

The use of immersive technology as a tool to ease anxiety during treatment at an orthodontist.



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Enjoy reading.

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Abstract

Visiting the dentist can potentially generate an array of negative emotions. It is therefore important for patients to feel more pleasant and in control, and to ease patients' negative emotions such as feelings of pain, stress and anxiety while receiving treatment at the orthodontist. Distraction techniques can influence people's emotions and mood. This study was executed to investigate whether music distraction or audiovisual distraction can aid to improve patients' perceived control, anxiety, pain, and stress levels, by creating a less arousing and more pleasurable environment. The field experiment (n= 105) was conducted in a German dental clinic. The patients' anxiety, stress, pain, control, pleasure, and arousal levels were measured in three conditions: with audiovisual distraction, with music distraction, without music or audiovisual distraction. The results showed that both distraction techniques used had no significant change on patients' perceived control, anxiety, pain, stress, pleasure and arousal levels. The results indicate that music and audiovisual distractions are not effective in easing patients' pain, stress, anxiety and arousal levels, and do not increase patients perceived control, and pleasure. However, patients within this study did generally indicated a low level of pain, stress and anxiety, as well as a high level of pleasure and feeling of being in control.

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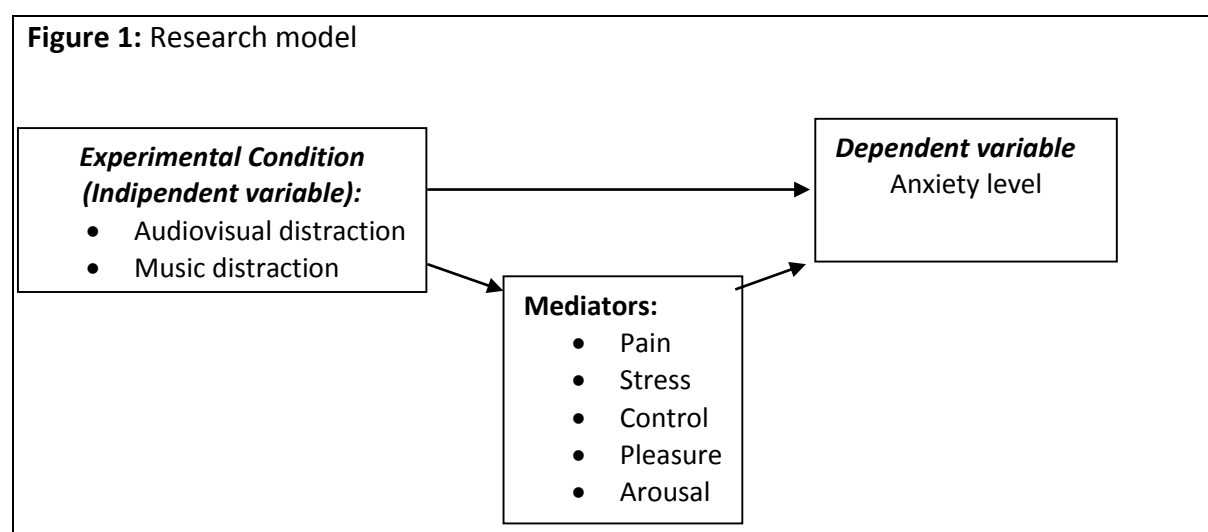
1. Introduction

A patient's emotional response to dental treatment is a common issue for dentists. Dental patients tend to respond to visiting the dentist with emotions such as stress, fear and anxiety (Milgrom, Fiset, Melnick, & Weinstein, 1988). Dental anxiety is an extremely common issue world-wide (Freeman, 1999). In a study conducted in Germany, it was reported that 11% of a representative German community sample experienced anxiety when receiving treatment at the dentist (Enkling, Marwinski, & Jöhren, 2006). In fact, a growing number of studies suggest that the main reason for patients avoiding or delaying treatment, is due to the patients' dental anxiety. This finding is rather concerning, since delaying treatment has significant negative effects on the deterioration of the patients' oral hygiene (Freeman, 1999; Mehrstedt, Tonnies, & Eisentraut, 2004). Therefore, it is important for dental clinics to create effective techniques that reduce patients' anxiety. In the pursuit of improving patients' dentist experience substantial research has been conducted on the reduction of dental anxiety over the past years (e.g. Lahmann et al., 2008; Prabhakar, Marwah, & Raju, 2007; Lai et al., 2008; Seyrek, Corah, & Pace, 1984; Corah, Gale, & Illig, 1979; Armfield, Stewart, & Spencer, 2007; Moore & Brodsgaard, 2001).

Dentists often use evasive medical interventions to reduce pain during procedures, however the sight of medical interventions is suggested to be a major trigger for dental anxiety (Cohen, Fiske, & Newton, 2000; Moore, Birn, Kirkegaard, Brodsgaard, & Scheutz, 1993). As a result, identifying un-evasive and non-medical alternatives is desirable (Hyde, Bryden, & Asbury, 1998). An area of research that has been receiving growing attention and has been proven to be successful is the use of distraction techniques. These techniques include watching a video (audiovisual distraction) (Weisenberg, Tepper, & Schwarzwald, 1995), listening to music (Carlin, Ward, Gershon, & Ingraham, 1962), and playing video games (Seyrek, Corah, & Pace, 1984) while receiving dental treatment.

The present study aims to explore the possibilities of improving patient's dental experience by using distraction techniques. By making use of a field study, patients will be exposed to music distraction and audiovisual (A/V) distraction while receiving treatment at a dentist in Germany. Information about patients' emotions during treatment will be gathered to find

out the effects of the aforementioned distraction techniques on patients' experienced anxiety. Additionally, the anxiety experienced by the subjects is expected to be influenced by the feeling of being in control (Moore & Brodsgaard, 2001), experienced and anticipated pain (Armfield, Stewart, & Spencer, 2007), as well as stress (Moore & Brodsgaard, 2001) during treatment. Moreover the implementation of distraction techniques is expected to influence patients' level of pleasure and arousal. Thus, all the aforementioned factors will be used as mediators within this study. The research model can be seen in Figure 1.



2. Theoretical Framework

2.1 Dental experience

This study focuses on one main aspect of the dental experience; the anxiety of patients during treatment. The most common reasons for patient anxiety will be investigated: the dental soundscape, dental patients' lack of control, pain and stress.

2.1.1. Anxiety

The main reason patients avoid dental treatment, is due to their dental anxiety (Mehrstedt, Tonnie & Eisentraut, 2004). Dental anxiety refers to a patient's negative experience and thoughts associated with the imminent treatment (De Jongh & ter Horst, 1995), which can lead to both mental and physical discomfort (Vaughn, Wichowski, & Bosworth, 2007). Therefore, dental clinics are continuously exploring new ways to try and reduce the anxiety experienced by patients. One important aspect is finding out what actually triggers anxiety when receiving treatment at the dentist. Studies indicate that the most common triggers of dental anxiety are caused by the sound and sight of dental tools (Cohen, Fiske, & Newton,

2000; Moore et al., 1993), a low sense of control within a dental setting (Moore & Brodsgaard, 2001; Jackson & Lindsay, 1995), the anticipation of pain, and the pain patients may feel (Armfield, Stewart & Spencer, 2007), as well as the stress patients may feel when visiting the dentist (Moore & Brodsgaard, 2001). Therefore trying to reduce these causes of anxiety is expected to result in a decreased level of anxiety for dental patients.

2.1.1.1. Soundscape

The soundscape is an important part of the dentist environment, similarly to other medical settings. Comparable to studies conducted on the soundscape at a hospital (Salandina, Arnold & Kornadt, 2011), patients receiving treatment at the dentist are often exposed to noise from the dental related equipment. In addition, the sound of equipment often alters patients' concentration to the treatment itself. Although patient exposure to complex sounds at the dentist is limited to the treatment time, studies have identified the sight and sound of dental equipment to be a main source of patient anxiety. In particular, the sight and sound of dental drills, and the sight and sensation of local anaesthetic injection (Cohen, Fiske, & Newton, 2000; Moore et al., 1993) have been suggested to be the leading causes of dental anxiety.

