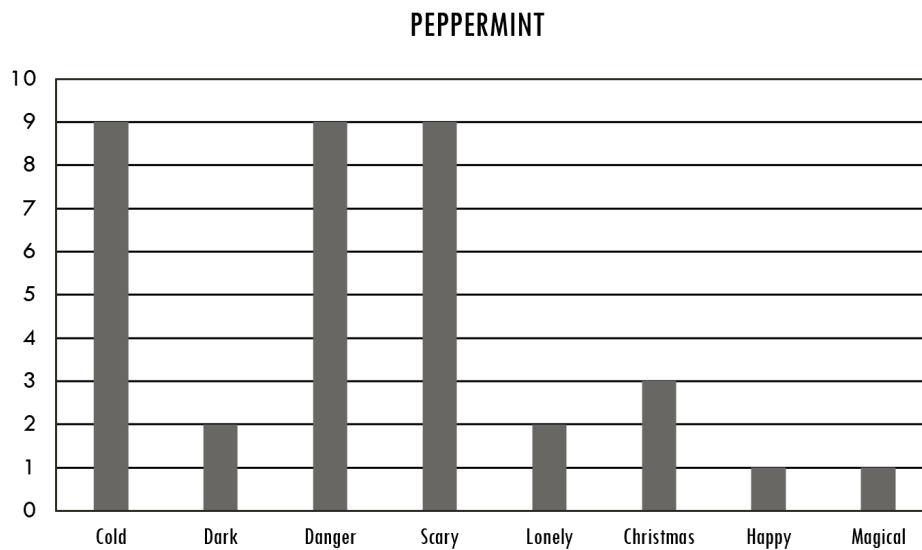


Figure 3.6 Key Words for Peppermint Group

the feeling of being warm, either in a cosy jacket or walking towards a warm destination, like a house with hot chocolates awaiting or hot springs in the forest. The interpretation of the landscape itself also shifted, where with no scent it was described using more mundane and realistic terms, a place to hike. Whereas with sandalwood, people saw it as more fantastical, imagining magical happenings and fairytale creatures living in the woods.

All instances of positive narratives construed from the peppermint group were a result of autobiographical odour memory. Peppermint appeared to be a scent many people strongly associated with Christmas [51], which in turn provoked tellings of happier, positive stories centred around winter holidays, with people directly citing Christmas as the inspiration. Without the influence of this autobiographical odour memory, there would have been no positive stories with the alert making peppermint scent and instead would have been 39.29% neutral and 60.71% negative.

### 3.4. Preliminary Evaluations

From these two preliminary studies it can be seen that non-diegetic scent has a real potential to be a powerful tool in storytelling. Study 1 showed that scent has a significant impact on immersion and that even the incongruous scent had a large effect on some immersion factors. Scent also had a positive impact on recall, even though the scent was not present while the participant underwent the quiz. This suggests that scent makes for a more memorable experience and helps consumers take in more information. Study 2 showed that there is a definite interaction between emotion eliciting scents and storytelling, where participants drew upon the emotional cues from the scent to build a narrative alongside the visual input. The consistency in response in Study 2 is promising for the idea that scent based storytelling experiences are not restricted to an individual's own autobiographical odour memory, and can be done with generic reactions to particular scents. That being said, it is prudent to avoid scents that are very particular or are keenly associated with specific events or ideas, like with the peppermint aroma being evocative of Christmas.

Although scent and storytelling are rarely used in tandem, it is clear that people respond well to the concept, easily able to integrate scent information, either explicitly connected like that of the diegetic congruous scent match-up in Study 1 or the more interpretive non-diegetic scent offerings in Study 2, into the narrative they are consuming.

# Chapter 4

## Proof of Concept

### 4.1. Evaluation for Final Prototype

#### 4.1.1 STUDY DESIGN

The aim of the study was to evaluate non-diegetic scent on the emotional reaction an audience has to a story, and whether it contributes to story immersion as measured through the IEQ. The study was conducted in accordance with the Keio University Ethics Committee. Participants, seated in a neutral environment, were asked to listen to a three minute audio of a horror story (appendix C), done in the style of a radio play. Participants were separated into two groups, the first group having the story experience with scent and the second group having no scent while listening to the story. After completing the story, participants were then asked to complete a questionnaire composed of 12 questions that asked immersion and emotional engagement questions and to rate their answers using the provided seven point Likert scale (appendix D). Two aromas were used as part of the scent score in the story for the participants in the scent group. The scents used were orange, which has a calming effect on people [52] and the second scent used was citronella which is known to induce agitation in people [28]. The scents were used consecutively to create a transition from one emotion to the another, orange followed by citronella was used to heighten the increase in tension in the story: thus scent would match the emotional difference in the story. The transition between the two scents was achieved by the area in front of the story installation having an orange scent, then the area where the story was consumed having the citronella scent. There were 53 participants in total, 32 were in the scent group and 21 were in the no scent group. During the story experience, participants were in a dark comfortable environment with no visual or tactile input so that

the story audio and the scent, if part of the scent group, were the only sensory experiences encountered. Most participants took part in the study at the Play to the Future Exhibition On the 28th and the 29th of May 2022 at Tokyo Portcity Takeshiba<sup>1</sup>, where each participant would enter a pitch black tent and listen to the story through noise cancelling headphones, with the aroma pumped into the tent, if in the scent group. However some participants as part of the no scent group were asked to replicate the exhibition conditions at home. The story itself is set on a spaceship somewhere in outer space. This location was picked as it is a setting that one may not already have an associated scent with and is one people would be familiar with across cultures. Participants are told the premise of the story before beginning the story experience. The premise of the story is that you, the listener, are the captain of a spaceship and have been trapped in the cargo hold where the lights have just gone out. The story uses the direction of sounds and varying volumes to create the illusion of actually being in the story setting. The story opens with your crewmate, Orla, contacting you through your in-ear communicator, asking of your whereabouts. Upon hearing no reply, Orla says that she will come find you in the cargo hold herself to repair the lights, meanwhile you can hear movement, footsteps and growling from an unknown creature in the environment around you. Eventually Orla makes it into the cargo hold and you can hear her call out to you in the environment. She realises that there is something dangerous in the room with the both of you, she whispers into the communicator saying she's going to approach you. As she creeps closer, so does the beast. The story ends when you can hear the creature breathing right over you as Orla whispers a nervous 'captain' into your ear.

The story builds tension through the immersive sound design; foley sound effects are used to give the listener the feeling as though they are in the environment themselves and accelerate the sonic immersion. This works in tandem with the pitch black tent, as the visual environment reflects what the captain would see. Creating a complex visual scene would be difficult to effectively and convincingly form in a shared exhibition space, let alone have remote participants be able to replicate in their homes. However, just having a lighting condition for the

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1 PLAY to the Future Exhibition <https://playexhibition2022.wixsite.com/playtothefuture>

visual component is easier to keep consistent across different spaces and removes some of the potential variance between experiences. Additionally, a lack of visual stimuli has been used before to help stimulate imaginative thinking and immersive experiences, as seen through the various works curated by Victoria Lynn for the Deep Space Immersion Exhibition at the Australian Centre for the Moving Image, Melbourne, Australia [53]. Many of the artworks used darkness to simultaneously evoke the feeling of being in deep space and to give a blank canvas for the mind to create its own immersive environments. The darkness in the tent was used to create a similar effect – the reduced sensory input gave the participant the room to invest further in the stimuli they were given, the audio and importantly the scent, and also it mirrored the story environment, both the power outage in the hull and the general space setting. Darkness also aided in enhancing a potential fear response in the audience. As fear or anxiety was the intended emotional reaction to the story, it benefitted to have a visual environment that aided in that pursuit, as darkness can trigger a fear response in many people [54].

The two scents used in the scent score were chosen in part due to them both being citrus scents, thus aiding the smooth transition between the two due to their likeness. Although there were jump scares built into the audio component to the story, suddenly assaulting the participant with a juxtaposing scent to the prior one would interfere with the ability to measure how the scent itself affected the emotional response. This helps to build the scent component to be more like that of a film score, that subtly influences the story consumer.

The survey used eight questions from the previously modified IEQ for audio stories and four questions about emotional engagement. For the eight immersion questions, there were two questions for each of the four immersion factors, captivation, real-world disassociation, comprehension and transportation.

