

Immersion in the virtual environment: The effect of a musical score on the video gaming experience

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Thank You

- Prof. Toshihara
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- COE & its members

enhancement of the aural component

- ultra-high fidelity surround sound systems are present
 - nearly 100,000 theaters (Dolby Lab, 2004)
- sonic accompaniment for video games has progressed
 - synthesized waveform beeps of *Pong* (Atari, 1975)
 - role-playing games (RPGs)
 - *Tony Hawk's Underground* (Activision, 2003)
 - customizable lists of commercial music tracks
 - *Medal of Honor Frontline* (Electronic Arts, 2002)
 - specially composed orchestral scores

personal computer & game systems

(Sony PlayStation 2, Microsoft Xbox, and Nintendo GameCube)

- significantly faster data processing capabilities
- greatly increased storage capacity
- recently developed methods for compressing the audio and video components of these games
 - audio-visual (A-V) quality that begins to rival the quality of film and television.

significance & need for study

- amount of time spent by individuals using or interacting with media
 - an average of five and a half hours a day for children in the United States (Rideout, 2004)
- serious attention given to the audio aspect of motion pictures and in the most recent generation of video games (Hill, 2003)
 - significant financial investment

past research

• Film music and animation – growing number

- e.g., Boltz, 2001; Bullerjahn and Güldenring, 1994; Iwamiya, 1994; Iwamiya et al, 2001; Lipscomb, 1995; Lipscomb, in press; Lipscomb and Kendall, 1994; Marshall and Cohen, 1988; Thayer and Levenson, 1983; Thompson et al, 1994
- for a more detailed review, see Cohen 2001 or Lipscomb and Tolchinsky, in press.

• Video games – very few

- Yamada, et al. (2001, 2002)
 - SD scales (same as Iwamiya, 1997)
 - three conditions
 - game with music, game without music, music only

Yamada - results

- Complex relationship exists
 - The positive correlation of the “neatness” axis vs. the “lightness,” “calmness,” and “performance score” vectors, shows that a “dark, agitated” excerpt provides a “mixed” impression to the game, and, in turn, results in a negative effect on driving performance. In order to obtain high performance scores, players must concentrate on manipulating the control unit. The negative effect on performance may be a result of music disturbing the players’ concentration.

Yamada – ecological validity

- musical excerpts selected from a wide range of varying musical styles for use in the experiment based on a music-only semantic differential rating task
 - results of the study are likely to be significantly different from those in which a musical score has been specifically composed to accompany events as a dramatic narrative unfolds
- Present study
 - incorporates the music of Academy Award-winning composer Howard Shore
 - *The Lord of the Rings: The Two Towers* (LR:TT; Electronic Arts, 2002)

limitations

- focus solely on the impact that the musical score has on the video gaming experience
- without consideration of improvement or degradation of performance scores

research questions

- Do players perceive a game differently due to the presence of music?
- If so, in what ways does music impact the aesthetic experience of gaming?
- Do attribute variables (e.g., gender or age level) significantly impact participant responses?

hypotheses

- We predicted that responses to a number of verbal scales – particularly those associated with Osgood et al's (1957) “potency” dimension – would be positively enhanced by the presence of the musical score and would intensify the overall gaming experience for the player

method

- N = 76 students
 - 63 college (19 males and 44 females)
 - 13 high school (6 males and 7 females)
- random assignment to one of three experimental conditions
 - game-with-music (GwM)
 - game-without-music (GwoM)
 - music-only (MO)
- each responded on 21 VAME scales after playing/listening to three segments from *LR:TT*
 - VAME scales vs. SD

generating stimuli

- GwM & GwoM

- option of turning the musical soundtrack on or off without affecting the presence of ambient sounds

- MO

- not possible to turn off the non-musical sound unless the auditory component is eliminated completely

