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RE-SCORING THE GAME’S SCORE: DYNAMIC MUSIC, PERSONALITY AND IMMERSION IN THE LUDONARRATIVE

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ABSTRACT

This study explores immersive presence as well as emotional valence and arousal in the context of dynamic and non-dynamic music scores in the 3rd person action-adventure video game genre while also considering relevant personality traits of the player. 60 subjects answered self-report questionnaires of experiential states each time after playing the game 'Batman: Arkham City' in one of three randomized conditions accounting for [1] dynamic music, [2] non-dynamic music/low arousal potential and [3] non-dynamic music/high arousal potential, aiming to manipulate emotional arousal and structural-temporal alignment in the resulting emotional congruency of nondiegetic music. Whereas imaginary aspects of immersive presence are systemically affected by the presentation of dynamic music, sensory spatial aspects show higher sensitivity towards the arousal potential of the music score. It is argued that a compatible integration of global and local goals in the ludonarrative contributes to a motivational-emotional reinforcement that can be gained through musical feedback. Shedding light on the implications of music dramaturgy within a semantic ecology paradigm, the perception of varying relational attributes between the player, avatar, and game environment is assumed to moderate a continuous regulatory modulation of emotional response achieved by context effects of dynamic music.

KEYWORDS

Dynamic Music, Video Games, Immersion, Presence, Emotion, HCI.

1. INTRODUCTION

Do narrative minds consist of personas that inhabit a virtual world or a virtual world that inhabits personas? While the answer to this question, if applicable, might be subject to further research, there are prospects in functional links between simulated minds and worlds to specific components of media presentations, such as sound-fx and music, evolving in interaction to each other. Whereas the concept of perceptual realism links natural sounds to embodied experiences of the world, music is recognized for its nuanced expressive qualities making us understand the meaning of highlighted contents in drama. Consequently, previous empirical efforts have examined dramaturgic music for its role in the psychological attribution of visual cues (Cohen, 2001, Gasselseder, 2012). However, the question remains what relevance these sonic markers pertain for the interpretation of interactive modalities as well as the experience of absorption herein.

For the video game community another minds and worlds related experience gained popularity in recent years. With 'Immersion' denoting the sense of being part of a media presentation, a term has been shaped by experience of empathy [relating to entities in worlds] and embodiment [relating to worlds in interaction to entities] within an interactive environment. Being non-linear by nature, video games accomplish this immersive quality by keeping structural and expressive features of stimuli congruent while playing (see Robillard et al., 2003; Cohen, 2001; Gasselseder, 2012). As a consequence thereof, the rising narrative-dramaturgic complexity of video games comes along with the need to incorporate music as an expressive marker. However, by utilizing culturally agreed upon codes in relation to a scene embedded in narrative context, the tradition of music dramaturgy has been inherently linked to linear storytelling, making game designers face a logistic as well as technical challenge when trying to implement music in games (Stevens & Raybould, 2012). Due to this apparent incompatibility to interactive offerings, the functional correlates of music not always align perfectly to the remaining modalities within the specific context defined by the narrative and drama. These correlates are even more so at risk when the users' attitudes and actions are to be taken into account in accordance to a bidirectional ideal of interactivity. By linking the attention directing correlates of music to different modes of perspectivation of empathetic understanding and embodiment of characters and environment, it is the aforementioned obstacles and sometimes-resulting incompatibility of stimuli that bears the chance to find out more about the nature of human interaction in a musically supported setting. Moreover, musical connotations may shed light onto the individual experience of relational attributes of drama experience in video games. Thus, video games may form a valuable tool in research on the relation of music, drama, cognition and emotion as a function of player action.

In order to confront the challenge of a non-linear time domain, game scores increasingly implement procedural techniques, popularly referred to as 'dynamic music', aiming to react musically to changes initiated by the games' environment as well as to actions performed by the player. Typical implementations of dynamic music can be distinguished in narrative-dramaturgic functional terms (Gasselseder, 2012). In this context, the notion of narrative functions refers to the design of horizontal sequencing, which retrieves music cues in a way to emphasize the general narrative background and mood of a scene. Drama, on the other hand, is handed over to the design of vertical re-orchestration that adds and removes separate layers of instruments according to the portrayed intensity and action relevance within a gaming scenario. While re-orchestration may also represent a specific state of characters in the narrative space, its expressive features relate to the actions initiated by the player. Thus, a dynamic music score may not only be seen as a means of describing the drama of a given narrative framework but in addition as an individual component of perception and behavior related phenomena of the player.

Despite its growing recognition in the designer and user community, a body of work involving prototyping as well as descriptive approaches on procedural mechanisms (for an overview see Gasselseder, 2012), the hypothetical reasoning of immersive functions of dynamic music has not been empirically assessed. On this account the present study sets out to expand the ludomusicological discipline from a cognitive narratological and experimental psychological perspective by integrating theoretical as well as empirical data gathered in an ongoing research project examining the hypothetical basis of immersive functions of dynamic music and its links to personality constructs for the first time.