2.1.1.2. Loss of control

A lack of control within a dental setting is another common reason for dental anxiety. It is obvious that getting treatment at a dentist can be invasive, and patients are forced to trust the dentist, despite usually lacking the medical knowledge to understand what is being done during treatment (Jackson & Lindsay, 1995).

The body of literature associated to the evaluation of control is so widespread (e.g. Averill, 1973), that within the present study only a short introduction will be provided on the different types of control and the effect they have on experienced stress levels, without going into extensive detail. Averill (1973) distinguishes between three types of control; behavioural, cognitive, and decisional. Behavioural control refers to a person's ability to alter an environment induced with unpleasant stimuli (Averill, 1973), an example of this includes the learning of relaxation skills. On the other hand, cognitive control is based on an individual's thoughts, beliefs, and interpretation of events. Cognitive control aims to facilitate a new understanding of unpleasant stimuli where it becomes less threatening for

subjects (Averill, 1973). Furthermore, decisional control provides subjects with the ability to choose between options (Averill, 1973).

Several studies propose that the information and choice provided to subjects are vital in influencing perceived control, and subsequently emotional outcomes in a medical setting (Langer & Rodin, 1976; Leventhal & Everhart, 1978; Mills & Krantz, 1979). Within a dental context, studies have indicated that the patient and dentist communication prior to treatment is a common way of creating a sense of control for patients. Information is suggested to be a form of cognitive control, since it allows an individual's interpretation of an unpleasant situation to change, to where the threat is reduced (Averill, 1973; Mills & Krantz, 1979). Providing precise information about sensations associated with unpleasant medical procedures has been shown to be effective in diminishing discomfort and stress (Johnson, 1973; Johnson & Leventhal, 1974), which is suggested to be due to subjects' ability to prepare for the procedures (Mills & Krantz, 1979). Thus, allowing the dentist to communicate with patients about the impending treatment can play an important role in making patients feel more secure, and as a result can reduce anxiety (Moore & Brodsgaard, 2001).

However, Averill (1973) suggests that providing a person with information prior to a procedure does not consistently reduce stress, but may also increase stress levels. In the current study, subjects' interpretation of the impending treatment may lead to an increase in stress, if the information patients are provided with about the imminent procedure is more complex and harmful than expected. Still, Averill (1973) concluded that participants generally prefer receiving information about an approaching harmful event.

Additionally, providing subjects with options also enables a potential increase in perceived control, since participants perceive that they have an influence on the outcome (Mills & Krantz, 1979). Choice is an example of decisional control, and has been suggested to reduce discomfort and stress associated with medical procedures (Cromwell, Butterfield, Brayfield, & Curry, 1977; Averill, 1973). One study conducted in a dental environment has shown that giving patients the choice to interrupt the treatment at any given time allows patients to overcome the feeling of not being in control of the situation, which in turn reduces anxiety (Jackson, & Lindsay, 1995).

2.1.1.3. Pain and Stress

A growing number of studies claim that another main source of anxiety for patients seeking dental care originates from the patient's fear of pain or pain felt during treatment (Arntz, van Eck, & Heijmans, 1990; Armfield, Stewart, & Spencer, 2007). Research suggests that patient and dentist communication prior to the treatment, as well as providing patients with certain options, can reduce the discomfort associated with the upcoming procedure (Cromwell et al., 1977; Armfield, Stewart, & Spencer, 2007).

In addition, when visiting the dentist, patients often feel stressed in regards to the imminent treatment to be undertaken, adding to the experienced anxiety. The primary triggers of patient stress are indicated as; perceived pain and the combination of sight and sound of dental equipment (Moore & Brodsgaard, 2001; Cohen, Fiske & Newton, 2000; Moore et al., 1993). Accordingly, reducing the triggers of stress by masking sounds and sights of dental equipment can be beneficial to reduce anxiety for dental patients. Additionally as mentioned above, providing subjects' with accurate information, as well as choices, can create a higher perceived control, which may consequently decrease subjects experienced stress (Averill, 1973).

2.1.2 Pleasure and Arousal

Visiting a dentist tends to generate negative emotions such as stress and anxiety. These negative emotions can be caused by the high arousing soundscape elements of a dentist (Cohen, Fiske, & Newton, 2000; Moore et al., 1993). In fact, Berlyne (1960) suggests that an individual usually favours medium levels of arousal, and if stimuli causes a high or a low level of arousal, this often results in a negative experience. Therefore, implementing distractions that can reduce or eliminate the arousing soundscape associated with the dentist, can result in a more pleasurable experience.

Within the current study, subjects' level of pleasure and arousal are also included as mediators, and can potentially explain the changes in emotional response patients forego within a this dental context.

2.2 Distraction techniques

Research shows evidence that the implementation of positive distractors within a healthcare setting can influence patients' emotions by easing pain (Corah, Gale, & Illig, 1979), stress (Beukeboom, Langeveld, & Tanja-Dijkstra, 2012), and anxiety (Tanja-Dijkstra, Pahl, White, Andrade, Qian, et al., 2014; Fenko & Loock, 2014; Corah, Gale, & Illig, 1979). Examples of distraction techniques implemented includes; adding natural elements to the environment (Beukeboom, Langeveld, & Tanja-Dijkstra, 2012), decorations (Ingham & Spencer, 1997), scent (Fenko & Loock, 2014), listening to music (Lahmann, Schoen, Henningsen, Ronel, Muehlbacher, et al., 2008; Lai, Hwang, Chen, Chang, et al., 2008; Aitken, Wilson, Coury, & Moursi, 2002; Fenko & Loock, 2014), watching a video via an audiovisual (A/V) device (Weisenberg, Tepper, & Schwarzwald, 1995; Seyrek, Corah, & Pace, 1984; Prabhakar et al., 2007; Furman, Jasinevicius, Bissada, et al., 2009; Frere, Court, Yorty, & McNeil, 2001; Bentsen, Svensson, & Wenzel, 1999; Bentsen, Wenzel, & Svensson, 2002), and virtual reality through an A/V device (Seyrek, Corah, & Pace, 1984; Bentsen, Svensson, & Wenzel, 1999; Furman, Jasinevicius, Bissada, et al., 2009; Tanja-Dijkstra, Pahl, & White, 2014). Dijkstra and Beukeboom (2012) demonstrate that adding real or artificial plants in a hospital waiting room can lead to a more enjoyable atmosphere, and can potentially diminish patients' stress levels. Moreover, Fenko and Loock (2014) showed that environmental stimuli such as music and scent appear to be beneficial in easing pre-operative anxiety at a plastic surgeon.

The benefits of distraction techniques specifically within the dental setting have been supported by several studies (Lahmann et al., 2008; Seyrek, Corah, & Pace, 1984; Corah, Gale, & Illig, 1979; Prabhakar et al., 2007, Tanja-Dijkstra, Pahl, & White, 2014; Frere, Court, Yorty, & McNeil, 2001; Bentsen, Wenzel, & Svensson, 2002). Corah and colleagues used video distraction, and audiotaped relaxation instructions as distraction techniques and found that adult dental patients experienced a reduced level of pain and anxiety with the use of visual distraction, but not with the use of audiotaped distraction (Corah, Gale, & Illig, 1979). Lahmann and colleagues (2008) on the other hand, applied a brief relaxation method alongside music distraction. The results confirmed both to be significant in reducing dental anxiety, with the brief relaxation method being superior compared to the music distraction.

Evidence on the effectiveness of distraction techniques, includes diverting patient's attention away from the sight and sound of negative stimuli being experienced in that

moment (Seyrek, Corah, & Pace, 1984; Baghdadi, 2000). The success of distraction techniques is based on the notion that the amount of attention directed to the negative stimuli corresponds to the amount of pain patient's perceive (McCaul, Mallot, 1984). Research on distraction techniques within a dental setting has demonstrated a reduction in anxiety, by minimizing the pain and stress associated to the medical procedure being experienced (Seyrek, Corah, & Pace, 1984; Frere, Court, Yorty, & McNeil, 2001; Prabhakar et al., 2007).