### 4.1.2 EXIT INTERVIEWS

Participants in the scent group were spoken to upon exiting the installation, these short interviews gave some insight into the value of the experience. It was from these interviews that it became clear how important understanding the cultural background of the audience is. The Play to the Future Exhibition was held in Tokyo, Japan, so many of the participants live in Japan and have possibly grown



Figure 4.1 Explaining to Participants

Photo by Manyu Zhang

up in Japan. The scent initially chosen to elicit an anxiety response in the participants was cypress as it is a woody astringent scent that can induce a feeling of apprehension/citeperfume. However, in Japan the smell of cypress is most closely associated with traditional Japanese hot springs, where the baths themselves are often made out of cypress wood [55]. This autobiographical odour memory of cypress being smelt at a time of relaxation interfered with the anxiety response the scent score was trying to elicit. From speaking to participants that had just experienced the story, it became apparent that the scent needed to be changed in order to garner the desired effect.

Another comment common to participants leaving the experience was that their own perception of the scent had changed over the course of the story. As an explicitly negative or unpleasant scent cannot be used as a part of a scent story lest the perceived quality of the story be reduced [56], many participants reported that they found the scent pleasant and even relaxing when first entering the tent. But as they listened to the story as it rose in tension they began to feel as though the scent itself was also unpleasant, smelling sharper and more astringent. This suggests some interplay between the emotional response to the scent and

the emotional response to the story audio, working in tandem to create a whole experience.

### 4.1.3 RESULTS

The Likert scale raw data is shown in Table 4.1, which was transformed into the number of participants scoring in each immersion category for each question (Table 4.2) and this converted to the percent responding in each category (Table 4.3), the mean and mode were calculated from the number of participants reporting for each category (Table 4.4). A one-way ANOVA of the Likert scale data revealed that there was a statistically significant difference in mean immersion scores between the two groups ( $F(23, 612) = [5.691]$ ,  $p < 0.001$ ).

A students T-test between the groups for each question revealed that there was no significant difference between the immersion scores for the scent and no scent groups for questions 1 through to 9 as shown in table 4.5. This indicates that the application of non-diegetic scent had no significant effect on the captivation, real-world dissociation, comprehension and transportation immersion factors felt by participants in this study. For question 10, 11 and 12 which probed the participants' emotional and physiological responses, it was found that there was a significant ( $p < 0.05$ ) difference between the scent and no scent groups (Table 4.5). Based on the effect size the scent group had a significant medium and larger emotional and physiological response to the story than the no scent group (Question 10:  $d = 0.66$ ; 99.5% CI: 0.06, 1.19; Question 11:  $d = 1.28$ ; 99.5% CI: 0.80, 1.03; Question 12:  $d = 1.22$ ; 99.5% CI: 0.77, 1.99). Furthermore participants in the scent group had a small positive effect ( $d = 0.17$ ; 99.5% CI: -0.38, 0.72) on emotional attachment to the characters in the story. Although not significant for Question 3 and Question 5 that probed real-world dissociation and transportation, the effect size calculation showed that there was a positive medium effect for the scent group compared to the no scent group, indicating that within the 3-minute audio participants in the scent group were able to feel disconnected from the world around them and more swept up in the world of the story.

Figures 4.2, 4.3, 4.4, 4.5 and 4.6 show the percent of participants in the scent and no scent groups that responded to each category for each question. It can be clearly seen that the scent group were more engaged in the audio story for

Scent Group												
Timestamp	To what extent did you enjoy the story experience? Question 1	To what extent did you feel you were focused on the story? Question 2	To what extent did you lose track of time? Question 3	To what extent did you feel consciously aware of being in the real world whilst listening? Question 4	To what extent did you forget about your everyday concerns? Question 5	To what extent did you feel that you were within the story environment? Question 6	To what extent did you find the story themes, concepts or ideas challenging to comprehend? Question 7	To what extent did you find the plot of the story easy to follow? Question 8	To what extent did you feel emotionally attached to the characters? Question 9	To what extent did you feel emotionally affected by the story? Question 10	To what extent did you feel your emotional state change throughout the story? Question 11	To what extent did you feel a physiological response to the story? Question 12
28/05/2022 14:19	6	5	5	3	4	4	5	6	4	4	6	7
28/05/2022 14:38	6	7	7	7	7	3	6	7	6	7	6	6
28/05/2022 14:49	7	6	7	2	2	5	3	3	5	5	5	3
28/05/2022 15:03	6	6	5	4	5	5	5	5	4	4	4	6
28/05/2022 15:13	6	5	7	6	7	3	5	4	7	3	3	7
28/05/2022 15:23	7	7	5	5	6	4	6	6	4	5	5	6
28/05/2022 15:28	7	7	6	6	6	6	7	7	5	6	6	5
28/05/2022 15:46	6	5	7	5	6	5	6	6	5	6	5	7
28/05/2022 15:50	7	7	7	5	7	6	7	7	5	7	6	7
28/05/2022 15:56	7	6	6	6	5	5	4	4	4	4	3	5
28/05/2022 16:02	5	5	5	4	4	5	5	5	5	5	6	5
28/05/2022 16:10	6	7	3	4	6	5	6	5	5	6	5	6
28/05/2022 16:16	7	6	5	5	7	6	7	7	4	4	5	6
28/05/2022 16:50	7	7	7	5	7	7	4	6	6	6	5	7
28/05/2022 16:50	4	2	5	6	6	4	3	2	1	6	6	6
28/05/2022 17:04	6	6	5	5	5	6	5	6	6	6	5	5
28/05/2022 17:11	5	7	4	2	7	4	4	3	3	3	5	3
28/05/2022 17:34	7	7	6	6	6	6	5	5	6	6	6	6
28/05/2022 22:22	6	4	7	6	6	2	4	6	2	2	5	4
29/05/2022 11:25	6	6	5	4	7	6	3	7	5	6	5	7
29/05/2022 11:41	6	5	6	4	5	6	5	5	5	5	4	5
29/05/2022 12:02	6	7	5	3	6	7	7	7	7	6	7	7
29/05/2022 12:09	7	6	7	7	6	7	6	6	7	7	6	4
29/05/2022 13:55	5	6	4	4	5	6	6	6	3	5	5	6
29/05/2022 13:56	7	7	6	6	5	6	7	7	6	6	6	5
29/05/2022 14:15	6	6	5	5	7	5	6	6	5	5	5	5
29/05/2022 14:15	1	6	7	5	6	5	4	6	5	6	5	5
29/05/2022 14:28	7	7	6	6	7	7	6	7	7	6	6	6
29/05/2022 15:28	5	7	6	5	5	7	5	4	4	4	5	5
29/05/2022 15:34	6	4	2	2	5	5	5	6	2	3	4	5
29/05/2022 16:34	7	6	5	2	4	6	7	6	6	6	5	7
29/05/2022 16:53	7	5	6	7	6	7	7	7	5	6	7	6

No Scent Group												
12/06/2022 15:03	6	4	3	2	3	5	5	6	5	5	3	3
18/06/2022 18:47	7	6	6	6	6	6	6	2	4	5	4	4
18/06/2022 18:50	7	7	7	7	7	7	3	3	6	6	4	4
18/06/2022 18:56	5	6	6	4	5	6	4	5	4	5	4	5
18/06/2022 18:58	7	6	7	3	4	6	2	6	3	3	4	3
19/06/2022 18:31	6	4	5	6	5	5	7	6	5	3	3	2
19/06/2022 18:31	5	6	4	3	6	5	7	5	3	4	5	5
19/06/2022 18:33	6	6	6	7	7	4	6	6	6	6	5	5
20/06/2022 4:27	7	5	5	3	6	5	7	6	2	5	3	5
21/06/2022 11:06	6	7	3	4	5	6	7	7	4	4	3	3
21/06/2022 20:20	5	7	2	5	3	5	6	7	5	5	3	4
21/06/2022 20:26	5	4	4	4	2	3	3	5	4	3	3	2
21/06/2022 20:38	7	7	4	4	4	5	6	6	4	4	3	3
21/06/2022 22:35	6	6	6	5	5	6	7	7	7	6	5	6
22/06/2022 9:53	2	4	4	4	6	5	1	7	2	2	3	2
22/06/2022 15:47	7	7	5	5	4	6	7	7	6	5	6	6
22/06/2022 19:43	6	6	5	4	7	6	5	7	5	5	4	5
23/06/2022 13:24	5	6	6	6	6	6	4	5	3	4	5	6
24/06/2022 12:17	7	7	6	6	6	6	7	7	7	6	6	6
25/06/2022 16:29	5	6	4	3	5	3	7	7	4	3	2	3
25/06/2022 16:40	6	6	7	5	6	5	7	7	3	3	2	2