2. MUSIC AND IMMERSION

The rather ambiguous understanding of the term 'immersion' as found in the literature calls for an integrated approach that considers imaginary aspects in absorption, suspension of disbelief and involvement as much as allowing for sensory-spatial aspects in flow, self-location and interactive actions. Aiming to consolidate these non-mediated phenomena within a unified framework, the present study devises the multi-construct ‘Immersive Presence’ (Gasselseder, 2012) to draw on a musically supported experience of absorption within a multisensory media environment. In this connection immersive experiences are understood as a result of the juxtaposition of expected and received sensory contents of the environment (Gasselseder, 2012; Popper & Fay, 1997; Bruner & Postman, 1949). Characterized by superior temporal resolutions of expressive qualities, sonic dimensions, like music, are highly suitable to take over other senses during the initial direction of selective attention towards congruent perceptions (Spence & Driver, 1997; Maasø, 2000). Thus, situation-specific associative and expectation driven evaluative functions of music influence the scenic interpretation in accordance to audio-visual correspondence as well as visual perception (Boltz et al., 1991; Cohen, 2001; Petrini et al., 2011). When expressive qualities of music stimuli become salient, multisensory expectations on emotional congruency towards the environment, termed hypotheses of perception, are formed. If the multisensory stimuli indeed match congruently to the hypotheses of perception, an intensified allocation of attentional resources to the media content arises (Gasselseder, 2012). Consequently the reference frame of extramedial processed, music-bound associated contents of schemata (e.g. challenge-based motives of success or failure) is attributed towards the medium in a process termed 'situational context localization' which leads to the state of imaginary immersion (Ermi & Mäyrä, 2005; Wirth et al., 2007; Gasselseder, 2012). An extramedial processing of active schemata implicates a conscious integration of associated contents within the situational context of the media reception. Are levels of music-induced emotional arousal increasing in proportion to arousal induced by the media presentation, the extramedial frame, with its associated contents of schemata, is shifted gradually into the intramedial space. The resulting cognitive and emotional involvement pertains the impression of an inclusion in the meaning of the expressive accent structure of the media presentation and contextualizes schemata beyond their motivational ties of the usage/reception situation (e.g. being aware that the game is played solely for entertainment purposes). This constellation supports spatial-sensory states from flow towards approximations of presence, a state of consciousness characterized by the physical 'self localization' into the virtual environment and its elevated perception of 'possible actions' herein (Wirth et al., 2007; Gasselseder, 2012). Here the associated contents of schemata are unconsciously attributed within the situational context of media reception, giving rise to intramedial localization.

In summary, the above outlined situational context model describes the mediated perspectivation of situational characteristics represented by the immersive media format and its associated meanings, allowing for a segregation of perceived relations within the narrative (Bruner, 1986; Zwaan, 1999; Gasselseder, 2012). This mediated perspectivation may rely on a modal-specific capacity of empathic understanding. Situational characteristics, such as features of rooms, characters, as well as their logical ties within a virtual ecology propose a mental model that is contrasted with the user's personal framing based on prior experiences and personality traits. In line with this, Davis' (1980) multi-dimensional definition of empathy as a cognitive and emotional process of perspective adoption includes inter-individual differences in the capability to project one's thoughts and actions into fictional settings. While representing fictional settings may seem more apparent in the visual domain, Slater (2003) notes the possibility of varying interindividual perceptual sensitivity and weighting of modalities in presence experience. Whereas Slater's statement relates to form, such as auditory fidelity, rather than content, the above reference to mental models may justify the use of a construct of empathy that pays justice to the representational syntax and the expressive fidelity of music within the intersection of the virtual and the real (Gasselseder, 2012). Such a relationship may be found in Baron-Cohen's (2005) Empathizing-Systemizing (E-S) distinction where the former serves as a decoding capacity of conceptual aspects in musical syntax, such as transported by narrative techniques, while the later refers to the sonorous quality of expression in music, as for example in orchestration/mix or counterpoint/movement. Not surprisingly, empathizing has been associated with correlations between music style preferences and decoding accuracy of emotions and thus may also be of relevance to supporting the sense of drama and following imaginary immersion by music (see Garrido & Schubert, 2011; Sandstrom & Russo, 2011; Rentfrow & Gosling, 2003). As much as there is reason to consider a decoding structure of perspectivation in the likes of Davis' (1980) 'Fantasy-Empathy' construct, it may be necessary to control for the user's sensitivity towards the expressive qualities of music that are assumed to play a role in forming hypotheses of perception (Gasselseder, 2012). Though, apart from decoding incoming stimuli as a result of cognitive empathy, another processing structure may be active with affective empathy in determining the actual emotional response (Shamay-Tsoory et al., 2009). In the situational context model this process of emotional contagion is reflected insofar that the shifting of schemata from the extra- towards intramedial space depends on a user's tendency for synthesizing unanimously decoded expressive cues from multi-sensory stimuli as well as concurring associations. Following this line of thinking, the present study aims to investigate the effects of dynamic music on immersive presence while also providing a first set of preliminary results on the role of trait empathy and tendency for emotional involvement in experiencing presence and emotion within interactive music drama.

3. METHOD

The purpose of the experiment was to study the effects of dynamic and non-dynamic music on the experience of imaginary and sensory immersion (iGEQ, Ijsselsteijn et al., 2007), flow (iGEQ), spatial presence self-location (MEC-SPQ, Vorderer et al., 2004), possible actions (MEC-SPQ) as well as emotional valence and arousal (EMuJoy, Nagel et al., 2007) within a 3rd person action-adventure video game environment. Further exploratory data collection accounts for decoding skills, appraisal and tendency for intensified emotional involvement by incorporating personality trait measures such as music empathy (ME, Kreutz et al., 2008) and emotional involvement (ITQ, Weibel et al., 2010). A total of 60 subjects (23 female, 37 male) aged 18-30 years (M=23.72, SD=3.4) answered self-report questionnaires of experiential states each time after playing the video game 'Batman: Arkham City' (Rocksteady, 2011) for 10 minutes in one of three randomized conditions accounting for [1] dynamic music, [2] non-dynamic music/low arousal potential and [3] non-dynamic music/high arousal potential, by these means aiming to manipulate affective arousal and structural-temporal alignment of non-diegetic music independently.