MO stimuli

- necessary to extract segments of the in-game musical soundtrack multiple times
 - digitally sampled audio output from the PlayStation 2 with a MOTU 828 audio interface connected to a Macintosh G4 Powerbook running Logic Audio Platinum5
- excerpts were then edited to ensure that all non-musical sounds were eliminated and reconstructed into an intact, natural sounding musical soundtrack
- lengths of the music-only stimuli for the three video game segments were 54, 86, and 85 seconds in duration, respectively
 - in comparison, scenes chosen for the game playing conditions (GwM & GwoM) were approximately 120 seconds each

selected game segments

- Weather Top
- Moria
- Amon Hen

Weather Top

- in this second-level segment, the player's primary objective is to protect the character Frodo from menacing creatures known as Ringwraiths. The nighttime setting is high atop a mountain ruin, surrounded by forest. The player must repeatedly re-light and wield a torch in order to fend off the enemy.
- the musical score consists of a driving rhythm with string glissandi at the beginning, gradually replaced by a low string ostinato with a prominent presence of a vocal choir, singing words in one of the languages of Middle Earth. This excerpt maintains a clear sense of tonality throughout.

Moria

- In this segment encountered later in the second level, the player must fight through a marsh while unhuman creatures (Orcs) attack from the water and arrows fly from surrounding cliffs. This scene is also very dark, as if at night, and the player experiences periods of relative quiet, punctuated by an occasional attack from Orcs hidden in the marsh.
- The musical score for this excerpt is highly dissonant, loud, and brash, initiated at the outset by a series of ascending chromatic motifs played by brass, woodwind, and string instruments, followed by a brief section of pounding percussion rhythms that is interrupted briefly by the same chromatic ascending motifs, then returning to the pounding rhythm. The tonal clusters in this excerpt result in an atonal harmonic context.

Amon Hen

- In this excerpt from the seventh level of the video game, the player must fight ferociously to make a path through the forest, as numerous fierce fighters (Uruk-Hai, a stronger and larger breed of Orc) are encountered. The daytime scene is set in a forest and includes a large number of enemies in close combat situations.
- The musical score for this segment is majestic in tone featuring a steady, syncopated rhythm in the percussion and low strings with brass instruments in the melodic foreground over a clearly tonal harmonic structure. Eventually, following the sound of a hunter's horn, the brass instruments are supplanted by strings in a chordal homophonic texture, and then, the brass return to the majesty of the opening section.

data collection

- Following each segment of game play, participants responded on a series of 21 verbal scales
 - Those assigned to the music-only condition simply listened to the musical score, then responded using the same verbal scales
- MEDS (Kendall, UCLA)
 - using a computer interface and a scroll bar that recorded the responses on a scale from 0 to 100
 - VAME scales presented in random order

VAME scales

- active
- annoying
- bright
- busy
- cold
- colorful
- dangerous
- exciting
- fast
- gentle
- good
- high
- intense
- labored
- loud
- masculine
- pleasant
- powerful
- relaxed
- simple
- strange

data analysis

- repeated measures ANOVA
 - between-subjects
 - experimental condition
 - gender
 - age level (college – HS)
 - within-subjects
 - video game segment
 - VAME scale

results

- between subjects variables
 - no main effects or interactions
- within-subjects variables
 - highly significant main effects & interactions

Significant Differences

(within-subjects)

● main effects

- VAME scales ($F(20,1280)=22.606, p<.0005$)
- age level ($F(20,1280)=1.760, p=.020$)s
- game segment ($F(40,2560)=1.464, p=.031$)
- experimental condition ($F(40,1280)=1.522, p=.020$)

● interactions

- gender x game segment ($F(40,2560)=1.657, p=.006$)
- age level x game segment ($F(40,2560)=1.622, p=.008$)
- VAME scales and experimental condition ($F(80,2560)=1.330, p=.028$)
 - confirming that the verbal ratings provided by participants do appear to be significantly influenced by the presence or absence of music.

digging deeper

- a 2nd ANOVA was calculated for each VAME scale independently to determine which specific scales were influenced by experimental condition
 - increase in probability of *alpha* determined appropriate for such an exploratory investigation
 - revised *alpha* = $1 - (.95 * .95) = .0975$