Table 4.1 Likert Scale Raw Data



Scent Group												
	To what extent did you enjoy the story experience?	To what extent did you feel you were focused on the story?	To what extent did you lose track of time?	To what extent did you feel consciously aware of being in the real world whilst listening?	To what extent did you forget about your everyday concerns?	To what extent did you feel that you were within the story environment?	To what extent did you find the story themes, concepts or ideas challenging to comprehend?	To what extent did you find the plot of the story easy to follow?	To what extent did you feel emotionally attached to the characters?	To what extent did you feel emotionally affected by the story?	To what extent did you feel your emotional state change throughout the story?	To what extent did you feel a physiological response to the story?
Number of Respondents	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7	Question 8	Question 9	Question 10	Question 11	Question 12
Fully Immersed	13	12	9	3	9	6	7	9	3	3	2	8
Mostly Immersed	13	11	8	8	11	10	8	12	6	14	10	10
Partially Immersed	4	6	11	9	8	9	9	5	11	6	15	10
Neutral	1	2	2	6	3	4	5	3	6	5	3	2
Weakly Immersed	0	0	1	2	0	2	3	2	3	3	2	2
Very weakly Immersed	0	1	1	4	1	1	0	1	2	1	0	0
Not Immersed	1	0	0	0	0	0	0	0	1	0	0	0
Total =	32	32	32	32	32	32	32	32	32	32	32	32

No Scent Group												
	To what extent did you enjoy the story experience?	To what extent did you feel you were focused on the story?	To what extent did you lose track of time?	To what extent did you feel consciously aware of being in the real world whilst listening?	To what extent did you forget about your everyday concerns?	To what extent did you feel that you were within the story environment?	To what extent did you find the story themes, concepts or ideas challenging to comprehend?	To what extent did you find the plot of the story easy to follow?	To what extent did you feel emotionally attached to the characters?	To what extent did you feel emotionally affected by the story?	To what extent did you feel your emotional state change throughout the story?	To what extent did you feel a physiological response to the story?
Number of Respondents	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7	Question 8	Question 9	Question 10	Question 11	Question 12
Fully Immersed	7	6	3	2	3	1	9	9	2	0	0	0
Mostly Immersed	7	10	6	4	7	9	4	6	3	4	2	4
Partially Immersed	6	1	4	4	5	8	2	4	4	7	4	5
Neutral	0	4	5	6	3	1	2	0	6	4	5	3
Weakly Immersed	0	0	2	4	2	2	2	1	4	5	8	5
Very weakly Immersed	1	0	1	1	1	0	1	1	2	1	2	4
Not Immersed	0	0	0	0	0	0	1	0	0	0	0	0
Total =	21	21	21	21	21	21	21	21	21	21	21	21

Table 4.2 Immersion Category Scores

Scent Group												
	To what extent did you enjoy the story experience?	To what extent did you feel you were focused on the story?	To what extent did you lose track of time?	To what extent did you feel consciously aware of being in the real world whilst listening?	To what extent did you forget about your everyday concerns?	To what extent did you feel that you were within the story environment?	To what extent did you find the story themes, concepts or ideas challenging to comprehend?	To what extent did you find the plot of the story easy to follow?	To what extent did you feel emotionally attached to the characters?	To what extent did you feel emotionally affected by the story?	To what extent did you feel your emotional state change throughout the story?	To what extent did you feel a physiological response to the story?
Number of Respondents	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7	Question 8	Question 9	Question 10	Question 11	Question 12
Fully Immersed	41%	38%	28%	9%	28%	19%	22%	28%	9%	9%	6%	25%
Mostly Immersed	41%	34%	25%	25%	34%	31%	25%	38%	19%	44%	31%	31%
Partially Immersed	13%	19%	34%	28%	25%	28%	28%	16%	34%	19%	47%	31%
Neutral	3%	6%	6%	19%	9%	13%	16%	9%	19%	16%	9%	6%
Weakly Immersed	0%	0%	3%	6%	0%	6%	9%	6%	9%	9%	6%	6%
Very weakly Immersed	0%	3%	3%	13%	3%	3%	0%	3%	6%	3%	0%	0%
Not Immersed	3%	0%	0%	0%	0%	0%	0%	0%	3%	0%	0%	0%
Total =	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

No Scent Group												
	To what extent did you enjoy the story experience?	To what extent did you feel you were focused on the story?	To what extent did you lose track of time?	To what extent did you feel consciously aware of being in the real world whilst listening?	To what extent did you forget about your everyday concerns?	To what extent did you feel that you were within the story environment?	To what extent did you find the story themes, concepts or ideas challenging to comprehend?	To what extent did you find the plot of the story easy to follow?	To what extent did you feel emotionally attached to the characters?	To what extent did you feel emotionally affected by the story?	To what extent did you feel your emotional state change throughout the story?	To what extent did you feel a physiological response to the story?
Number of Respondents	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7	Question 8	Question 9	Question 10	Question 11	Question 12
Fully Immersed	33%	29%	14%	10%	14%	5%	43%	43%	10%	0%	0%	0%
Mostly Immersed	33%	48%	29%	19%	33%	43%	19%	29%	14%	19%	10%	19%
Partially Immersed	29%	5%	19%	19%	24%	38%	10%	19%	19%	33%	19%	24%
Neutral	0%	19%	24%	29%	14%	5%	10%	0%	29%	19%	24%	14%
Weakly Immersed	0%	0%	10%	19%	10%	10%	10%	5%	19%	24%	38%	24%
Very weakly Immersed	5%	0%	5%	5%	5%	0%	5%	5%	10%	5%	10%	19%
Not Immersed	0%	0%	0%	0%	0%	0%	5%	0%	0%	0%	0%	0%
Total =	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 4.3 Immersion Category Percentages

Scent Group												
	To what extent did you enjoy the story experience?	To what extent did you feel you were focused on the story?	To what extent did you lose track of time?	To what extent did you feel consciously aware of being in the real world whilst listening?	To what extent did you forget about your everyday concerns?	To what extent did you feel that you were within the story environment?	To what extent did you find the story themes, concepts or ideas challenging to comprehend?	To what extent did you find the plot of the story easy to follow?	To what extent did you feel emotionally attached to the characters?	To what extent did you feel emotionally affected by the story?	To what extent did you feel your emotional state change throughout the story?	To what extent did you feel a physiological response to the story?
	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7	Question 8	Question 9	Question 10	Question 11	Question 12
Mean =	5.83	5.79	5.43	4.47	5.57	5.16	5.19	5.42	4.38	5.00	5.13	5.50
Stdev =	1.22	1.16	1.24	1.48	1.17	1.29	1.26	1.34	1.47	1.28	0.94	1.13
Mode =	6	7	5	5	6	6	5	6	5	6	5	6

No Scent Group												
	To what extent did you enjoy the story experience?	To what extent did you feel you were focused on the story?	To what extent did you lose track of time?	To what extent did you feel consciously aware of being in the real world whilst listening?	To what extent did you forget about your everyday concerns?	To what extent did you feel that you were within the story environment?	To what extent did you find the story themes, concepts or ideas challenging to comprehend?	To what extent did you find the plot of the story easy to follow?	To what extent did you feel emotionally attached to the characters?	To what extent did you feel emotionally affected by the story?	To what extent did you feel your emotional state change throughout the story?	To what extent did you feel a physiological response to the story?
	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7	Question 8	Question 9	Question 10	Question 11	Question 12
Mean =	5.69	5.75	4.78	4.36	4.92	5.18	4.94	5.68	4.13	4.21	3.64	3.73
Stdev =	1.20	1.06	1.41	1.40	1.39	1.01	1.89	1.37	1.47	1.20	1.17	1.45
Mode =	6	6	6	4	6	6	7	7	4	5	3	3