3.1 Subjects

Subjects spend on average 2.37 hours [SD=1.68] at 2.81 days per week [SD=1.78] with playing digital games. 56.8 per cent of responses on preferred game genres related to narrative-dramaturgic elements found in action-adventure game titles. None of the included subjects had played the stimulus game ’Batman: Arkham City’ (Rocksteady, 2011) or its predecessors in the series before. Subjects were well familiar with the main protagonist ’Batman’ and hold a neutral or positive attitude towards the characters‘ other media appearances. While the handling of gamepads didn’t present any particular challenge, some subjects were less acquainted with the ergonomics of the Xbox 360 controller used in the experiments. In order to ease the learning process, vertical axis directionality was adjusted to subjects‘ preference. All subjects included in the study finished the presented game conditions successfully and did not identify the experimental manipulation of music background.

3.2 Materials

In order to maintain the stringent criteria of a controlled experiment while also achieving ecological validity in form of natural interactions within the context of a video game, a particular focus of stimulus selection involved the presence of guided navigation that would allow free movement but still be determined by dramaturgic structure. Typical genre implementations of the latter are found in accentuations of performative goals, which are set to global [narrative-related] and local [drama-related] task demands. Having these criteria evaluated, the challenge map ’Penguin Museum’ of the critically acclaimed 3rd person action-adventure game ‘Batman: Arkham City’ (Rocksteady, 2011) was set as a stage for investigating immersive experiences. The game’s demands set as per instruction allow the player 10 minutes of time to distract enemies from chasing escaping hostages before challenging them in a final battle. A corresponding countdown is provided to the player next to health statistics in the Heads-Up Display of the game. While this enables players to adjust their actions within the set limits, it also ensures sufficient time for the rise of immersive experiences (Örtqvist & Liljedahl, 2010).

The orchestral score of ‘Arkham City’, written by Nick Arundel and Ron Fish, makes use of a horizontal sequencing mechanism that reflects calm and confrontation situational changes in the musical expression of low and high arousal potential while sharing several structural features such as the change of passages and reappearing themes (Gasselseder, 2012). Moreover, the music makes use of a vertical mechanism that reflects dramaturgic aspects ranging from danger to task progress by adding and removing four orchestral stems to the mix relative to the actions and performance of the player. For example, should the enemies unexpectedly confront the avatar, the density of the orchestration immediately thickens into a full-scale tutti. On the other hand, if the avatar manages to attack enemies unnoticed, the orchestration dims down to a texture consisting of strings only. Additional layers of brass and percussion will be introduced when further enemies are attacked in secret. Whilst the here used dynamic music condition is based on both the original horizontal and vertical mechanisms, non-dynamic conditions are restricted to the horizontal mechanism derived from the original score’s full mix. These were prepared from separate recordings of the music in calm and confrontational scenarios. Inspections of A-weighted level changes in ‘AudioLeak 3.1’ (Channel D, 2009) make sure that both live input [sound-fx, dialogue] and the digitally recorded material [music] match the volume levels of the original mix. All tracks were recorded in-game to obtain a seven-fold loop of the original music cues, totaling in length 15′31″.

3.3 Instruments

3.3.1 EMuJoy

The emotion software measurement instrument ’EMuJoy’ (Nagel et al., 2007) operationalizes the circumplex model of emotion (Russell, 1980) in an easy to understand, intuitive visual interface by presenting the emotional space as a coordinate system between degree of valence [pleasure-displeasure, X-axis] and arousal [Y-axis]. Subjects report their emotional state by adjusting a cursor and pressing a controller button when a corresponding location within the XY emotional space has been found. When testing for reliability and validity, the instruments‘ authors find high re-test and construct correlations of about r>0.8 as well as high consistency between continuous and distinct measures between stimulus presentation. Accordingly, the present study devises EMuJoy for distinct measures before and after stimulus presentation as to prevent distortive effects of diverted attention potentially interfering with immersive experiences.

3.3.2 iGEQ

Two dimensions taken from the ‘In-Game Experience Questionnaire’ (IJsselsteijn et al., 2007) were used to measure subjects‘ experience of immersion and flow while playing the game. Each dimension contains a pair of items rated on a Likert-type scale scored from 0-4. Good internal consistencies of about α=.80 attest reliable measures for the German translation in use (Klimmt et al., 2010) on the selected dimensions. The dimension ‘Imaginative and Sensory Immersion’ aims to measure narrative aspects and associated empathic responses while also considering sensations caused by the audio-visual quality and style of the game presentation. The dimension ‘Flow’ derives its name from Csikszentmihalyi's (Csikszentmihalyi, 1991) popular construct describing a holistic mental feeling of absorption when merged in performing an activity and its intrinsic gratification, though it has been found that iGEQ item formulations primarily address autotelic experiences (Poels et al., 2007; Gasselseder, 2012).