In the present study we manipulate two distraction techniques: Music and Audiovisual distraction.

2.2.1 Music as a distraction technique

Research performed on the application of music within a dental setting has provided evidence that the use of music could decrease the anxiety of patients undergoing dental treatment (Lai et al., 2008). The effect of music as a form of distraction is suggested to bring a combination of relaxation and distraction, when being listened to by patients (Good, Anderson, Ahn, Cong, & Stanton-Hicks, 2005). This is based on the perception that within a dental setting music allows patients to supersede the negative stimuli, and instead focus their attention on the music itself (which can potentially reduce the perceived pain) (Lahmann et al., 2008). Furthermore, if the music is also soothing, patients can feel relaxed, which can alter their mood by potentially easing anxiety (Korhan, Khorshid, & Uyar, 2010).

However, studies on the effectiveness of music as a distraction technique within the dental setting have varied results. Some studies have found that music does not create a significant distraction to reduce the anxiety of patients (e.g. Corah, Gale, Pace, & Seyrek, 1981; Seyrek, Corah, & Pace, 1984; Aitken et al., 2002.). This could be due to music alone not fully distracting patients from the anxiety-enhancing sounds, as well as the sight of dental equipment. Therefore, failing to distract the patient completely from the negative stimuli. A more recent study of dental patients in Germany showed evidence that the use of audio distraction does significantly reduce dental anxiety, however, when compared to other forms of distractions, in this case brief relaxation, the effect of music on easing anxiety is considerably less (Lahmann et al., 2008).

Regardless, given the lack of negative and harmful effects, as well as the ease of offering audio distractions within a dental clinic, this technique would be worth investigating, especially with the potential for positive emotional outcomes (easing anxiety). Within this study, different types of music are considered, since various genres of music can influence the patient's emotional state differently. Various studies have examined the effect of different music types on patients' evaluation of a healthcare setting. One study showed evidence that fast tempo music caused an arousing effect, while soft, slow tempo music caused a relaxing effect for patients (Bernardi, Porta, & Sleight, 2006). Research concentrating on relaxing music demonstrated that calm and soothing music is an effective tool in reducing anxiety (Wong, Lopez-Nahas, & Molassiotis, 2001). Therefore, within this study a pre-test will be conducted in an attempt to find the most calming and soothing music genre, which will subsequently be used as the audio distraction in this study.

Although the use of audio distraction within this study is not expected to fully mask the anxiety-enhancing dental soundscape, patients are expected to be diverted from the negative stimuli and concentrate more on the music, and as a result decrease patients' experienced anxiety. Based on these findings, the first hypothesis was generated.

H1: Calm and soothing music distraction eases dental patients' experienced anxiety.

H1b: This effect is mediated by patients' level of pain, stress, control, pleasure, and arousal.

2.2.2 Audiovisual as a distraction

The dentist environment during a procedure creates several unpleasant sounds and movement. Therefore, in order to distract patients from this unpleasant environment, techniques that stimulate more than one sense seem to be more appropriate to be able to ensure the patients' attention is focused away from the negative stress enhancing stimuli (Seyrek, Corah, & Pace, 1984; Prabhakar et al., 2007)

Research on the effects of Audiovisual (A/V) distraction within a healthcare setting is restricted, but steadily growing. A/V distraction has been receiving greater attention as an alternative to effectively reducing anxiety in medical contexts, including the dentist (Seyrek, Corah, & Pace, 1984; Corah, Gale, & Illig, 1979; Corah, Gale, & Illig, 1978; Prabhakar et al.,

2007; Frere, Court, Yorty, & McNeil, 2001; Bentsen, Wenzel, & Svensson, 2002). Frere and colleagues (2001) investigated the use of an A/V with a video as the stimuli, as a tool to reduce dental anxiety in adult patients. Similarly, Prabhakar and company (2007) conducted a study comparing the use of music with the use of an A/V device (in the form of a television) in reducing dental anxiety in paediatric patients. Both studies concluded that A/V distraction is effective in easing dental anxiety. Furthermore, Corah and colleagues found that incorporating both audio and visual distraction is more effective in reducing adult dental patients' anxiety during treatment. Since A/V distraction stimulates two senses, and may therefore be an effective technique to distract patients from the negative stimuli within the dental environment, which in turn can reduce the patients felt anxiety. Corah and colleagues demonstrated that patients expressed reduced pain and anxiety with the use of A/V distraction (Seyrek, Corah, & Pace, 1984; Corah, Gale, & Illig, 1978; Corah, Gale, & Illig, 1979).

Within a dental setting A/V stimuli are often implemented through the use of a television, however, within the current research, A/V glasses will be implemented as an immersive technique. With this device, the patient can watch and listen to pleasant and humorous stimuli, during a dental treatment (via the aforementioned A/V glasses) (Image of the device used can be seen within the method section in Figure 2). The use of an immersive A/V distraction is expected to block out the negative visual and auditory stimuli from the real dentist environment, allowing the patient to be isolated from stress and pain provoking stimuli, and potentially easing dental patients' anxiety during treatment (Seyrek, Corah, & Pace, 1984; Gale, & Illig, 1979).

Klein and Winkelstein (1996) suggest that playing familiar stimuli, such as familiar songs enhances pediatric patients' sense of being in control over an unpleasant situation, by allowing patients to feel more familiar with the dental environment. This is also expected to be the case with adult dental patients. Therefore within this research, patients are given the freedom to choose their desired material from a few options provided on the A/V device, which is expected to increase patients' perceived control (Averill, 1973). As mentioned previously, a high sense of control is suggested to ease dental anxiety (Jackson & Lindsay, 1995; Moore & Brodsgaard, 2001).

Based on these findings, a second hypothesis was developed.

H2: Using familiar audiovisual distraction during dental treatment eases dental patients' experienced anxiety.

H2b: This effect is mediated by patients' level of pain, stress, control, pleasure, and arousal.

3. Research Methods

3.1. Pre-study: Selecting Music

The pre-study was aimed at identifying the most soothing and pleasant genre of music, to subsequently use it as a distractor in the main study.

3.1.1. Method

Three different types of music were included in this pre-study: Classical music, Piano music, and Modern music. One song from each genre was selected, with the modern choice being "Calm after the storm" by The Common Linnets, the piano track selected was "Love me" by Yiruma, and Mozart's "Violin Concerto No. 5 in A Major" was chosen for the classical music genre.

Twenty four bachelor students (N=24) taking a bachelor course participated in the pre-study. One questionnaire was handed out to participants in a class room, participants were told to answer the questionnaire based on the music being played. After, the responded questionnaires were collected, and participants were given a new questionnaire to answer, based on the music genre being played. This happened three times, one for each song. Each song contained two questions: "How pleasant is this Music?" and "How soothing is this Music?", which participants answered on a 5-point scale from "very pleasant" to "not at all pleasant" and "very soothing" to "not at all soothing". Participants were exposed to the song for a minute at a time.

3.1.2. Results

The results (shown in table 1) indicated modern music to be the most pleasant (45%), with piano music following closely with 41% of respondents reporting "very pleasant". Modern music may have been selected as the most pleasant music genre due to participants' familiarity with the modern song. The song used is very popular, and is repeatedly

broadcasted on radio outlets and television music channels. Thus the possibility that most subjects within this pre-study were familiar with the song is very probable.

Table 1: Frequencies showing how pleasant each of the three music genres are					
Classical Music		Piano Music		Modern Music	
Very pleasant	16.70%	Very pleasant	41.70%	Very pleasant	45.80%
Somewhat pleasant	45.80%	Somewhat pleasant	41.70%	Somewhat pleasant	25.00%
Neutral	25.00%	Neutral	0.00%	Neutral	25.00%
Not very pleasant	12.50%	Not very pleasant	16.70%	Not very pleasant	0.00%
Not at all pleasant	0.00%	Not at all pleasant	0.00%	Not at all pleasant	4.20%

However as can be seen in table 1, a large number of participants also reported piano music to be “somewhat pleasant” at (41%), whereas with modern music only 25% indicated it to be “somewhat pleasant”, with another 25% reporting a “neutral” liking to this modern genre. In addition, 4% of subjects found modern music to be “not at all pleasant”, whereas 0% found piano music to be “not at all pleasant”. Furthermore, the results also indicated (table 2) piano music to be reported as the most soothing (50%), compared to both other genres (33%).