Table 4.4 Mean, Standard Deviation and Mode

Question	Scent group			Non-Scent group			p-value (2-tailed T-test)	Confidence Interval		Effect Size (Cohen's d) <sup>a</sup>
	mean	n	SD	mean	n	SD		lower	upper	
Question 1	5.83	32.00	1.22	5.69	21.00	1.20	0.683	-0.44	0.66	0.12
Question 2	5.79	32.00	1.16	5.75	21.00	1.06	0.916	-0.52	0.58	0.03
Question 3	5.43	32.00	1.24	4.78	21.00	1.41	0.085	-0.07	1.04	0.46
Question 4	4.47	32.00	1.48	4.36	21.00	1.40	0.773	-0.47	0.63	0.08
Question 5	5.57	32.00	1.17	4.92	21.00	1.39	0.074	-0.05	1.06	0.46
Question 6	5.16	32.00	1.29	5.18	21.00	1.01	0.990	-0.56	0.54	-0.02
Question 7	5.19	32.00	1.26	4.94	21.00	1.89	0.578	-0.40	0.71	0.13
Question 8	5.42	32.00	1.34	5.68	21.00	1.37	0.970	-0.74	0.36	-0.19
Question 9	4.38	32.00	1.47	4.13	21.00	1.47	0.547	-0.38	0.72	0.17
Question 10	5.00	32.00	1.28	4.21	21.00	1.20	0.028	0.06	1.19	0.66
Question 11	5.13	32.00	0.94	3.64	21.00	1.17	0.000	0.80	2.03	1.28
Question 12	5.50	32.00	1.13	3.73	21.00	1.45	0.000	0.77	1.99	1.22

<sup>a</sup> = Cohen's d = >0.8 = large effect; >0.5<0.8 = medium effect; >0.2<0.5 = small effect.

Table 4.5 Statistical Analysis of the Scent v No Scent Number of Participants Score

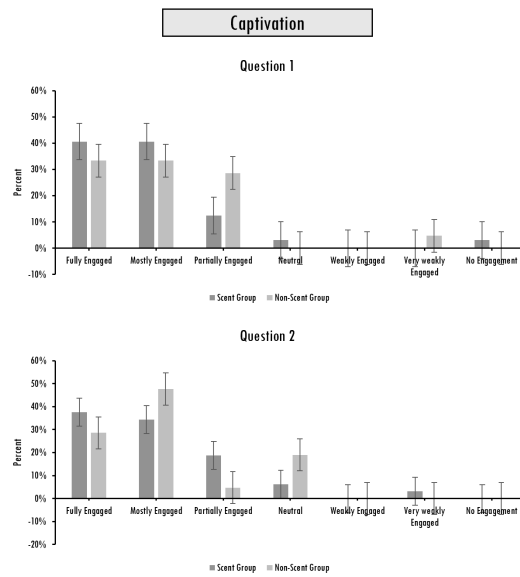


Figure 4.2 Captivation Questions Response Comparison

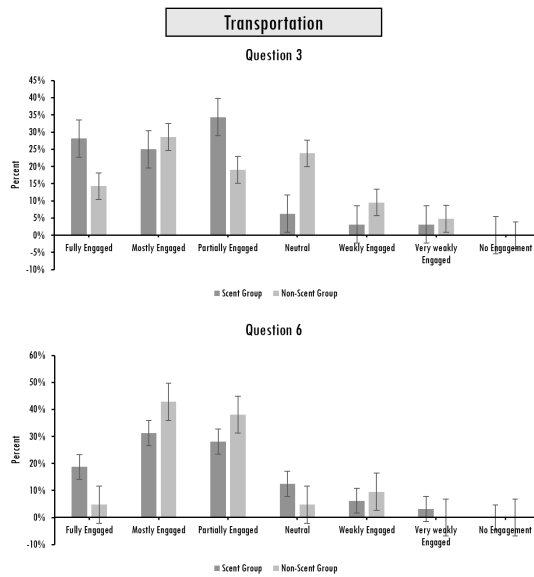


Figure 4.3 Transportation Questions Response Comparison

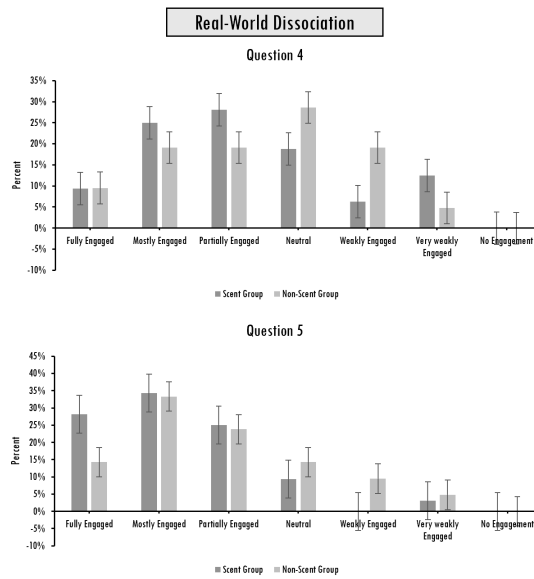


Figure 4.4 Real-World Dissociation Questions Response Comparison

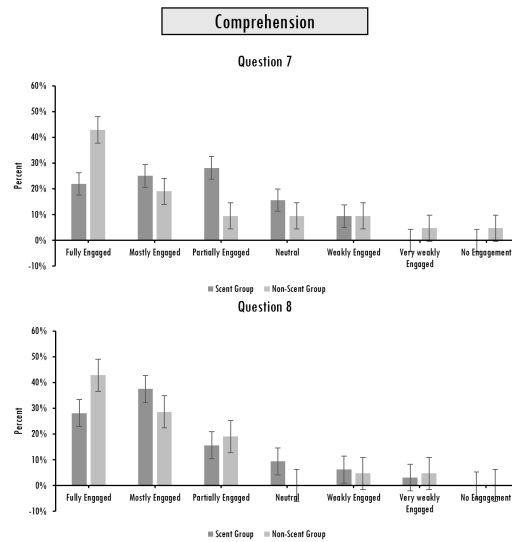


Figure 4.5 Comprehension Questions Response Comparison

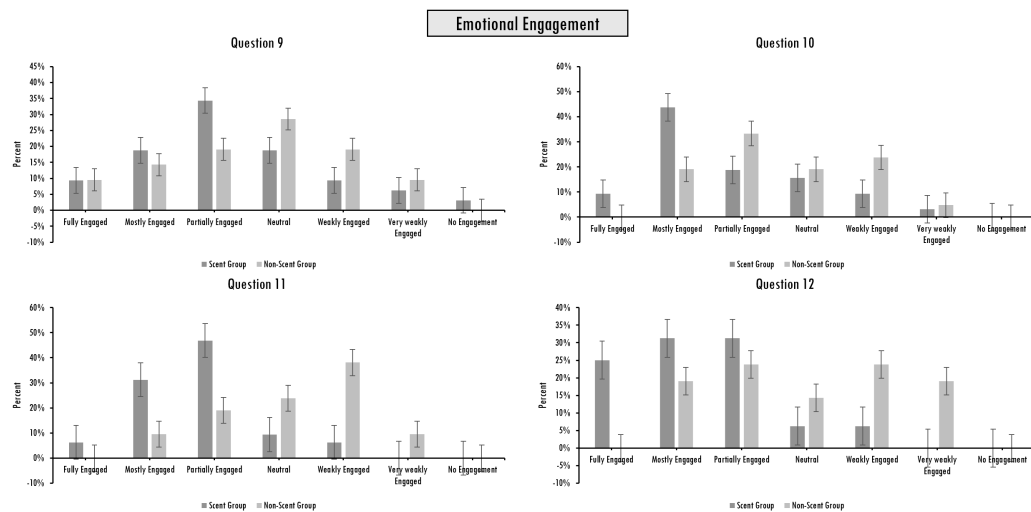


Figure 4.6 Emotional and Physiological Engagement Questions Response Comparison

emotional and physiological responses (Figure 4.6). Interestingly, for question 1, which asked about story enjoyment, 82% of participants in the scent group responded that they were fully or mostly immersed (enjoyed) the story while only 66% of the no scent group reported being this strongly immersed in the story. For the emotional and physiological engagement none of the participants in the non scent group reported being fully immersed, whereas 9%, 6% and 25% (questions 10, 11 and 12, respectively) of the Scent group reported being fully immersed (Table 4.3 and Figure 4.6).