3.3.3 MEC-SPQ

Three dimensions taken from the ‘MEC Spatial Presence Questionnaire’ (Vorderer et al., 2004) add to the measurement of immersive presence. Each dimension contains four items presented in randomized order and rated on a Likert-type scale scored from 0-4. Studies undertaken by the instruments‘ authors show good internal consistencies of the chosen dimensions in the range from α=.80 to α=.92 as well as construct validity of about k>.70. The dimension ‘self location’ refers to a sense of physical projection when interacting with the game. Herein the dimension ‘possible actions’ measures perceived interactive qualities. ‘Suspension of disbelief’, a dimension more akin to the concept of absorption (Gasselseder & Dobler, 2009), draws on the cogency of the medium, thus serving as a possible prerequisite of immersive experiences. MEC-SPQ-suspension of disbelief item operationalization appears to refer on the plausibility of media presentations, in this way accommodating links to imaginary immersion (Gasselseder, 2012).

3.3.4 Music Empathizing-Systemizing, ME-MS

The dimension ‘Music Empathizing’ taken from the ‘Music Empathizing-Music Systemizing Inventory’ (Kreutz et al., 2008) was used to assess the ability to focus and reenact expressive content in music. Based on Baron-Cohen's ’Empathizing-Systemizing theory’ (Baron-Cohen et al., 2005), the ME-MS assumes that music processing depends, inter alia, on a continuum of cognitive styles between male and female brains as a result of the evolutionary adaptation to environmental demands. In its original conception the dimension empathizing marks the capacity to identify and respond to feeling states of other individuals. The ME-MS presents music empathizing with nine items in randomized order on a Likert-type scale ranging from 0-3. For the original English version, the authors report acceptable internal consistencies of α=.69. This compares well to the α=.71 found in the German translation as devised in the present study on the premises of the decentering/back-translation approach (see Triandis, 1994).

3.3.5 Immersive Tendency Questionnaire, ITQ

The dimension ‘Emotional Involvement’ taken from Weibel and colleagues’ (Weibel et al., 2010) German adaptation of the ’Immersion Tendency Questionnaire’ (ITQ, Witmer & Singer, 1998) refers to the tendency for emotional reactions during media usage and (day-) dreaming. Whereas Witmer and Singers’ original ITQ subscales’ ’Involvement’, ’Focus’ and ’Tendency to Play Video Games’ were based on a priori theoretical considerations, the subscales of the German adaptation used here originate from an empirical evaluation of the postulated factor structure (see Weibel et al., 2010). Besides ’Emotional Involvement’ explaining 17.32% of variance, a second factor is identified as ’Absorption’, comprising items on focused attention and loss of time perception, explaining 8.11% of variance. The subscale hereafter presented, ‘Emotional Involvement’, consists of five items presented in randomized order and rated on a Likert type scale scored from 0-4. Results of the present study show acceptable internal consistency of α=.71.

3.4 Procedure

Game contents are displayed in 30 to 40 cm distance from subjects‘ faces on a 15.6” notebook running at 1366x768 pixels, 32-bit, 60Hz in the game’s second highest graphic settings. Sound is provided through closed stereo headphones (AKG K270 Studio) at 30 per cent volume on an audio interface (MOTU 828 mk1), which is connected to a separate control system (Apple MacBook Pro 6.1). In order to mix in-game sound-fx and A-weighted volume matched pre-recorded music tracks for non-dynamic music, sound-fx contents are fed to the monitoring input of a software sequencer (Apple Logic Pro) set at 128 samples buffer size. Prior testing, subjects get acquainted with the game mechanics and the emotion software measurement instrument ‘EMuJoy’ (Nagel et al., 2007) during a 30 minutes training session. Before starting the game, subjects are asked to rate their current emotional state on EMuJoy. Whenever subjects are ready, pressing the corresponding controller button triggers the start of the game segment. The game segment is presented in three sessions of 10 minutes length, each reflecting one out of three music modalities contrasting dynamic/non-dynamic mechanisms and arousal potential characteristics in randomized order. Subjects are not made aware of stimulus manipulation nor the order of conditions. At the end of the game segment, an animation of 5 seconds length signals successful completion of the session, which marks the point when sound is faded out gradually. Subsequently, subjects are asked to give a rating on EMuJoy and to complete measurements on the 'iGEQ' and 'MEC-SPQ' instruments. After having passed all sessions, subjects complete the experiment by filling out the personality trait questionnaires 'ME-MS' and 'ITQ'.

4. RESULTS

As depicted in table 1, the music background systematically affected both ratings on imaginary and sensory-spatial aspects of immersive presence in the video game. Compared to non-dynamic conditions, Friedman's test attests significantly higher ratings on the dimension 'imaginary and sensory immersion' when playing the game with dynamic music, $\chi^2(60)=6.23$, $p=.04$, while 'suspension of disbelief' closely approached significance, $\chi^2(60)=5.14$, $p=.07$. The sensory-spatial aspect 'flow' showed significantly higher sensitivity towards the the low arousal potential of the non-dynamic music score when compared to non-dynamic high arousal potential and dynamic conditions, $\chi^2(60)=5.88$, $p=.05$, whereas ratings on 'possible actions' approached significance when non-dynamic music with high arousal potential was presented, $\chi^2(60)=5.22$, $p=.07$. No differences in ratings on 'self-location' were observed in any of the experimental conditions.