Based on the results of this pre-study, piano music, with a whole album by Yiruma including the aforementioned song “love me” will be used as the audio distraction within this study.

Table 2: Frequencies showing how soothing each of the three music genres are					
Classical Music		Piano Music		Modern Music	
Very soothing	33.30%	Very soothing	50.00%	Very soothing	33.30%
Somewhat soothing	45.80%	Somewhat soothing	29.20%	Somewhat soothing	29.20%
Neutral	16.70%	Neutral	8.30%	Neutral	20.80%
Not very soothing	4.20%	Not very soothing	12.50%	Not very soothing	8.30%
Not at all soothing	0.00%	Not at all soothing	0.00%	Not at all soothing	8.30%

3.2. Pre-study: Selecting Audiovisual stimuli

The dentist in study already provided popular television shows for the dental patients to choose from. The videos provided included Sex in the City, Two and a Half Men and Scrubs. The shows ranged in length from 20 to 40 minutes.

The aforementioned television shows were deemed as well-known comedy shows. The television shows used within this study were popular hits, thus anticipating dental patients to be familiar with at least one of the provided stimulus. In addition, the use of comical stimuli was appropriate, since it has been suggested to be effective in directing patients' attention away from the negative stimuli and focus on the humorous stimuli instead (Martin & Lefcourt, 1983), which can increase pain tolerance (Weaver and Zillmann, 1994; Weisenberg et al., 1995, 1998-bonbentsen) and lead to a positive response (McClelland, Ross, & Patel, 1985).

3.3. Main study

The aim of this study was to examine the effects of soothing music, and separately the effects of audiovisual distraction (A/V) on patients' level of anxiety.

3.3.1. Method

A field study was carried out on patients of a dental clinic in Germany with a one factor between-subject design, using Music distraction in one condition, A/V distraction as another condition, and finally the control condition; where both distractions were absent.

3.3.2. Participants

Patients of the dental clinic named "Wededent" in Bissendorf, Germany, took part in this study. When a patient had an appointment at the dentist office, he/she was automatically a potential respondent and was asked by the receptionist to fill in a questionnaire while waiting for treatment, as well as informed of a second questionnaire to be filled in after treatment while checking out (The questionnaire used in this study can be seen in appendix 1). All respondents willingly participated in this study, and were provided with information about the purpose of the study, and ensured that the results will remain anonymous.

After excluding some subjects (N=7) due to their large amount of missing values, a total of 105 patients were included in this study; 69 in the Control condition, 25 in the Music condition, and 11 in the A/V condition. The sample consists of 41 males and 64 females, with a mean age of 44 years, (the ages ranged from 20 to 80). The lack of participants within the A/V condition is a concern within this study; patients within this condition were mostly

unwilling to wear the immersive technology. Therefore a short interview (N=6) was held to assess why patients did not want to wear the A/V distraction during treatment. In addition, some patients who did accept to wear the A/V equipment were also interviewed after the treatment (N=4), to gain further insight in regards to their feelings towards wearing the A/V glasses during treatment.

3.2.3 Procedure

When a patient visited the orthodontic clinic, the receptionist asked if he or she was willing to answer a questionnaire while waiting for the appointment with the dentist. If a patient agreed, he or she was handed the questionnaire with a pen, and a verbal explanation that this is a study for a master thesis focusing on patients' emotions at the dentist. The initial text of the questionnaire consisted of a welcoming introduction and a general description of the study itself. Patients were informed in more detail about the study, and were also asked to confirm their consent for their responses to be used anonymously (can be seen in appendix 1). Patients were instructed to answer the first part of the survey while waiting, including demographic questions, dental habits including regularity of visits to a dentist in general, frequency of visit to this specific dentist, the type of treatment the patients are receiving, and anxiety experienced the day before and while waiting for treatment. While checking-out at the reception desk, the second questionnaire on the mediators (pain, stress, control, pleasure and arousal) as well as anxiety felt during treatment was handed to patients. Finally, the researcher thanked the patients for participating and provided a debriefing card containing information on the study, and contact information (can be seen in appendix 1).

The data collection occurred during normal work hours (five days a week). Initially, patients were assigned randomly (using a random number designator online) to the A/V condition and control group condition. When patients did not accept to wear the A/V glasses the respondents were treated as control group participants. The aim was to obtain at least 25 subjects for each condition, however it turned out patients often did not accept to wear the A/V glasses, thus the number of participants were cumulating very slowly within the A/V condition. Therefore without reaching the aimed 25 subjects, data collection started for the Music condition, this continued until at least 25 questionnaires were answered. During the

collection of data for the music condition, subjects were still randomly asked to wear the A/V glasses if willing to. Once the preset number of 25 respondents was obtained within the music condition, data collection ended. The process of data collection spanned over fifteen working days.

3.2.4 Stimuli

The current field study consisted of three conditions: One control group receiving normal treatment without any added stimuli, a group receiving soothing music, and finally a group receiving A/V distraction during treatment.

A CD collection by the South Korean pianist Yiruma was used for the music condition, and lasted approximately two hours, in order to ensure a variety of sounds rather than the same song repeatedly. The music was played through speakers allowing the sound to surround the entire dental practice.

For the A/V condition patients wore an audiovisual device in the form of glasses with headphones, where patients could operate the device using an Apple iPod (image of the device used can be seen below in Figure 2). Patients could choose between three television shows ranging in length from 20-40 minutes, ensuring that patients could finish a show during treatment. The range of humorous television shows were already supplied by the dentist in German, and included: Sex in the City, Two and a Half Men and Scrubs. Patients could choose what they preferred to watch to ensure familiarity, and had volume control at their discretion.

3.2.5. Questionnaire constructs (measurements)

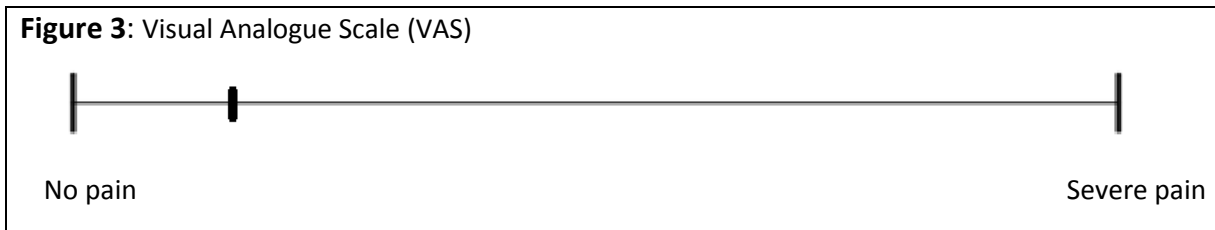
All questions asked within this research were in the German language. Initially, demographic questions and general dental information including regularity of visits to a dentist in general, and the frequency of visit to this specific dentist (both measured on a 5-point scale from “very rarely” to “very frequently”), how patients compare this dentist to others (measured on a 5-point scale from “much better” to “much worse”), and what treatment patients were receiving were included. It is expected that patients’ type of treatment and familiarity with the dental clinic would impact the experienced anxiety during treatment.

Figure 2: Image showing the use of an audiovisual distraction device during treatment



Subsequently, after being exposed or not to either the music or A/V condition during treatment, patients level of pain, stress, sense of being in control, pleasure, arousal, and anxiety were measured using a questionnaire in German. Pain and stress were measured using a Visual Analogue Scale (VAS) (can be seen below in figure 3), where patients had to rate their level of pain and stress by placing a vertical mark on the scale. The line length to be used was of 130mm, rather than the usual 100mm (Wewers & Lowe, 1990). Responses of 0mm indicated “No pain/Stress” and responses of 130mm indicated “Severe Pain/Stress”. Furthermore, patients’ level of control was measured with two questions based on literature (Jackson & Lindsay, 1995; Moore & Brodsgaard, 2001), including “I feel like I was adequately informed about the process of my treatment” and “I feel like I can stop the treatment whenever I want”. Patients reported on a 5-point Likert scale, from “Strongly agree” to “Strongly disagree”, where patients who agree report a high sense of control and patients who disagree report a low sense of control. The two items used to measure control have a significant moderate positive correlation ($R = .56, p < 0.01$).