# Chapter 5

## Conclusion

### 5.1. Main Findings

In the short 3-minute story time, both groups were able to have an enjoyable, immersive experience, however when it came to emotional engagement the scent group saw a large positive effect in boosting their emotional response to the story, feeling a change in their emotional state to match the change of aroma, and in feeling a physiological response. Emotional engagement ratings for the no scent group remained fairly neutral, greatly contrasting the high rates of emotional response and mood state changes reported by the scent group, suggesting that the non-diegetic scent score was the catalyst in turning this experience into an emotionally valuable one for the audience. Although both groups found the audio story experience enjoyable, the scent group had a much higher proportion of users rating their enjoyment on the two highest options on the Likert scale. Humans enjoy emotionally engaging stories [57], these higher ratings of enjoyment could be in response to having a more emotionally engaging time due to the scent.

For question 10, 11 and 12 - *To what extent did you feel emotionally affected by the story?*, *To what extent did you feel your emotional state change throughout the story?*, *To what extent did you feel a physiological response to the story?*, the scent group had a significant increase in impact. The scent score was designed to see a shift in emotion and mood, with the calming orange scent in the beginning and the agitating citronella becoming stronger as the narrative progressed. This large positive effect when compared to the no scent group shows that the use of non-diegetic scent worked as intended; eliciting a greater emotional shift than the audio could on its own. Interestingly, it was not just the feeling of a heightened emotional response but also the corresponding physiological response, suggesting that the scent helped to induce a genuine sense of fear in the story

consumer.

Of the four questions that dealt with emotional engagement, question 9 did not see a difference between the scent and no scent groups. Question 9 asked specifically about one's emotional connection to the characters of the story, however this story was not geared for character reception. The audio scene gave little information about the characters, did not give the key character any emotional reactions beyond fear or any defining character traits to connect to, nor was it long enough to give time to any character journey in its action driven plot. Given these factors [58], it is unsurprising that even with the addition of an emotionally evocative scent, it only had a small effect on audience members' ability to connect with the characters any further.

Questions 3 and 5 dealt with the immersion factors of real-world dissociation and transportation, asking the participant *to what extent did you lose track of time?* and *to what extent did you forget about your everyday concerns?*. Scent had a medium effect on these factors, suggesting that the non-diegetic scent helped participants to lose track of time and feel more a part of the story environment. For the other immersion factors of captivation and comprehension however, there was no difference in the immersion ratings, showing that scent did not have an impact on these aspects in this study. The immersion and emotional engagement factors that were altered by the use of non-diegetic scent show that story consumers are able to integrate scent influenced emotional information into the story they are experiencing. The scent not only altered their own state but also worked in tandem with the story content, increasing their emotional engagement. For the immersion factors of real-world dissociation and transportation there was a medium positive effect in the scent group, however this change did not extend to the other factors of captivation and comprehension. With increased story length and further refinement in the chosen scents, it could be possible to increase the character emotional engagement, as seen in the small difference in responses to question 9, and immersion factors across the board with questions 1 - 8. As seen in Study 1, it is possible for a non-diegetic scent to have an impact on immersion even if it is incongruous with the story environment.

This study shows that non-diegetic scent that induces the desired emotional response, is a valid and greatly effective tool and medium for enhancing story-

telling. The non-diegetic scent emotional information was smoothly integrated into the audience reaction to story and efficiently brought about a shift in mood and physiological response within narrative consumers. Emotional engagement is key to creating fulfilling, memorable and impactful stories that add value to the human experience [59] [60], and scent offers storytellers a way to influence story consumers at a base level in a powerful, direct way, eliciting emotional reactions and engagement, tapping into their memories and emotional processing core.

This study is one of the first investigations into the use of non-diegetic scent in storytelling. Although the idea of diegetic scent used alongside narratives is an concept that is familiar to us and has been researched extensively [61], using scent to elicit emotions is mostly looked at as a way to influence consumer behaviour in marketing [62] [63], or in a therapeutic way as seen in aromatherapy treatments [64] or anxiety reduction through ambient scents [65] [66]. As a result there are no studies to compare this one to, due to its novelty as a pioneer in this field of storytelling research and expression. Further studies into this particular application of aroma must be conducted to gain greater perspective on this concept, as well as to help validate the data gained through this research.

## 5.2. Limitations

This study has several limitations that must be considered when interpreting the results. The first of which being the limited number of participants, with the scent group containing 32 respondents and the no scent group having only 21. In order to ascertain the validity of non-diegetic scent on a deeper level, a further study would need to be larger to smooth out outlying responses, and especially with this medium, to account for any autobiographical odour memory interference.

Additionally some participants experienced the story under varied and not fully controlled conditions. Although most participants experienced the story at the PLAY to the Future Exhibition, many people as a part of the no scent group were asked to complete the task at home. Participants were given instructions to replicate the conditions of the study on their own, however variance in their experience is inevitable and uncontrolled and could have impacted results.

The audio story was offered in both English and Japanese to cater to the lan-



guage needs of both the domestic and international participants. The audio story content and length remained the same with the only difference being the spoken dialogue. The original English voiced by Zoe Padgham was faithfully translated into Japanese by Arata Shimojo and recorded by native speaker Annika Kondo. All efforts were made to ensure that there was as little difference between the two recordings as possible, however as is the nature of translated works, there would be differences that could have interacted with participants' story engagement.

### 5.3. Future Works

In order to investigate this further, larger studies with more participants, varied story types, different scents and different elicited emotional reactions are needed. This would be to ensure that the effect observed in the Proof of Concept Study could be replicated, as well as showing that non-diegetic scent can be used for other emotional outcomes. Scent can be used to elicit emotions beyond just that of the anxiety induced by the citronella used in the Proof of Concept Study, and it is important to investigate whether the emotional engagement is still heightened when other emotional reactions induced by scent are used instead. This study also just looked at the transition from calm to anxious using scent, it would be interesting to investigate whether the inverse mood shift could be created by reversing the scent order, paired with a story that lessened in tension over time.

In order to combat the potential interference of autobiographical odour memory, investigating whether blended scents of odours that evoke the same emotion, still elicit that particular response. For example, if cypress, peppermint and citronella were blended together, would it still agitate the consumer, and if it did, does the combination of these three scents nullify the memory association that some people have with these aromas – the relaxing hot springs for cypress and Christmas for peppermint. If this were possible, it would make for a more universally accessible scent story experience, with storytellers able to employ emotionally evocative scents without fear or triggering one of the widespread scent associations, or any of the infinite possible autobiographical odour memories an individual audience member might have. Testing across a variety of scent combinations would be needed to verify the validity of this idea.

A key goal of this research was to provide storytellers with evidence-based research so that they had more options and more creative avenues to express themselves through storytelling. To make non-diegetic scent a more widespread and accessible medium, the information about how it is best utilised and what scents can and cannot be used to induce particular emotions must also be widespread and accessible. Research done into scent and emotion is not as easily accessible to the general public as it is to researchers. If all of this information from many different sources and many different fields of study were collated into a single source it would help with the propagation of this tool and mode of expression. For this purpose a set of guidelines with information about how to use scent effectively and the limitations to its use, as well as an index of emotions and the odours one can use to elicit them, would be extremely useful and help spread this idea to a wider audience.

In the Proof of Concept Study it was only the scent group that had major emotional engagement with the story, making the non-diegetic scent an integral part of that story experience. Without the scent however the story was still able to be understood and enjoyed as an experience despite the lack of emotional response. To push this concept further as non-diegetic scent as a standalone medium it would be interesting to investigate the possibility of stories that cannot be told without the use of scent. Crafting narratives that rely on the emotional input of the scent to convey the meaning, tension, character motivations or even action.

There are many potential ways non-diegetic scent can be easily integrated into media forms we have currently. Scented books, scent cards provided with cinema tickets, instructions for aroma diffusion to experience while consuming at home media are all simply and cheaply implementable by storytellers today. With a normalisation of scent as a sensory input for narrative consumption, it eases the public into accepting this as a new mode for creative expression. Although as a consumer, scent used alongside narrative is easy to interpret, it may not occur to the storytellers themselves that this is a possibility for their own creative outputs. Seeing and experiencing scent as a part of emotional storytelling in the world around us would inspire new works, and fuel creativity and inspiration. Bringing new levels of emotional complexity to story creation, and help to enhance storytelling - a key part of human expression.