Considering emotional measures taken on the software EMuJoy, reports of valence approached significance after playing the game in non-dynamic high arousal-potential as against low arousal-potential conditions, $F(59)=3.83$, $p=.06$. Contrary to expectations, no differences were observed when comparing ratings on arousal in low and high arousal-potential conditions, $F(59)=0.48$, $p=.49$. When conducting correlations between measures of emotion and immersive presence, it is to be noted that prior studies investigating correlations of latent variables in music and social psychology typically show mean effect sizes between $r=.21$ and $r=.40$ (see Sandstrom & Russo, 2011). This approach of interpreting data as well as a local significance level of $p=.017$ (Bonferroni-corrected) was taken into account in the following analysis. A moderate to strong correlation based on Spearman-ranks between post-gameplay arousal and self-location appeared when the game had been played with dynamic music, $r=.37$, $p=<.01$, and non-dynamic music with low arousal potential, $r=.32$, $p=.01$, but not when played with non-dynamic music with high arousal potential, $r=.22$, $p=.09$. A subsequent analysis revealed no significant differences between dynamic music and non-dynamic music with low arousal potential, 95% confidence interval $l=-.27$ and $u=.17$. In contrast to these results, pre-post difference measures of arousal showed a Spearman-ranks based moderate correlation with self-location only when dynamic music was presented, $r=.31$, $p=.01$, but didn't meet significance in non-dynamic conditions with low arousal-potential, $r=.22$, $p=.09$, and high arousal-potential, $r=.23$, $p=.08$.

Table 1. Mean rankings (Friedman's test statistics), arithmetic mean, standard deviation (sd), median, and interquartile range (iQ) of ratings on dimensions of immersive presence. 'AP' denotes arousal potential. Asteriks in brackets (*) denote approached statistical significance.

		Dynamic Music	Non-Dynamic Music Low AP	Non-Dynamic Music High AP
Imaginary & Sensory Immersion (iGEQ)		2.23 *	1.87	1.90
	Mean (sd)	3.59 (.83)	3.22 (.86)	3.18 (.88)
	Median (iQ)	3.50 (1.37)	3.50 (1.50)	3.50 (1.50)
Suspension of Disbelief (MEC-SPQ)		2.23 (*)	1.89	1.88
	Mean (sd)	4.12 (.71)	3.79 (.82)	3.86 (.90)
	Median (iQ)	4.00 (1.25)	3.75 (1.25)	4.00 (1.25)
Flow (iGEQ)		1.88	2.23 *	1.88
	Mean (sd)	3.23 (.98)	3.58 (.83)	3.22 (.91)
	Median (iQ)	3.25 (1.50)	3.50 (1.00)	3.50 (1.50)
Self Location (MEC-SPQ)		.90	.90	.90
	Mean (sd)	2.48 (1.07)	2.45 (1.03)	2.53 (1.07)
	Median (iQ)	2.25 (1.63)	2.25 (1.75)	2.38 (1.69)
Possible Actions (MEC-SPQ)		1.96	1.83	2.21 (*)
	Mean (sd)	3.30 (.79)	3.15 (.87)	3.58 (.83)
	Median (iQ)	3.50 (1.25)	3.25 (1.00)	3.75 (1.25)

Moving on to investigate the relationship of trait empathy and emotional experience with Spearman ranks, music empathizing and pre-post arousal measures were correlated only in the non-dynamic low arousal potential condition, r=.26, p=.04, while no correlations manifested in conditions presenting dynamic, r=.01, p=.96, and non-dynamic music with high arousal potential, r=.06, p=.63. Similar results are found for emotional involvement for which a moderate correlation with pre-post arousal appeared only in non-dynamic music with low arousal potential, r=.33, p=.01, whereas non-significant results were obtained from the high arousal potential counterpart, r=.22, p=.09, and dynamic music conditions, r=.10, p=.46. When changing over to MEC-SPQ measures of self location, music empathizing correlates roughly moderately after playing in the dynamic music, r=.28, p=.03, and non-dynamic low arousal potential conditions, r=.26, p=.04, albeit results from the high arousal potential variant remain non-significant, r=.21, p=.10. Interestingly, emotional involvement and self location showed relatively strong correlations only in non-dynamic music with high arousal potential conditions, r=.39, p=<.01, despite non-significant results for dynamic, r=.13, p=.33, and non-dynamic low arousal potential, r=.13, p=.34.

5. DISCUSSION

To the knowledge of the author, the data gathered in this study represents the first empirical evidence of dynamic music supporting immersive experiences in a video game. While this may make exhale those who extensively invested in dynamic music implementations, the involved perceptual processes as well as their outcomes and associated suggestions for optimization are still subject to evaluation. Specifically, it is to be clarified if the effects of dynamic music are to be attributed to a process akin to the mediated perspectivation as outlined in the situational context model. Not only do subjects report higher imaginary and sensory immersion but also they are more likely to perceive these experiences as being plausible when the game is played in dynamic music as opposed to non-dynamic music conditions. The latter notion of plausibility becomes apparent in reports of heightened suspension of disbelief following the dynamic music condition. While this may seem evident due to an overlapping construct operationalization to imaginary immersion, the item wording of MEC-SPQ suspension of disbelief refrains from a distinction of sensory and imaginary aspects of immersive experience, thus, making it prone for mixing both bottom-up and top-down processes on an abstract level of evaluation. Accordingly, the expressive characteristics in dynamic music may exhibit interactional effects with perceived degrees of realism in other modalities such as sound-fx, visuals and the naturalness of interaction (Witmer & Singer, 1998). If dynamic music exerted a strong influence on the narrative-dramaturgic contextual localization, this effect would seem to be less constituted by stringing together music cues with stable emotional arousal potential than rather a progressive modulation corresponding to the remaining stimuli constituting a scene. Considering that subjects' reports are less likely to separate sensory from imaginary stimuli, instead opting for a more holistic approach of evaluation, it may seem advisable to expand the current focus of dynamic music from narrative-dramaturgic aspects of gameplay towards integrating sensory aspects. An example of a corresponding design, which is currently under investigation as part of this research project, is being seen in sensory-reactive music scores that incorporate visual brightness as well as amplitude of remaining sound stimuli in vertical implementations of music expression.