VAME scales revealing NO significant difference

● Evaluative

- cold
- good
- pleasant

● Activity

- active

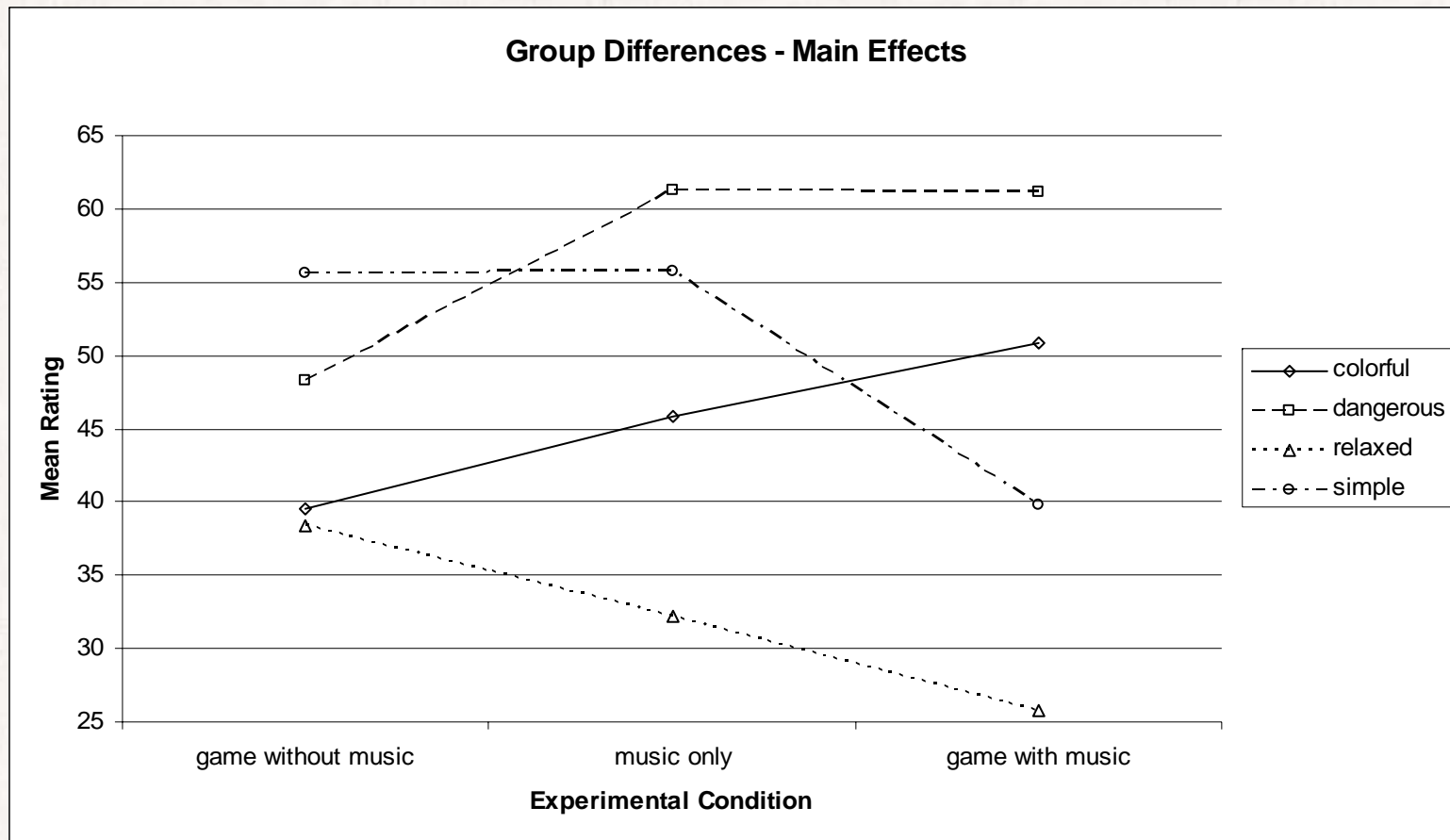
● potency

- exciting
- gentle
- high
- intense
- loud
- powerful

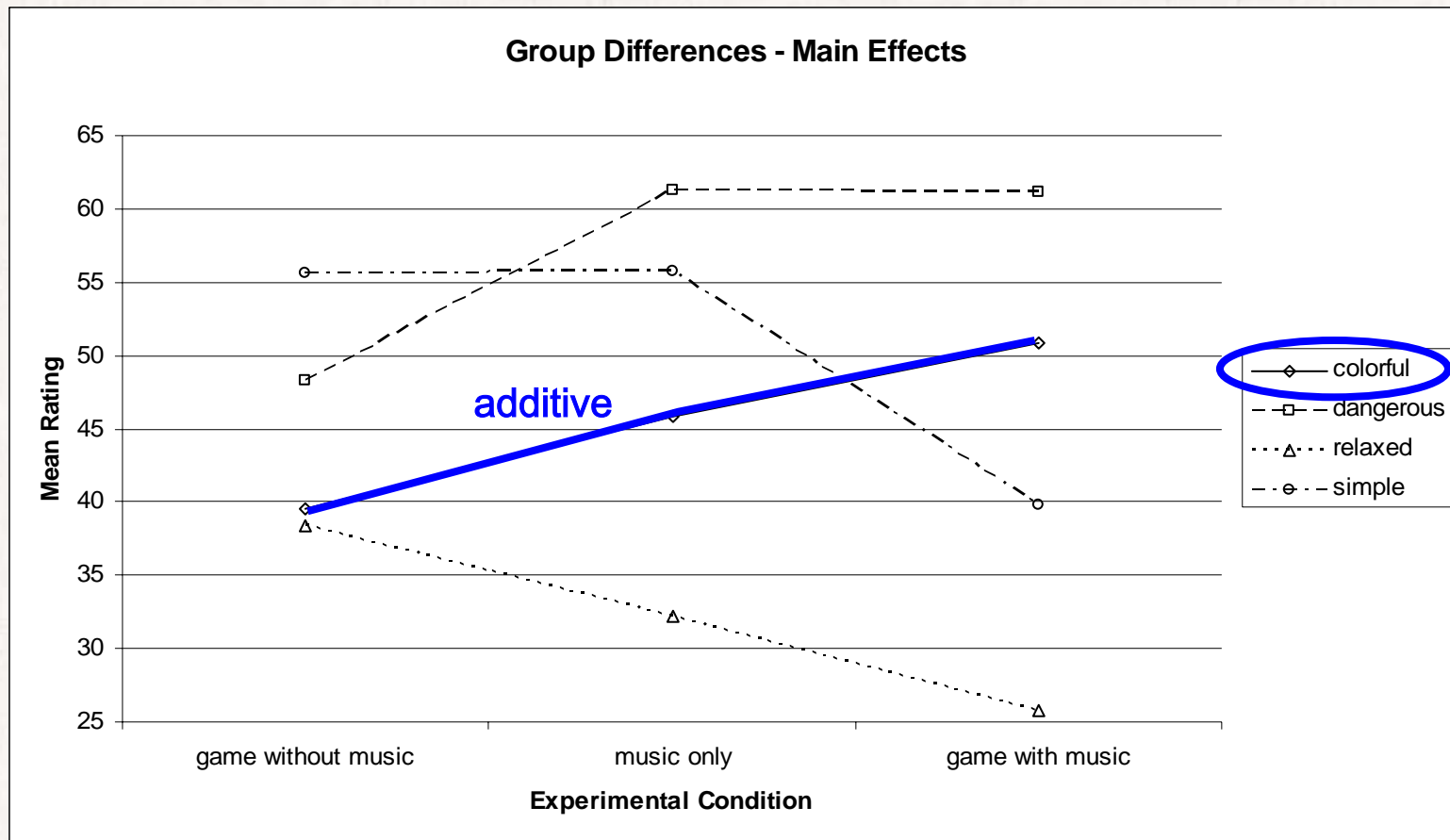
statistical significance

- experimental condition
 - colorful, dangerous, relaxed, simple
- experimental condition x gender
 - dangerous, busy
- experimental condition x game segment
 - annoying, strange
- experimental condition x age level
 - labored