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# Appendices

## A. Study 1 - The Picture of Dorian Gray Edited Excerpt

The studio was filled with the rich odour of roses, and when the light summer wind stirred amidst the trees of the garden, there came through the open door the heavy scent of the lilac, or the more delicate perfume of the pink-flowering thorn.

From the corner of the divan of Persian saddle-bags on which he was lying, smoking, as was his custom, innumerable cigarettes, Lord Henry Wotton could just catch the gleam of the honey-sweet and honey-coloured blossoms of a laburnum, whose tremulous branches seemed hardly able to bear the burden of a beauty so flamelike as theirs; and now and then the fantastic shadows of birds in flight flitted across the long tussore-silk curtains that were stretched in front of the huge window, producing a kind of momentary Japanese effect, and making him think of those painters of Tokyo who, through the medium of an art that is necessarily immobile, seek to convey the sense of swiftness and motion. The sullen murmur of the bees shouldering their way through the long unmown grass, or circling with monotonous insistence round the dusty gilt horns of the straggling woodbine, seemed to make the stillness more oppressive. The dim roar of London was like the bourdon note of a distant organ.

In the centre of the room, clamped to an upright easel, stood the full-length portrait of a young man of extraordinary personal beauty, and in front of it, some little distance away, was sitting the artist himself, Basil Hallward, whose sudden disappearance some years ago caused, at the time, such public excitement and gave rise to so many strange conjectures.

As the painter looked at the gracious and comely form he had so skilfully mirrored in his art, a smile of pleasure passed across his face, and seemed about

to linger there. But he suddenly started up, and closing his eyes, placed his fingers upon the lids, as though he sought to imprison within his brain some curious dream from which he feared he might awake.

“It is your best work, Basil, the best thing you have ever done,” said Lord Henry languidly. “You must certainly send it next year to the Grosvenor. The Academy is too large and too vulgar. Whenever I have gone there, there have been either so many people that I have not been able to see the pictures, which was dreadful, or so many pictures that I have not been able to see the people, which was worse. The Grosvenor is really the only place.”

“I don’t think I shall send it anywhere,” he answered, tossing his head back in that odd way that used to make his friends laugh at him at Oxford. “No, I won’t send it anywhere.”

Lord Henry elevated his eyebrows and looked at him in amazement through the thin blue wreaths of smoke that curled up in such fanciful whorls from his heavy, opium-tainted cigarette. “Not send it anywhere? My dear fellow, why? Have you any reason? What odd chaps you painters are! You do anything in the world to gain a reputation. As soon as you have one, you seem to want to throw it away. It is silly of you, for there is only one thing in the world worse than being talked about, and that is not being talked about. A portrait like this would set you far above all the young men in England, and make the old men quite jealous, if old men are ever capable of any emotion.”

“I know you will laugh at me,” he replied, “but I really can’t exhibit it. I have put too much of myself into it.”

Lord Henry stretched himself out on the divan and laughed.

“Yes, I knew you would; but it is quite true, all the same.”

“Too much of yourself in it! Upon my word, Basil, I didn’t know you were so vain; and I really can’t see any resemblance between you, with your rugged strong face and your coal-black hair, and this young Adonis, who looks as if he was made out of ivory and rose-leaves. Why, my dear Basil, he is a Narcissus, and you—well, of course you have an intellectual expression and all that. But beauty, real beauty, ends where an intellectual expression begins. Intellect is in itself a mode of exaggeration, and destroys the harmony of any face. The moment one sits down to think, one becomes all nose, or all forehead, or something horrid. Look at

the successful men in any of the learned professions. How perfectly hideous they are! Except, of course, in the Church. But then in the Church they don't think. A bishop keeps on saying at the age of eighty what he was told to say when he was a boy of eighteen, and as a natural consequence he always looks absolutely delightful. Your mysterious young friend, whose name you have never told me, but whose picture really fascinates me, never thinks. I feel quite sure of that. He is some brainless beautiful creature who should be always here in winter when we have no flowers to look at, and always here in summer when we want something to chill our intelligence. Don't flatter yourself, Basil: you are not in the least like him."

"You don't understand me, Harry," answered the artist. "Of course I am not like him. I know that perfectly well. Indeed, I should be sorry to look like him. You shrug your shoulders? I am telling you the truth. There is a fatality about all physical and intellectual distinction, the sort of fatality that seems to dog through history the faltering steps of kings. It is better not to be different from one's fellows. Your rank and wealth, Harry; my brains, such as they are—my art, whatever it may be worth; Dorian Gray's good looks—we shall all suffer for what the gods have given us, suffer terribly."

"Dorian Gray? Is that his name?" asked Lord Henry, walking across the studio towards Basil Hallward.

"Yes, that is his name. I didn't intend to tell it to you."

"But why not?"

"Oh, I can't explain. When I like people immensely, I never tell their names to any one. It is like surrendering a part of them. I have grown to love secrecy. It seems to be the one thing that can make modern life mysterious or marvellous to us. The commonest thing is delightful if one only hides it. When I leave town now I never tell my people where I am going. If I did, I would lose all my pleasure. It is a silly habit, I dare say, but somehow it seems to bring a great deal of romance into one's life. I suppose you think me awfully foolish about it?"

"Not at all," answered Lord Henry, "not at all, my dear Basil. You seem to forget that I am married, and the one charm of marriage is that it makes a life of deception absolutely necessary for both parties. I never know where my wife is, and my wife never knows what I am doing. When we meet—we do meet

occasionally, we tell each other the most absurd stories with the most serious faces. My wife is very good at it—much better, in fact, than I am. She never gets confused over her dates, and I always do. But when she does find me out, she makes no row at all. I sometimes wish she would; but she merely laughs at me.”

“I hate the way you talk about your married life, Harry,” said Basil Hallward, strolling towards the door that led into the garden. “I believe that you are really a very good husband, but that you are thoroughly ashamed of your own virtues. You are an extraordinary fellow. You never say a moral thing, and you never do a wrong thing. Your cynicism is simply a pose.”

“Being natural is simply a pose, and the most irritating pose I know,” cried Lord Henry, laughing; and the two young men went out into the garden together and ensconced themselves on a long bamboo seat that stood in the shade of a tall laurel bush. The sunlight slipped over the polished leaves. In the grass, white daisies were tremulous.

After a pause, Lord Henry pulled out his watch. “I am afraid I must be going, Basil,” he murmured, “and before I go, I insist on your answering a question I put to you some time ago.”

“What is that?” said the painter, keeping his eyes fixed on the ground.

“You know quite well.”

“I do not, Harry.”

“Well, I will tell you what it is. I want you to explain to me why you won’t exhibit Dorian Gray’s picture. I want the real reason.”

“I told you the real reason.”

“No, you did not. You said it was because there was too much of yourself in it. Now, that is childish.”

“Harry,” said Basil Hallward, looking him straight in the face, “every portrait that is painted with feeling is a portrait of the artist, not of the sitter. The sitter is merely the accident, the occasion. It is not he who is revealed by the painter; it is rather the painter who, on the coloured canvas, reveals himself. The reason I will not exhibit this picture is that I am afraid that I have shown in it the secret of my own soul.”

Lord Henry laughed. “And what is that?” he asked.

“I will tell you,” said Hallward; but an expression of perplexity came over his

face.

“I am all expectation, Basil,” continued his companion, glancing at him.

“Oh, there is really very little to tell, Harry,” answered the painter; “and I am afraid you will hardly understand it. Perhaps you will hardly believe it.”

Lord Henry smiled, and leaning down, plucked a pink-petalled daisy from the grass and examined it. “I am quite sure I shall understand it,” he replied, gazing intently at the little golden, white-feathered disk, “and as for believing things, I can believe anything, provided that it is quite incredible.”

The wind shook some blossoms from the trees, and the heavy lilac-blooms, with their clustering stars, moved to and fro in the languid air. A grasshopper began to chirrup by the wall, and like a blue thread a long thin dragon-fly floated past on its brown gauze wings. Lord Henry felt as if he could hear Basil Hallward’s heart beating, and wondered what was coming.