While a more abstract narrative understanding may benefit from such gained expressive fidelity, it is the sensory-spatial components, such as 'flow', that are assumed to be affected by it most. These sensory-spatial components are assumed to be more sensitive to sensory inputs attributed to the form or surface of the media presentation. In the present study, perceptual realism, a concept inherent to the formation of presence experiences, may have also paved the way for higher ratings on flow when playing in the non-dynamic low arousal potential music condition compared to high arousal and dynamic counterparts (for perceptual realism see Witmer & Singer, 1998; Gasselseder, 2012). Due to elevated volume levels in high arousal potential music, sound-fx may be more difficult to discern from the auditory scene. Low arousal potential music, on the other hand, brings along a reduced music scenery that allows for sound-fx to be perceived more similarly as a direct feedback. In receiving feedback to set actions as well as enhancing the sense of control of action and environment, two fundamental components of the original flow-model are met by the role assumed in sound-fx (Csikszentmihalyi, 1991). As a consequence, sound-fx may achieve a moment-to-moment synchronization of player skills and task difficulty as experienced in successful or failed actions in gameplay. In this light, the higher ratings given on flow following low arousal potential conditions go in accord with the desideratum of sensory-reactive implementations of dynamic music, aiming to provide a holistic audio experience by ensuring sound to stay perceptually distinguishable from music and dialogue stimuli. Previous studies on game audio echo these findings in identifying sound-fx as supportive to the experience of flow (Grimshaw et al., 2008; Gasselseder & Dabbler, 2009) and music as obstructive in challenge based game genres (Yamada et al., 2001; Cassidy & MacDonald, 2010). As is suggested here, genre exerts a determining influence on how music and sound-fx are experienced during gameplay. Yamada and colleagues (2001) attest negative effects of music on gameplay experience in the racing genre, whereas Sanders and Cairns (Sanders & Cairns, 2010) bring music in connection with subjects' positive experiences and altered sense of time while solving puzzles. It may thus be advisable to treat findings obtained within different game genres in isolation. Accordingly, when conducting focus interviews after playing in the 3rd person action-adventure genre, subjects ascribe mixed attributes to music conditions, without being actually aware of experimental manipulation [music on/off, sound-fx on/off| (Gasselseder & Dabbler, 2009). However, when music is presented following an animation sequence that introduces the avatar and opponent, mentions of obtrusive and distractive character decrease. Consequently, the appraisal of music background as well as its effect on gameplay experience seems to depend on established narrative context, resulting the majority of subjects to pick context music as their favorite condition (Gasselseder & Dobler, 2009; Gasselseder, 2012). Preliminary results taken from a replication in a quantitative paradigm of the original study by Gasselseder and Dobler (2009) reiterate the notion of music supporting subjects' assessment of avatar skill set and task difficulty of opponents.

Recalling the balance of skill set and task difficulty as two fundamental components of flow experience, game-context aware implementations of music may exchange to prepare flow within the action-adventure genre. Accordingly, if flow is to be distinguished from presence-like states linked to perceptual realism, its evolvement should depend on factors stimulating autotelic experiences, such as multisensory sources of feedback (Csikszentmihalyi, 1991; Gasselseder, 2012). Contextualizing this within ludonarrative structures presents a challenging task. In the theory of flow typology, goal definitions that are associated to the dramaturgic tie of the game used in the present study, address mainly the saving of hostages as well as the vigilante fight of criminals. In this way suggesting a global goal to players, these definitions stand in stark contrast to local goals as demanded in gameplay. Such may span from gameplay elements of hiding, distraction to intimidation of opponents. A constant readjustment of goals, as suggested by a changing dramaturgic background, might hinder the centering of attention as well as a fluid course of action (Csikszentmihalyi, 1991). If music is presented in a narrative-dramaturgic and task-related compatible context, subjects may feel more confident about their assessment of the avatar [skill set] and opponents [task difficulty], giving rise to forming expectations towards success or failure and subsequent motivational implications for the experience of flow (Gasselseder & Dobler, 2009; Gasselseder, 2012; Csikszentmihalyi, 1991). Consequently, new ways of embedding global and local goals in a compatible manner will have to be found in order to assure fluid accessibility through coherent musical connotations. One solution may be seen in the interconnection of local goals that pave the way to global goals set in the main narrative. If a derivation from the original path occurs, intermediate goals can be adapted to allow for a sufficient contextualization within the main narrative. In this regard, music may also help to camouflage design decisions related to gamification by contextualizing local goals within the main narrative by the means of vertical layer dramatization (Gasselseder, 2012).