Figure 3: Visual Analogue Scale (VAS)



To measure pleasure and arousal an adapted PAD scale (Mehrabian & Russel, 1974) was used, with an adopted 5-point Likert scale of semantic differential items. To ensure the survey remains as short as possible only a few items were selected. The scale was adapted to the context of this study, asking patients to “Rate your emotions according to how the treatment you just experienced made you feel” after receiving treatment at the dentist. Patients’ arousal was gauged using two semantic differential items ($\alpha=.83$) including “Stimulated: Relaxed” and “Excited: Calm”, both items had a strong significant positive correlation ($R= .75$, $p<0.01$). Similarly the pleasure scale was adapted and measured using two semantic differential items ($\alpha= .81$) including “Satisfied: Unsatisfied” and “Happy: Unhappy”, with both items also indicating a strong significant positive correlation ($R= .69$, $p<0.01$).

Finally, to measure anxiety a modified version of the Corah’s dental anxiety scale (DAS) (Corah, 1969) was implemented. DAS is one of the most used dental scales to identify dental patients’ level of anxiety, and Corah himself showed for DAS to be a reliable and valid scale when measuring dental anxiety (Corah, Gale, & Illig, 1978). Within this study, the dental concern assessment part of the questionnaire was left out, since it is a very long scale which may add to patients’ negative emotions in an already stress and anxiety induced environment. Thus only three questions were selected from the DAS scale. Two questions were asked in the first questionnaire while waiting for the appointment, including “How did you feel the day before you visited the dentist?”, and “When you are waiting in the waiting area for your treatment, how do you feel” The reliability of the scale was good (Chronbach’s $\alpha = 0.70$). One question from the DAS scale was asked in the second questionnaire after patients received treatment, consisting of “When you were in the dentist’s chair, waiting while the dentist gets the equipment necessary to begin your treatment, how did you feel?”.

All three anxiety questions were assessed by patients using a five point scale with “Relaxed”, “A little uneasy”, “Tense”, “Anxious” and “So anxious”.

3.2.6 Data analysis

Prior to performing data analysis, both items for pleasure, the two items for arousal and both control questions were computed to create one pleasure, one arousal and one control variable. Subsequently the arousal, pleasure and control variables were recoded, whereby the reported responses were reversed and become 1=not aroused/pleased/low sense of control and 5= very aroused/pleased and high sense of control, in line with the direction of the other variables within the present study.

For statistical analysis one-way ANOVAs with Music and A/V distraction as independent factors and; Anxiety, Pain, Stress, Control, Pleasure, and Arousal as dependent variables were performed.

Furthermore, a Pearson’s product-moment correlation coefficient was conducted with the level of anxiety, the mediators within this study (pain, stress, control, pleasure and arousal), as well as the moderators within this study (regularity of visits to a dentist in general, frequency of visit to this specific dentist). Lastly, a Hierarchical Multiple Regression Analysis was performed to assess how much of the individual characteristics, dental habits, mediators, and experimental conditions used within this study predict the variation of anxiety reported by patients.

4. Results:

4.1 Analysis of variance (Anova) Analysis

Effects of A/V and Music distraction on Anxiety

A one-way between groups analysis of variance (ANOVA) was conducted to investigate the impact of the Audiovisual (A/V) condition, and the impact of the music condition on the subjects’ level of anxiety during treatment.

The ANOVA results showed that both Music ($F=0.01$, $p=0.76$), and Audiovisual (A/V) distractions ($F=0.25$, $p=0.62$) had no significant effect on patients’ reported anxiety levels

(contrary to hypothesis 1 and 2). As shown in table 3, patients within the Music condition (M=1.41), A/V condition (M=1.70), and control group condition (M=1.55) report similar levels of anxiety. The reported anxiety between all three conditions is low (With 1= not anxious at all to 5= very anxious).

Table 3: Mean anxiety levels between all three conditions.

	N	Treatment Anxiety (M)	SD
With A/V	11	1.70	0.95
With Music	22	1.41	0.67
Control Group	64	1.55	0.82

In addition, patients' reported anxiety levels the day before and while waiting for treatment remains low. As shown in table 4 the reported anxiety levels the day prior to (M=1.50) and while waiting for treatment (M=1.67) is very similar to patients' reported anxiety levels after treatment (M=1.53).

Table 4: Mean anxiety levels for the day before, while waiting, and during treatment.

	N	Anxiety (M)	SD
Before anxiety	105	1.50	0.88
Waiting anxiety	104	1.67	0.93
Treatment anxiety	96	1.53	0.79

Effects of A/V and Music distraction on the Mediators

Another one-way between group analysis of variance (ANOVA) was conducted to examine the effect of the A/V condition and music condition on subjects' level of pain, stress, control, arousal and pleasure.

The results showed that, both conditions (music and A/V distraction) have no significant effect on any of the aforementioned mediators (all ps > 0.05). Patients reported pain, stress, control, arousal and pleasure remains similar between both conditions (Music and A/V)

(Results can be seen in table 3). As can be seen in table 5, patients' reported a low level of stress with the music condition (M=12.65), also with the A/V condition (M=26.80) and with the control group condition (M=13.36). Similarly subjects' generally reported a low level of pain between all conditions (with 0= low pain/stress and 130= high pain/stress).

However the standard deviation for stress and pain between conditions is rather high, showing a high variation of responses below and above the mean. In addition, patients generally reported a high sense of control throughout all conditions (with 1=low sense of control and 5= a high sense of control). Lastly, throughout all conditions patients indicated to feel unaroused and pleased (with 1= not aroused/pleased at all to 5= very aroused/pleased).

Table 3: Mean ratings for Stress, Pain, Pleasure ,Arousal and Control between conditions (Music and Audiovisual)

		N	Mean (M)	SD
Stress	With A/V	11	23.80	32.96
	With Music	22	11.35	18.33
	Absent	64	14.91	23.96
Pain	With A/V	11	11.44	19.03
	With Music	22	8.00	17.38
	Absent	65	4.58	19.03
Pleasure	With A/V	11	4.18	1.22
	With Music	21	4.35	0.61
	Absent	65	4.00	0.82
Arousal	With A/V	9	2.33	1.06
	With Music	18	2.06	1.20
	Absent	56	2.02	1.00
Control	With A/V	11	4.42	0.71
	With Music	22	4.53	0.51
	Absent	65	4.33	0.76

4.2 Correlation analysis

A Pearson's product-moment correlation coefficient (r) was assessed to identify the size and direction of relationship and association between the level of Anxiety, the mediators within

this study (pain, stress, control, arousal, and pleasure), and the expected moderators within this study (regularity of visits to a dentist in general, frequency of visit to this specific dentist) (Results are shown in table 6). The results show a few weak and moderate positive and negative correlations between constructs. As can be seen in table 6 the level of stress patients are experiencing has a moderate positive correlation with the level of anxiety patients are experiencing ($r=.42$, $p<0.01$). This association implies that an increase in patients stress levels also moderately increases patients reported anxiety levels. Results also showed a negative weak association between patients regularity of visits to the dentist in general, with patients level of anxiety ($r=-.33$, $p=0.01$), stress ($r=-.21$, $p=0.04$), and arousal ($r=-.27$, $p=0.01$). The correlation indicates that patients who visit the dentist less frequently mildly creates an increase in reported anxiety, stress, and arousal. In addition subjects' regularity of visits to the dentist in general, has a weak positive association with the level of pleasure experienced ($r=.27$, $p=0.01$). Furthermore, as can be seen in table 6, arousal has a positive weak relationship with the reported Anxiety ($r=.24$, $p=0.03$), a moderate correlation with the reported stress ($r=.40$, $p<0.01$), and a weak negative association with the reported pleasure ($r=-.28$, $p=0.01$). This shows an increase of arousal also creates an increase in anxiety and stress, as well as a decrease in pleasure. Another moderate positive correlation can be seen in table 6, with an increase in control indicating an increase in pleasure ($r=.40$, $p<0.01$). Finally the correlation analysis indicates that patients' that regularly visit the dentist in general, also shows more frequency of visits to the specific dentist clinic in study ($r=.50$, $p<0.01$).