“The story is simply this,” said the painter after some time. “Two months ago I went to a crush at Lady Brandon’s. Well, after I had been in the room about ten minutes, talking to huge overdressed dowagers and tedious academicians, I suddenly became conscious that some one was looking at me. I turned half-way round and saw Dorian Gray for the first time. When our eyes met, I felt that I was growing pale. A curious sensation of terror came over me. I knew that I had come face to face with some one whose mere personality was so fascinating that, if I allowed it to do so, it would absorb my whole nature, my whole soul, my very art itself. I did not want any external influence in my life. You know yourself, Harry, how independent I am by nature. I have always been my own master; had at least always been so, till I met Dorian Gray. Then—but I don’t know how to explain it to you. Something seemed to tell me that I was on the verge of a terrible crisis in my life. I had a strange feeling that fate had in store for me exquisite joys and exquisite sorrows. I grew afraid and turned to quit the room. It was not conscience that made me do so: it was a sort of cowardice. I take no credit to myself for trying to escape.”

“Conscience and cowardice are really the same things, Basil. Conscience is the trade-name of the firm. That is all.”

“I don’t believe that, Harry, and I don’t believe you do either. However, whatever was my motive—and it may have been pride, for I used to be very proud—I

certainly struggled to the door. There, of course, I stumbled against Lady Brandon. ‘You are not going to run away so soon, Mr. Hallward?’ she screamed out. You know her curiously shrill voice?”

“Yes; she is a peacock in everything but beauty,” said Lord Henry, pulling the daisy to bits with his long nervous fingers.

“I could not get rid of her. She brought me up to royalties, and people with stars and garters, and elderly ladies with gigantic tiaras and parrot noses. She spoke of me as her dearest friend. I had only met her once before, but she took it into her head to lionize me. I believe some picture of mine had made a great success at the time, at least had been chattered about in the penny newspapers, which is the nineteenth-century standard of immortality. Suddenly I found myself face to face with the young man whose personality had so strangely stirred me. We were quite close, almost touching. Our eyes met again. It was reckless of me, but I asked Lady Brandon to introduce me to him. Perhaps it was not so reckless, after all. It was simply inevitable. We would have spoken to each other without any introduction. I am sure of that. Dorian told me so afterwards. He, too, felt that we were destined to know each other.”

“Then why won’t you exhibit his portrait?” asked Lord Henry.

“Because, without intending it, I have put into it some expression of all this curious artistic idolatry, of which, of course, I have never cared to speak to him. He knows nothing about it. He shall never know anything about it. But the world might guess it, and I will not bare my soul to their shallow prying eyes. My heart shall never be put under their microscope. There is too much of myself in the thing, Harry—too much of myself!”

“Poets are not so scrupulous as you are. They know how useful passion is for publication. Nowadays a broken heart will run to many editions.”

“I hate them for it,” cried Hallward. “An artist should create beautiful things, but should put nothing of his own life into them. We live in an age when men treat art as if it were meant to be a form of autobiography. We have lost the abstract sense of beauty. Some day I will show the world what it is; and for that reason the world shall never see my portrait of Dorian Gray.”

“My dear fellow, I have just remembered.”

“Remembered what, Harry?”



“Where I heard the name of Dorian Gray.”

“Where was it?” asked Hallward, with a slight frown.

“Don’t look so angry, Basil. It was at my aunt, Lady Agatha’s. She told me she had discovered a wonderful young man who was going to help her in the East End, and that his name was Dorian Gray. I am bound to state that she never told me he was good-looking. Women have no appreciation of good looks; at least, good women have not. She said that he was very earnest and had a beautiful nature. I at once pictured to myself a creature with spectacles and lank hair, horribly freckled, and tramping about on huge feet. I wish I had known it was your friend.”

“I am very glad you didn’t, Harry.”

“Why?”

“I don’t want you to meet him.”

“You don’t want me to meet him?”

“No.”

“Mr. Dorian Gray is in the studio, sir,” said the butler, coming into the garden.

“You must introduce me now,” cried Lord Henry, laughing.

The painter turned to his servant, who stood blinking in the sunlight. “Ask Mr. Gray to wait, Parker: I shall be in in a few moments.” The man bowed and went up the walk.

Then he looked at Lord Henry. “Dorian Gray is my dearest friend,” he said. “He has a simple and a beautiful nature. Your aunt was quite right in what she said of him. Don’t spoil him. Don’t try to influence him. Your influence would be bad. The world is wide, and has many marvellous people in it. Don’t take away from me the one person who gives to my art whatever charm it possesses: my life as an artist depends on him. Mind, Harry, I trust you.” He spoke very slowly, and the words seemed wrung out of him almost against his will.

“What nonsense you talk!” said Lord Henry, smiling, and taking Hallward by the arm, he almost led him into the house.

## B. Study 1 - Story Immersion Survey

6/28/22, 2:21 AM

Post Story Survey

### Post Story Survey

Thank you very much for your participation. In this survey you will be asked questions to determine how immersive you found the experience and also how much of the story you recall.

\*Required

1. What is your age? \*

Mark only one oval.

- Under 18
- 19 - 25
- 26 - 30
- 31 - 35
- 36 - 40
- 41 - 45
- 46 - 50
- 51 - 55
- 56 - 60
- 61 - 65
- 66 - 70
- 71+

2. What is your gender? \*

Mark only one oval.

- Female
- Male
- Non-binary
- Other

3. Is English one of your native languages? \*

Mark only one oval.

- Yes
- No

4. What is your nationality? \*

\_\_\_\_\_

6/28/22, 2:21 AM

Post Story Survey

5. Were you familiar with this story before listening to the excerpt? \*

Mark only one oval.

- Yes
- No

6. Have you read the book that this story excerpt came from? \*

Mark only one oval.

- Yes
- No

Story  
Immersion

This section of this survey looks at how immersed in the story you felt whilst listening. Please answer as honestly as you can.

7. To what extent did you enjoy the story experience? \*

Mark only one oval.

1   2   3   4   5   6   7   8   9   10

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Did not enjoy it at all            Enjoyed it very much so

8. To what extent did the story hold your attention? \*

Mark only one oval.

1   2   3   4   5   6   7   8   9   10

---

Did not hold your attention at all           Fully held your attention

9. To what extent did you feel you were focused on the story? \*

Mark only one oval.

1   2   3   4   5   6   7   8   9   10

---

Were not focussed at all           Completely focussed

10. How much effort did it take to stay focussed on the story? \*

Mark only one oval.

1   2   3   4   5   6   7   8   9   10

---

No effort           A lot of effort

6/28/22, 2:21 AM

Post Story Survey

11. To what extent did you lose track of time? \*

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Keenly aware of passing time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Completely lost track of time

12. To what extent did you feel consciously aware of being in the real world whilst listening? \*

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Unaware	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Aware

13. To what extent did you forget about your everyday concerns? \*

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Did not forget everyday concerns	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Forgot everyday concerns

14. To what extent were you aware of yourself in your surroundings? \*

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Unaware	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Aware

15. Did you feel the urge at any point to stop listening and see what was happening around you? \*

Mark only one oval.

Yes  
 No

16. To what extent did you feel that you were within the story environment? \*

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Not within the story at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Totally within the story

6/28/22, 2:21 AM

Post Story Survey

17. To what extent did you feel as though you were separated from your real-world environment? \*

Mark only one oval.

1   2   3   4   5   6   7   8   9   10

---

Not separated            Totally separated

18. To what extent did you feel that the story was something you were experiencing, rather than something you were just listening to? \*

Mark only one oval.

1   2   3   4   5   6   7   8   9   10

---

Listening to           Experiencing

19. At any point did you find yourself become so involved that you were unaware you were even listening to an audio recording? \*

Mark only one oval.

Yes  
 No

20. To what extent did you find the story themes, concepts or ideas challenging to comprehend? \*

Mark only one oval.

1   2   3   4   5   6   7   8   9   10

---

Very easy to comprehend           Very challenging to comprehend

21. Were there any times during the story in which you wanted to stop listening? \*

Mark only one oval.

Yes  
 No

22. To what extent did you find the plot of the story easy to follow? \*

Mark only one oval.