Likewise to flow, the dimension 'self location' is assumed to exhibit links to perceptual realism. Furthermore, several studies have identified a correlation between presence/self-location and arousal (see e.g. Robillard et al., 2003). The present study did not find any differences in subjects' ratings on self-location when presented with dynamic/non-dynamic and low/high arousal potential modalities. Accordingly, music may not affect the experience of self-location. Alternatively, the lack of effects could be due to the small screen size the game was played on as well as different qualitative modes of presenting visual, auditory, and tactile channels, hereby reducing the sense of coherence of stimulus features (Lombard et al., 2000; Wirth & Hofer, 2008). Furthermore, effects resembling the influence of sound-fx on perceptual realism can be seen in correlations between arousal and ratings on self-location when playing with dynamic music and non-dynamic music with low arousal potential. Compared to single measurements taken after gameplay, a differentiated result pattern appeared in pre-post arousal measures, which are assumed to be more sensitive to in-game variations and associated dramaturgic context. In line with this, the present study found measures of pre-post arousal and self-location to correlate only in the dynamic music condition. Considering the lack of correlations between post-gameplay measures of arousal and self location, there is reason to assume that the effect of dramaturgic context indicates a covarying influence on pre-post measures across gameplay in the dynamic music condition. However, this would not necessarily implicate any significant deviations of arousal after gameplay, as is reported in this study. Adding in the results on imaginary components [imaginary and sensory immersion, suspension of disbelief] as well as the aforementioned technical limitations possibly affecting ratings on self-location, dynamic music may be put in use as a protective factor against post-gameplay arousal typically associated with temporary aggressive behavioral tendencies (see Anderson et al., 2010; Gasselseder, 2012). This could be achieved by regulating emotional experience and hereby reducing cognitive as well as emotional dissonance associated with the narrative and herefrom derived dramaturgic motivational relevance of gameplay while maintaining levels of immersive experience. Due to the fact that measures taken after dynamic and non-dynamic music conditions didn't differ in subjects' reports of self-location nor post-gameplay arousal, one may also presume a combined effect of dynamic music and accentuations of sound-fx. Traces of such effects can be observed in a study by Grimshaw and colleagues (Grimshaw et al., 2008) where subjects would consider the combined presence of music and sound-fx as less tense and negatively affecting, rating the condition the highest on immersion scales. If similar processes are to be held responsible for the results reported in the present study, higher degrees of interactivity in music may contribute to better emotional regulation during gameplay. Nevertheless, the suggested protective effects of dynamic music still need to be investigated more thoroughly in order to support the interpretation given above.

In accordance to previous non-music related findings, the dimension 'perceived possible actions' tends to exhibit stronger sensitivity to high arousal potential material (Ravaja et al., 2004; Gasselseder & Dobler, 2009; Freeman et al., 2005). Contrary to expectations, the present results demonstrate this sensitivity rather in ratings on valence than in arousal. Subjects recall non-dynamic music with high arousal potential more positively than when playing with music characterized by low arousal potential. A possible explanation for this can be seen in what Stevens and Raybould (Stevens & Raybould, 2012) recognize as 'Fiero' within the context of video games, an emotional state brought about by overcoming obstacles and providing positive reinforcement to the player. Given that recency effects significantly influence retrospectively reported experiences, it is important to ensure consistent modes of completing a game segment (Atkinson & Shiffrin, 1968). Whereas most research done on video games doesn't take into account the successful completion of game trials that form the basis of stimuli under investigation, the present study decisively included an animation signaling success and providing positive feedback after completing a trial. This feedback is translated musically only under conditions of dynamic music, while non-dynamic music continues to accompany in its predefined arousal potential characteristics. Being an important source of pleasure or 'Fun', fiero will stand out when high arousal potential characteristics meet the positive reinforcement implied by the visuals (Koster, 2005). When analyzing the expressive parameters of music separately, a higher accordance to the emotion category 'fun' is found in the high arousal potential condition versus its low arousal potential and dynamic music counterparts (see Gasselseder, 2012; Juslin & Lindström, 2011). Being exposed to expressive parameters that match those of 'fun' more closely combined with congruent visual stimuli, subjects are more likely to temporarily reevaluate their current emotional state in accordance to task progress, resulting in higher ratings on valence/pleasure after completing the game segment. In accordance with a rather young line of research investigating the influence of visuals on music perception, this interpretation of results demonstrates how visual and dramatic elements alter the meaning of music in a mood congruent manner of emotion induction by virtue of interacting multisensory stimuli (see Moore, 2010). Conversely, future studies will have to check for effects on positive valence when game segments are not completed successfully while being accompanied by congruent music stimuli.

Not only to sense but also to understand and tie together expressive cues of stimuli marks the premises of this studies' inclusion of personality constructs. As a result, compared to tendency for general emotional involvement, the capacity of decoding expression in music is expected to correlate higher with pre-post arousal measures in the dynamic music condition. Interestingly, while this hypotheses wasn't supported in regards to music empathizing and emotion measures, the expected pattern of results appeared for music empathizing and reported self location during dynamic music and non-dynamic low arousal potential conditions, albeit without observable difference between either condition. The lack of same correlation reaching significance in the high arousal potential condition may suggest an inferior role of musical decoding structures in the experience of spatial presence when being exposed to a higher volume/intensity of sensory stimulation. This view agrees with the finding that trait emotional involvement, a construct more close to emotional contagion, and self location correlated only in the high arousal potential condition, indicating the presumed role of the former in synthesizing decoded expressive cues from multiple channels and turning them into a holistic experience. Moreover, when inspecting the expressive parameters of music for each condition separately, the above given interpretation finds support in the limited dynamic range of high arousal potential material compared to the more complex sweeping dynamics and ambivalent expression, ranging from sadness, mystery up to danger, characterizing the low arousal potential material (Gasselseder, 2012). This complexity may also constitute the reason for low arousal potential music marking the only condition in which trait music empathizing as well as trait emotional involvement correlate with pre-post arousal measures. Besides a reported predictive validity for enjoying sad music (see Garrido & Schubert, 2011), music empathizing's correlation with pre-post arousal may be due to higher decoding demands set by low arousal potential music. For emotional involvement, as discussed further above, the pattern of results suggests the participation of a distinct structure which may be responsible for the vicariousness of decoded expressive stimuli, presumably also indicating a link to perceptual realism as witnessed in environmental feedback such as the higher prominence of sound-fx in the low arousal potential condition. It should be noted that, contrary to presence research, prior studies in music perception have suggested a dissociation between trait (music) absorption and pre-post measures of reported arousal, initially making the personality trait appear a less-than-ideal choice in studying interindividual differences of reported intensity changes in dynamic music. On the other hand, the present study demonstrates the lifting of this disconnection when considering experiential measures involving cognitive components, such as spatial presence. This finding goes in line with discussing trait music empathizing closer to decoding capacities as implied by the construct of cognitive empathy. Conversely, future studies aiming to capture the construct of trait emotional involvement may benefit from a division of expression synthesis, which primarily marks a cognitive effort, and emotional contagion, the extend to which decoded expression is promoted to the emotion system. While the above discussion may provide initial insights regarding cognitive styles in experiencing music within a video game, further evaluations and adaptation of the scales in use will be necessary in order to determine its ties to the immersive presence multiconstruct.