Table 6: Pearson's product-moment correlation coefficient of the mediators, moderators and anxiety

Measures	1	2	3	4	5	6	7
1 Treatment Anxiety	1						
2 Stress	0.42**	1					
3 Pleasure	-0.19	-0.25**	1				
4 Arousal	0.24*	0.40**	-0.28*	1			
5 Control	-0.02	-0.07	0.40**	-0.12	1		
6 Pain	0.10	0.12	0.01	-0.04	0.08	1	
7 Regularity of visits	-0.33**	-0.21*	0.27**	-0.27*	0.14	-0.15	1
8 Visited before	-0.16	-0.28**	0.26*	-0.17	0.07	0.01	0.50**

**correlation is significant at the 0.01 level (2-tailed).

*correlation is significant at the 0.05 level (2-tailed).

4.3 Regression analysis

Hierarchical Multiple Regression Analysis was conducted to find out whether any of the three constructs, condition, mediators (pain, stress, control, pleasure and arousal) and moderators (gender, age, regularity of visits to a dentist in general, and frequency of visit to this specific dentist) predict the level of anxiety (results can be seen in table 7).

Initially all the moderators including age, gender, regularity of visits to a dentist in general, and frequency of visits to the specific dentist within this study were included as predictors for anxiety (model 1). This accounted for a significant 17% of the variance on experienced anxiety ($R^2=0.169$ $F(74, 4)=3.80$, $p=0.08$). Within model 1, the gender variable ($p=0.04$) and patients regularity of visits ($p=0.01$) were significant in predicting anxiety.

Subsequently, Music and the A/V condition were added as predictors of anxiety to the regression model (model 2). This did not change the predictors variance on anxiety much, with only a insignificant 0.5% increase of variance (The change in $R^2=0.005$ $F(73,1)=0.45$, $p=0.50$). In combination, the five predictor variables explained 17% of the variance on experienced anxiety ($R^2= 0.174$ $F(73,5)=3.10$, $p=0.02$).

Finally all the mediators, including pain, stress, control arousal and pleasure were included to the regression model (model 3) as predictors on experienced anxiety. This accounted for an additional significant 14% of the variance on experienced anxiety (change in $R^2=0.115$ $F(68,5)=2.75$, $p=0.03$). Altogether, the ten predictor variables explained a significant 31% of the variation on experienced anxiety ($R^2=0.313$, $F(68,10)=3.10$, $p=0.03$). Within model 3 gender and regularity of visits remain significant, the Stress variable proves to be a significant predictor for patients anxiety ($p=0.01$).

Overall, the constructs mentioned are a weak predictor of patients experienced anxiety. Even though the regression analysis shows the chosen variables explained a significant 31% of the reported anxiety. Only the gender, regularity of visits, and stress variables prove to be a significant predictor of anxiety. In addition, 69% of variability with patients' reported anxiety in this study can not be accounted for by these factors.

Table 7: Regression analysis predicting anxiety

Regression coefficients	β	t-value	Sig.	R ²	Change in R ²		
					Change	f-value	Sig
Model 1: F(74,4)=3.80, p=0.08				0.169			
Gender	0.24	2.10	0.04*				
Age	0.04	0.40	0.71				
Regularity of Visists (in general)	-0.38	-2.94	0.01*				
Frequency of Visits (this dentist)	-0.04	-0.34	0.74				
Model 2: F(73,5)=3.10, p=0.02				0.174	0.005	F(73,1)=0.45	0.50
Gender	0.25	2.20	0.03*				
Age	0.03	0.27	0.79				
Regularity of Visists (in general)	-0.40	-2.96	0.04*				
Frequency of Visits (this dentist)	-0.05	-0.39	0.70				
Music and A/V	-0.74	-0.67	0.51				
Model 3: F(68,10)=3.10, p=0.03				0.313	0.139	F(68, 5)=2.75	0.03
Gender	0.26	2.29	0.03*				
Age	0.02	0.24	0.81				
Regularity of Visists (in general)	-0.36	-2.87	0.01*				
Frequency of Visits (this dentist)	0.08	-0.58	0.57				
Music and A/V distraction	-0.11	-1.02	0.31				
Control	-0.07	-0.68	0.50				
Arousal	-0.06	0.51	0.61				
Pleasure	-0.06	-0.51	0.27				
Pain	0.12	1.51	0.62				
Stress	0.36	3.11	0.01*				

* $p < 0.05$

4.4 Short interviews

As previously mentioned some extra information was gathered on a few (N=6) patients, asking for reasons as to why they were unwilling to wear the A/V equipment. The most popular reasons as to why patients' did not want to wear A/V glasses, is reported to be the "closeness (personal contact) with the dentist and assistant would be missing". In addition information was also gathered on the patients who wore the A/V glasses, a (N=4) number of patients gave some extra information on how the A/V glasses made them feel, and respondents general remarks were all very positive including, "I Never had such a relaxing treatment", "I never laughed during treatment before".

5. Discussion:

The aim of this research was to find whether Music and A/V distractions could be used to ease patients' experienced anxiety during treatment at a dentist. In addition, this study incorporated mediators, assuming that the two conditions (music and A/V) influence the mediators (pain, stress, control, arousal and pleasure) experienced by patients, which in turn influences the anxiety experienced by patients whilst being treated.

Overall, the results showed that both music and A/V distractions did not significantly reduce anxiety during treatment. The anxiety levels indicated by patients during treatment did not change from the reported level of anxiety the day prior to, and while waiting for treatment. In addition, the reported level of patients' anxiety during treatment is relatively similar to when they are exposed to the distractions (Music and A/V) and when no distractions are in place; with the reported anxiety level being low between all conditions. Similarly, the two conditions (music and A/V) did not significantly influence patients' reported pain, stress, control, arousal and pleasure whilst being treated. With patients generally reporting low pain, stress, and arousal, as well as high sense of control and pleasure throughout all of the conditions.

The insignificant effect of music distraction on anxiety reduction within this study is consistent with several studies (Corah, Gale, Pace & Seyrek, 1981; Seyrek, Corah, & Pace, 1984; Aitken et al., 2002). Together, these insignificant outcomes suggest that music alone is ineffective as a distraction during dental treatment. On the other hand, with the A/V distraction condition, the insignificant results are inconsistent with previous studies which found that A/V distraction does reduce dental anxiety (Seyrek, Corah, & Pace, 1984; Corah, Gale, & Illig, 1979). Corah and colleagues found that A/V distraction produced a reduced reported level of pain and anxiety during dental procedures. The inconsistent results may be explained by the fact that within this study patients had positive responses overall. The mean reported level of patient anxiety between all conditions when receiving treatment in the present study ($M=1.53$) is lower compared to the mean dental anxiety levels reported in

the study conducted by Corah and colleagues ($M=1.80$)¹, on the corah dental anxiety scale recorded for 750 dental patients (Corah et al., 1978). Similarly, the mean reported anxiety score in the current study is lower compared to the anxiety ratings in a study conducted by Bentsen and colleagues (2002) ($M=1.80$)¹, when patients are exposed to an A/V device. Thus within the current study it can be assumed that the influence of dental anxiety is low. In addition, within this study the mean VAS rating for pain when patients are exposed to the A/V distraction is significantly lower ($M=7.37$) compared to the VAS pain rating ($M=25.2$) in the same study conducted by Bentsen and colleagues (2001).