1   2   3   4   5   6   7   8   9   10

---

Very hard to follow           Very easy to follow

6/28/22, 2:21 AM

Post Story Survey

23. To what extent were you interested in seeing how the story's events would progress? \*

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Not interested at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very interested

Plot Recall

This section of the survey looks at how well you remember the events of the story. This is not a test by any means, so please do not worry if you cannot recall the information, just leave the question blank. You do not need to give detailed answers to the questions, single words and short sentences are fine. Do not listen to the story again to confirm your answers during or after completing this survey.

- 24. What part of the house did this story take place in?  
\_\_\_\_\_
- 25. What was the name of young man in the portrait?  
\_\_\_\_\_
- 26. What was Henry Wotton's title?  
\_\_\_\_\_
- 27. What university did Basil Hallward attend?  
\_\_\_\_\_
- 28. Where did Basil Hallward meet the subject of the painting?  
\_\_\_\_\_
- 29. What colour was the dragonfly that floated past the two men?  
\_\_\_\_\_
- 30. What profession did Henry Wotton describe as 'less scrupulous' than artists like Basil Hallward?  
\_\_\_\_\_
- 31. What kind of flower did Henry Wotton pick apart whilst listening to Basil Hallward's story?  
\_\_\_\_\_
- 32. How did Basil Hallward feel when he first saw the subject of the painting?  
\_\_\_\_\_

<https://docs.google.com/forms/d/1pzyCKPJS7G7QbyuFvleZvOx1HUrpqUewtyGrhcXOwlc/edit>

5/6

6/28/22, 2:21 AM

Post Story Survey

33. Why wouldn't Basil Hallward send the painting to a gallery?

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## C. Proof of Concept - Audio Horror Story Script

**INT. EXHIBITION. DARK.**

Participant sits in a pitch black booth. They wear headphones that play the story sounds through it.

**INT. CARGO HOLD. DARK.**

The low hum of electric devices and light creaking echoes through a large mostly empty room. A comm line buzzes in the ear. The voice of their crewmate ORLA is artefacted like that of an old walkie talkie.

ORLA (THROUGH COMMS)

Hey Captain, I saw the lights just went out in the cargo hold, you still down there? Captain? Can you hear me? *Is there a? Hmmm.* Hang on a sec. 船長、貨物室の明かりが消えたんですが、まだそこにいるんですか? 船長? 聞こえますか? 聞こえますか? ちょっと待てよ。

The line whines and sputters. ORLA's voice crackles through again.

ORLA (THROUGH COMMS)

Captain? This is Orla, just seeing if you're still down in the cargo hold. I saw up on the ship computer that the lights went out. Captain? Hmmm. Just checking now, there doesn't seem to be any connection issues on the comms, I think you might be having problems on your end. Captain? Hmmm, well I hope you can hear me. I'll come down there anyway and see what I can do about the lights.

船長? オーラよ、まだ貨物室にいるかどうか確認してるの。船のコンピュータで確認したけど、明かりが消えている。船長? うーん、今確認したところ、通信に問題はなさそう。そっち側に問題があるんじゃない? 船長? うーん、まあ、聞こえるといいんだけど。とにかく降りて行って、明かりをどうにかしてみよう

Faint chittering echoes from far off. A nondescript sound of movement pulses like breath from somewhere in the room, the sound gets slightly closer, circling in.

ORLA (THROUGH COMMS)

Huh. Um. I just got to hull blast doors and it looks like the power is out across the whole underside of the ship. Weird. Um, well I'll manually override these doors and get you out and then we can see about sorting out the power issue. Hang tight.



はあ、ブラストドアに着いたけど 船底が停電してるみたい。 変  
だな 手でドアを無効化し、あなたを脱出させてみる。  
その後、電源の問題を解決する。踏ん張って。

The cargo hold ambiance dims slightly. A few moments of silence pass before the sound distant scuttling. The silence stretches again. Clawed footsteps ring distantly and slowly approach. Heavy rattling breaths and the wet sound of ichor dripping pair with the footsteps as it appears to get closer. The sound gets further away as the creature passes by, eventually it is silent again. The comms line crackles suddenly and ORLA's voice cheerfully breaks through.

ORLA (THROUGH COMMS)  
Alrighty! I reckon that'll do it. The security  
anyway, I'll winch it open now.  
よしっ！これでよしとしよう。とにかくセキュリティよ、今すぐ  
ウィンチで開けよう。

Metal scraping and electrical sparking sounds in the distance.  
There is a soft human grunt of effort.

ORLA  
Captain? Where are you?  
船長？どこにいるんだ？

From the opposite direction of ORLA's voice a dry growl echoes in the room.

ORLA (THROUGH COMMS)  
Captain I just got the door open. Give us a shout  
and let's get out of... Wait... Did you hear that?  
船長.....今、ドアが開きました。声をかけてくれ、そして...  
待てよ、今の聞こえたか？

ORLA  
Captain!?  
船長!？

ORLA's voice calls out panicked. The clawed footsteps sound close as wood splintering scratches cut through nearby crates. The comms line buzzes again, ORLA's voice is whispered and frightened, she swallows thickly as she speaks.

ORLA (THROUGH COMMS)  
Captain, I think there's something in the room.  
I'm going to... I'm going to try and find you.  
Don't make a noise.  
船長、部屋に何かいるみたい。探してみるよ。音を立てないで

The same dry growl sounds closer but still on the opposite side to ORLA. Rasping breath and wet dripping comes closer. ORLA's voice trembles as she speaks.

ORLA (THROUGH COMMS)

Captain I've just picked up your heat signature, I'm going to come get you, then we've got to get out of here, okay?

船長、今あなたの熱源を探知した。迎えに行くわ。  
その後ここから出ましよう、それでいい？

The comms line does not turn off immediately and ORLA's forced calm breaths rattle in the ear piece. ORLA's soft and cautious footsteps approach slowly. The clawed footsteps stop as the creature sounds to be right on top of the listener. Its rasping breaths rumble menacingly as thick splats of dripping ichor hit the nearby ground. The communicator stops and ORLA's soft shaky breaths cut through the silence. ORLA swallows before breathing through her mouth as if gearing up to speak. The creature's breath stops in anticipation. ORLA's voice is barely above a whisper, heavy with fear.

ORLA

Captain?

船長？

## D. Proof of Concept - Story Immersion and Emotional Engagement Survey

### Story Engagement Survey

Thank you very much for your participation. In this survey you will be asked questions to determine how immersive you found the experience and also about your emotional engagement.

**1. To what extent did you enjoy the story experience?**

Did not enjoy (1) – (2) – (3) – (4) – (5) – (6) – (7) Enjoyed a lot

**2. To what extent did you feel you were focused on the story?**

Not focussed at all (1) – (2) – (3) – (4) – (5) – (6) – (7) Very focussed

**3. To what extent did you lose track of time?**

Very conscious of time passing (1) – (2) – (3) – (4) – (5) – (6) – (7) Completely lost track of time

**4. To what extent did you feel consciously aware of being in the real world whilst listening?**

Very aware (1) – (2) – (3) – (4) – (5) – (6) – (7) Completely unaware

**5. To what extent did you forget about your everyday concerns?**

Very conscious of concerns (1) – (2) – (3) – (4) – (5) – (6) – (7) Concerns completely forgotten

**6. To what extent did you feel that you were within the story environment?**

Not within the environment (1) – (2) – (3) – (4) – (5) – (6) – (7) Completely within environment

**7. To what extent did you find the story themes, concepts or ideas challenging to comprehend?**

Very hard (1) – (2) – (3) – (4) – (5) – (6) – (7) Very easy

**8. To what extent did you find the plot of the story easy to follow?**

Very hard (1) – (2) – (3) – (4) – (5) – (6) – (7) Very easy

**9. To what extent did you feel emotionally attached to the story?**

Completely unattached (1) – (2) – (3) – (4) – (5) – (6) – (7) Very attached

**10. To what extent did you feel as though you sympathised with the characters?**

Characters unrelatable (1) – (2) – (3) – (4) – (5) – (6) – (7) Connected to characters a lot

**11. To what extent did you feel emotionally affected by the story?**

Completely unaffected (1) – (2) – (3) – (4) – (5) – (6) – (7) Very affected

**12. To what extent did you feel your emotional state change throughout the story?**

Remained consistent (1) – (2) – (3) – (4) – (5) – (6) – (7) Greatly changed

**13. To what extent did you feel a physiological response to the story?**

No response (1) – (2) – (3) – (4) – (5) – (6) – (7) Great response