In recapitulating and expanding the theoretic framework presented in section two, inferences to scenic contents are to be understood as a predominantly unconscious processing of corresponding expressive parameters, which find entrance into the situational context model by defining relational characteristics of the portrayed events (Zwaan, 1999; Zbikowski, 1999). Having reached this stage, the integration and elaboration of decoded connotations is assumed to lead to empathic re-enactments analogues to salient motivations and patterns of behavior. The resulting relational attributes, which are exemplified in the contrasting of avatar and opponent features, are assumed to be influenced by changing levels of dynamic music. Inspired by Langs' (1992) 'Semiotic Ecology', the 'Relational Model of Interaction in Digital Imaginary, REMIDI' (Gasselseder, 2012) attempts to define layers of relational attributes as virtual mind-sets which describe distinct modes of perspective within communicative structures and attitudes between environment (inter-), avatar (intra-), and player (introrelation). Connotative references in music are expected to influence relational attributes mainly on inter- and intrarelational layers where position in the field of action and attitude between characters in the environment (inter) are negotiated whilst handing over the resulting dispositions, views and situational positioning of portrayed dramatis personae to a separate perspective of the avatar (intra; Gasselseder, 2012; Gasselseder & Dobler, 2009). Posing a question about interrelational mind-sets might involve how characters act, effect and understand each other within the realm of the narrative. Following this reasoning, a question about intrarelational mind-sets comprises how other characters within the narrative realm affect the avatar and how the avatar is thought to perceive those external characters in turn. Musical codes and acoustic-structural features, such as expressed in arousal potential, are assumed to contribute to directing selective attention towards relational structures as well as the formation and recall of associations in a process analogous to the situational context model. To give an example by applying REMIDI on the data obtained in the present study, perceived relations between extro-avatar characters are described as 'multifaceted' (interrelational) according to subjects' ratings on imaginary and sensory immersion questionnaire items as well as pretest REMIDI scales when dynamic music is presented (Gasselseder, 2012). In ratings on suspension of disbelief intentions between characters and avatar are operationalized in stronger 'credibility' (intrarelational) when gameplay is accompanied by dynamic music. In contrast, sensory-spatial components largely affect introrelational mind-sets that form the basis of embodied communication between the avatar and the player. In line with this, a previous qualitative study (Gasselseder & Dobler, 2009) employing focus interviews on game audio dimensions found sound-fx more closely related to introrelational attributions that, for the most part, result in more frequent reports of competency in avatar-player interaction and lower ratings on difficulty in environment-avatar-player interactions (see also Gasselseder, 2012). Accordingly, REMIDI assumes that subjects are capable of simulating different relational perspectives when using interactive immersive media. Players perceive virtual environments from several vantage points, which can, but necessarily don't have to, culminate in a direct line of communicative messages from inter- over intra- to intro relational attributes. Utilizing dedicated measures, future work on REMIDI may allow to systematically evaluate and categorize these ludonarrative and -dramaturgic functions of audio modalities in video games.

6. CONCLUSION

The present study provided first insight into the immersive experience of dynamic music as devised within ludonarrative structures found in current generation 3rd-person action-adventure video games. As demonstrated by subjects' inability to identify experimental manipulation, future iterations of dynamic music not only promise enhanced immersive experiences but also unintrusive guiding functions that affect gameplay motivation and performance. Considering that these effects can be found in rather basic implementations of dynamic music, ludopsychology is in need to gain more knowledge on the semantic processing of procedural aesthetics in order to account for future complex systems that harness sonic emotioneering and meaning making within interactive storytelling to their full extend. The situational context model intends to reflect this by regarding imaginary and spatial-sensory components as part of an interactional process that accumulates to a shared semantic ecology between the real [media usage] and the virtual [ludonarrative- and dramaturgy]. Thus, the accompanying stimuli must be reviewed according to their shaping by the players' individual manifestations of meaning. Allesch and Krakauer (2006) argue for the need to refocus the contextual implications of aesthetic experience analogues to Bruner's description of "the nature and cultural shaping of meaning-making, and the central place it plays in human action" (Bruner, 1986). Indications of varying music drama sensitivity/apprehension as well as immersive tendency form general examples of how individual dispositions affect the experience of gaming scenarios, raising the rationale for customized dynamic soundtracks (Gasselseder, 2012). In designing for behavioral tendencies and decoding skills, the situational context model may help to enhance the predictive validity of immersive experiences. Hereby further investigating interindividual differences in sonic interaction, it remains to be seen if procedural audio will indeed make minds meet virtual worlds.

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