The positive results throughout all conditions could be explained by the satisfaction patients have with the dental practice, and how they are treated prior to and when receiving treatment at the dentist in study. More evidence of patient satisfaction can be seen with the remarks patients provided about the reason they were unwilling to wear the A/V device, which was reported as patients not wanting to disrupt communication between them and the dentist. This suggests that the dentist-patient communication prior and during treatment was sufficient. Moreover, as mentioned in previous literature, good communication is essential for patients to achieve a sense of control, and reduce perceived pain which as a result eases patients level of anxiety (Armfield, Stewart, & Spencer, 2007; Moore & Brodsgaard, 2001). Thus good dentist-patient communication during and prior to treatment may have added to the positive results reported by patients throughout each condition. Another plausible explanation for the positive results throughout all conditions may be that patients were not recording their emotions truthfully, and tended to report more positive choices, in the thought/fear that this study may be an evaluation of the dental practice. Using objective measures, such as galvanic skin response, that does not rely on patients' veracity, could result in much more honest results (Caprara, Eleazer, Barfield, & Chavers, 2003). It is plausible that the results in this study differ compared to results in other studies because of the different methods and techniques used.

¹ The mean anxiety score reported by Corah and colleagues and Bentsen and colleagues were modified in regards to this study, where only one anxiety question is asked to report anxiety rather than four questions, like in the other studies. The anxiety score of the other studies were divided by four to effectively compare it to the anxiety results in this study.

Furthermore, the results from the regression analysis showed that out of all the constructs used in this study Stress is the only significant predictor of patients' reported anxiety. With 69% of patients experienced anxiety being explained by unknown factors. Therefore, the insignificant change of anxiety between conditions (Music and A/V), may also be explained by the fact that the constructs chosen to predict anxiety (pain, stress and control) are statistically weak predictors of anxiety. Other factors, such as the causes of pain, stress and control could be measured, and may create more insight into where patients' anxiety is coming from. Another likely reason is that perhaps the measures chosen to record patients' emotions (pain, stress, control, pleasure and arousal) were not sufficient, which may be caused by the adaptation and condensed questions used to measure these constructs. The questionnaire within this study was short to ensure no more added stress to the already stress enhanced dentist environment. However, this may have caused insufficient measures of patients' emotions.

6. Conclusion and practical implication:

This study demonstrates no change in effect on anxiety, stress or pain levels when dental patients are exposed to both music or A/V distractions. Music has mixed results in pervious research, and within this study does not alter the patients level of anxiety. Regardless, since it is not too hard or expensive to implement, and does not tamper with the patient-dentist communication, it would not be detrimental to have calm and soothing music for patients to hear during treatment.

Even though patients exposed to the A/V distraction reported a positive response, a majority of patients were reluctant to wear the immersive technology, since patients found it intimidating as it removes the contact between the dentist and the patients. Therefore A/V distraction is likely to be unwanted if implemented, and therefore may not be a good idea to introduce within a dental setting. This type of distraction would probably be more effective during a situation where people feel bored or do not feel threatened, and thus are more accepting with being closed off to the outside world, and communication becomes less important.

The insignificant results did provide an indication that patients are generally satisfied with the treatment they receive at the dental clinic in focus. The short interviews suggested that the communication between the dentist and patient is one main reason for the overall positive results that patients experienced during treatment.

7. Limitations and Suggestions for future research

The similarity between patients' reported anxiety between all conditions (music and A/V) in the current study may be explained by the lack of variation in levels of anxiety between patients, with patients' generally reporting low anxiety. There is evidence that patients with moderate anxiety tend to benefit more from the use of distraction techniques (Lahmann et al., 2008). Therefore for future research, patients' reported anxiety levels prior to treatment should be considered and based on this, patients can be included within the study. Using subjects based on the anxiety levels prior to treatment can ensure more variation in anxiety levels during treatment.

Additionally, to measure anxiety, a subjective method was used; using three questions from Corah Dental Anxiety Scale, where participants self-reported their dental anxiety. Using objective measures such as a heart rate monitor or galvanic skin response, which does not rely on patients veracity, could result in less biased results. These objective measures, are suggested to be accurate (Caprara, Eleazer, Barfield, & Chavers, 2003) and there are un-invasive ways to measure these responses.

Furthermore, the questions used to test the mediators (pain, stress and control) within this study can be elaborated for future research. Also, more constructs could be added as predictors of anxiety, including the causes of pain and stress, which have been suggested to be the sight and sound of dental equipment (Armfield, Stewart, & Spencer, 2007). This can allow a more detailed understanding of what is causing distress in patients' during treatment. However, it should be kept in mind that when creating measurements for patients at a dental clinic, it would be important to ensure that the measurements are kept short, in order to not add to the already stressful environment.

Good dentist-patient communication has proven to reduce patients' anxiety (Armfield, Stewart, & Spencer, 2007; Moore & Brodsgaard, 2001) and should be accounted for in future research. Asking patients about the patient-dentist communication, or changing the dentist-patient communication between groups, to see whether this has an effect on patients' anxiety. The immersive nature of the A/V distraction device severely limits the communication between the patient and the dentist during a procedure, therefore dentist-patient communication prior to a procedure is even more important with the application of this A/V distraction device during treatment, to ensure patients can feel in control of the situation.

Moreover, measuring the impact of dentist-patient communication on patients' experience during treatment can also be important in understanding whether patients are in fear of danger or if patients feel safe after receiving accurate information. This can be implemented with the reversal theory (Apter, 1982), identifying whether patients feel safe or not after receiving information can be used to recognise whether patients' have to reverse to a playful (para-telic) state of mind to enjoy the implemented distractions.

Another limitation within this research is that all types of treatments were used, making it hard to evaluate the intensity of treatments received by patients. If there would be high variation in patients' anxiety levels, using only one or two main treatment types would allow a much more specific conclusion. Within this study overall the responses indicated a low level of anxiety, with little variation.

8. References

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9. Appendix

9.1 Appendix 1

Questionnaire used during field study in the original English language:

Questionnaire for the field study in the dental office “Wededent” in Bissendorf, Germany.

Thank you for agreeing to participate in this study. We are two Master students from the University of Twente in the Netherlands, currently doing our Master thesis, on the topic of emotions at a dentist office. The study will be separated into two small sets of questions, one while waiting for your treatment and the other one after your treatment. The second questionnaire revolves around the topic of using an Audiovisual (A/V) device during the treatment. This device is already used at this dentist office, it is a device that can be worn like glasses, while showing a video, as well as hearing the sound via headphones.

This questionnaire will take you between five and ten minutes and you will have enough time to complete this questionnaire before your treatment. Please take it with you to the treatment room and hand it to the dentist. If you have questions at any point during this study, please do not hesitate to ask us. Please always choose for just one option in answering the questions.

We would like to remind you that participation in this study is entirely voluntary and the results will be treated confidentially. Also you have the right to terminate your participation in this study at any time and without giving reasons. If desired you will get a detailed debriefing after your participation at the end of this study.

I read the information given above and voluntarily agree to participate in this study. I reserve the right to terminate my participation at any point in time and without giving reasons. My results and data will be handled anonymously and not given to third parties.

☐ I agree

☐ I don't agree

Demographics (given while waiting):

What is your gender?

☐ Male

☐ Female

What is your age?

Do you visit a dentist regularly?

Very rarely
☐

Rarely
☐

Occasionally
☐

Frequently
☐

Very frequently
☐

Have you visited this dentist before?

Very rarely
☐

Rarely
☐

Occasionally
☐

Frequently
☐

Very frequently
☐

In comparison to other dentists, this office is:

Much better
☐

Somewhat better
☐

The same
☐

Somewhat worse
☐

Much worse
☐

What kind of treatment are you receiving today?

How did you feel the day before you visited the dentist?

- ☐ Relaxed
- ☐ A little uneasy
- ☐ Tense
- ☐ Anxious
- ☐ So anxious that I sometimes break out in sweat or almost feel physically sick

When you are waiting in the waiting area for your treatment, how do you feel?

- ☐ Relaxed
- ☐ A little uneasy
- ☐ Tense
- ☐ Anxious
- ☐ So anxious that I sometimes break out in sweat or almost feel physically sick

After treatment:

Rate your emotions according to how the treatment you just experienced made you feel.

Satisfied	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Unsatisfied
Happy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Unhappy

Stimulated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Relaxed
Excited	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Calm

Please indicate your agreement with the following statements, during dental treatment:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I feel like I was adequately informed about the process of my treatment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I feel like I can stop the treatment whenever I want	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Rate the level of stress you experienced during treatment: Place a vertical mark on the line below to indicate the level of stress.

Not stressful at all		Severe stress

Rate the level of pain you felt during treatment: Place a vertical mark on the line below to indicate the level of pain

No pain		Severe pain

When you were in the dentist's chair, waiting while the dentist gets the equipment necessary to begin your treatment, how did you feel?

- ☐ Relaxed
- ☐ A little uneasy
- ☐ Tense
- ☐ Anxious
- ☐ So anxious that I sometimes break out in sweat or almost feel physically sick

Briefing text, to be printed on separate cards and given to the participants

Thanks you very much for taking part and showing an interest in this study. This study was done by two Master students of the University of Twente in the Netherlands. One of the students, Larissa, was investigating the impact that atmospheric cues, specifically scent and music, in the waiting room can

have on emotions and the anxiety level of patients. For this purpose a subtle scent and some music were added to the waiting environment during certain points in time. The second student, Mieke, was investigating the impact of audiovisual devices during the dentist treatment on the emotions and anxiety levels of patients. For this purpose a number of patients was asked to experience the potential impact of audiovisual glasses on patients' emotions.

If you have further questions or are interested in the final results of this study, please contact:

Larissa Falk – Email: l.falk@student.utwente.nl – Telephone: +491771723890

Mieke Delbaere – Email: m.c.delbaere@student.utwente.nl – Telephone: +31647630868

Questionnaire used during the field study in German:

Fragebogen für die experimentelle Studie in der Zahnarztpraxis "Wededent" in Bissendorf, Deutschland

Vielen Dank, dass Sie sich bereit erklärt haben, an dieser Studie teilzunehmen. Wir sind zwei Master Studentinnen von der Universität Twente in den Niederlanden und arbeiten derzeit an unserer Master Arbeit zum Thema „Emotionen in einer Zahnarztpraxis“. Die Studie ist in zwei Sets von Fragen unterteilt: ein Set während Sie im Wartezimmer sind und ein Set nach Ihrer zahnärztlichen Behandlung.

Das Ausfüllen dieses Fragebogens dauert zwischen fünf und zehn Minuten. Sie haben genügend Zeit, um den Fragebogen in Ruhe vor Ihrer Behandlung auszufüllen. Bitte nehmen Sie den Fragebogen anschließend mit zur Behandlung und geben Sie ihn Ihrer Zahnärztin. Sollten Sie während der Teilnahme in dieser Studie irgendwelche Fragen haben, wenden Sie sich bitte an uns. Bitte geben Sie immer nur eine Antwort auf die Fragen an – pro Linie eine Antwort.

Wir möchten Sie hiermit daran erinnern, daß die Teilnahme an dieser Studie freiwillig ist und die Ergebnisse anonym behandelt werden. Außerdem haben Sie jederzeit, und ohne Gründe anzugeben, das Recht die Teilnahme abubrechen. Wenn Sie möchten, bekommen Sie am Ende Ihrer Teilnahme an dieser Studie eine detaillierte Erklärung über die Hintergründe und die Prozesse.

Ich habe die oben angegebenen Informationen gelesen und erkläre mich freiwillig bereit an dieser Studie teilzunehmen. Ich habe das Recht meine Teilnahme jederzeit abubrechen ohne irgendwelche Gründe anzugeben. Meine Ergebnisse und Daten werden anonym behandelt und nicht an dritte weitergegeben.

☐ Ich bin einverstanden

☐ Ich bin nicht einverstanden

Demografische Daten :

Was ist Ihr Geschlecht?

☐ Männlich

☐ Weiblich

Wie alt sind Sie?

Besuchen Sie regelmäßig den Zahnarzt?

Sehr selten
☐

Selten
☐

Gelegentlich
☐

Häufig
☐

Sehr häufig
☐

Haben Sie schon einmal den Zahnarzt "Wededent" besucht?

Sehr selten
☐

Selten
☐

Gelegentlich
☐

Häufig
☐

Sehr häufig
☐

Im Vergleich zu anderen Zahnärzten ist diese Praxis:

Viel besser
☐

Etwas besser
☐

Gleich
☐

Etwas schlechter
☐

Viel schlechter
☐

Welche zahnärztliche Behandlung bekommen Sie heute?

Im Warteraum:

Wie haben Sie sich am Tag vor Ihrem Zahnarztbesuch gefühlt?

- ☐ Entspannt
- ☐ Ein wenig unruhig
- ☐ Angespannt
- ☐ Ängstlich
- ☐ So ängstlich, dass ich manchmal in Schweiß ausbreche und mich körperlich fast krank fühle

Wenn Sie im Warteraum auf die Zahnärztliche Behandlung warten, wie fühlen Sie sich?

- ☐ Entspannt
- ☐ Ein wenig unruhig
- ☐ Angespannt
- ☐ Ängstlich
- ☐ So ängstlich das ich manchmal in Schweiß ausbreche und mich fast körperlich krank fühle

Bitte schätzen Sie, wieviel Zeit Sie gerade im Warteraum verbracht haben.

Minuten

Nach der Behandlung:

Bewerten Sie ihre Stimmung, welche Sie durch die gerade erfolgte Behandlung erfahren haben.

Zufrieden	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Unzufrieden
Glücklich	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Unglücklich
Angeregt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Entspannt
Aufgeregt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Ruhig

Bitte geben Sie an inwiefern die angegebenen Erfahrungen während der zahnärztlichen Behandlung zutreffen:

	Ich stimme voll zu	Ich stimme zu	Neutral	Ich stimme nicht zu	Ich stimme absolut nicht zu
Ich fühle mich über den Behandlungsprozess hinreichend informiert	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ich bin mir sicher dass ich die Behandlung jederzeit unterbrechen kann	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Bitte beschreiben Sie ihren momentanen Stresspegel: Setzen Sie eine vertikale Markierung in Bezug auf Ihren aktuellen Stresspegel auf der unten angegebenen Skala

Überhaupt nicht stressig Sehr stressig

Bitte beschreiben Sie Ihren momentanen Schmerzpegel: Setzen Sie eine vertikale Markierung in Bezug auf Ihren aktuellen Schmerzpegel auf der unten angegebenen Skala

Keine Schmerzen Starke Schmerzen

Während Sie im Behandlungsstuhl saßen und während Ihr Zahnarzt die Ausrüstung vorbereitet hat: Wie haben Sie sich gefühlt?

- ☐ Entspannt
- ☐ Ein wenig unruhig
- ☐ Angespannt

- ☐ Ängstlich
- ☐ So ängstlich das ich manchmal in Schweiß ausbreche und mich fast körperlich krank fühle

Erklärung der Studie und Kontaktinformationen

Vielen Dank, dass Sie sich für unsere Studie interessieren und an dieser teilgenommen haben. Diese Studie wurde von zwei Master Studentinnen der Universität Twente in den Niederlanden durchgeführt. Eine der Studentinnen, Larissa, untersucht für Ihre Masterarbeit den Einfluss von atmosphärischen Einflüssen, insbesondere Geruch und Musik, auf die Emotionen und Ängste von Patienten im Warteraum des Zahnarztes. Zu diesem Zweck wurde, für ausgewählte Untersuchungsgruppen, im Warteraum ein subtiler Geruch plaziert und Musik gespielt. Die zweite Studentin, Mieke, untersucht für ihre Masterarbeit den Einfluss von Audio-visuellen Geräten auf die Emotionen und Ängste von Patienten während der zahnärztlichen Behandlung. Zu diesem Zweck wurde eine Anzahl von Patienten gebeten den potentiellen Einfluss durch diese Geräte zu erleben.

Bei weiteren Fragen über die Studie oder die Ergebnisse dieser Studie wenden Sie sich bitte an:

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