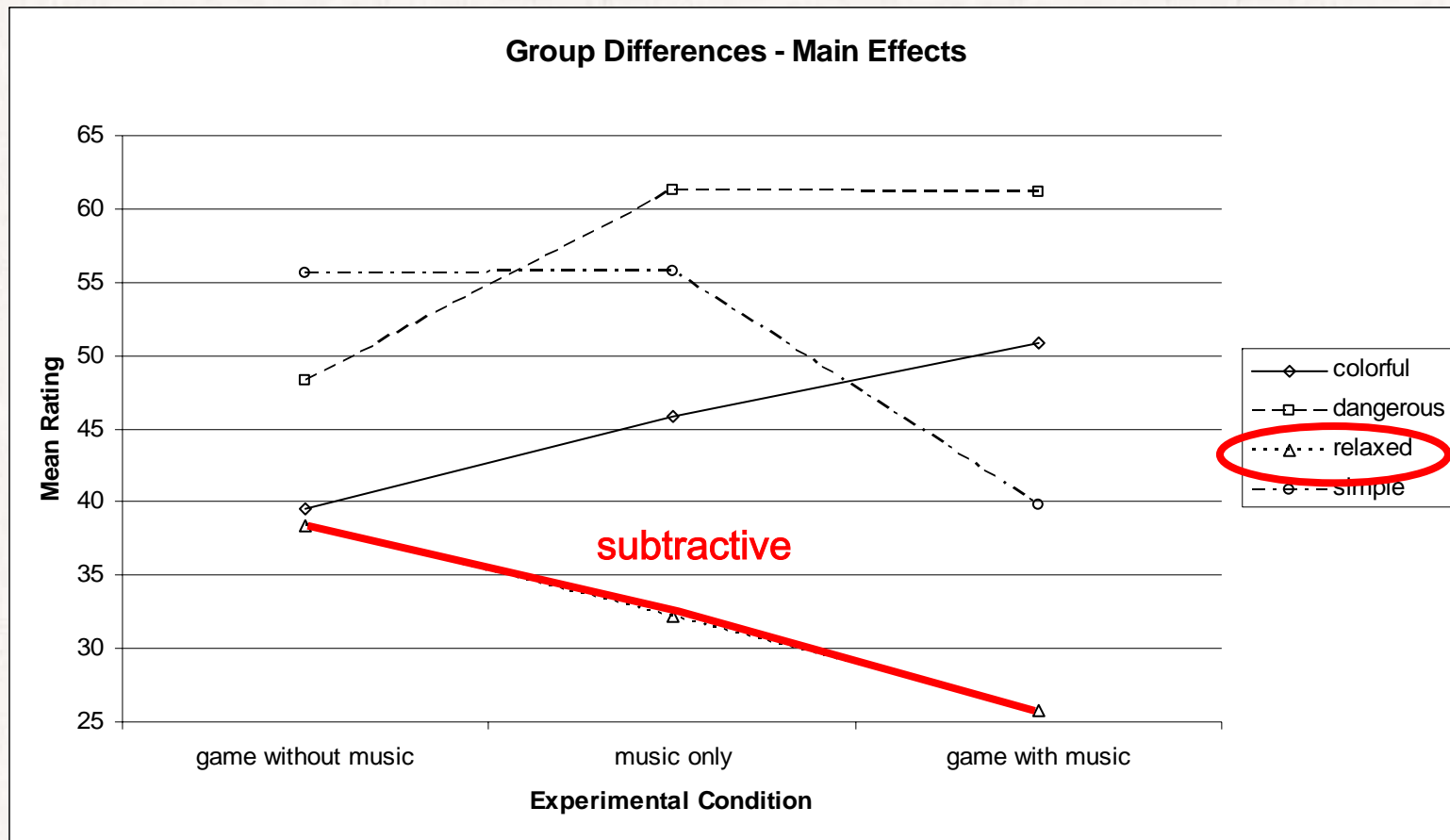
experimental condition main effect



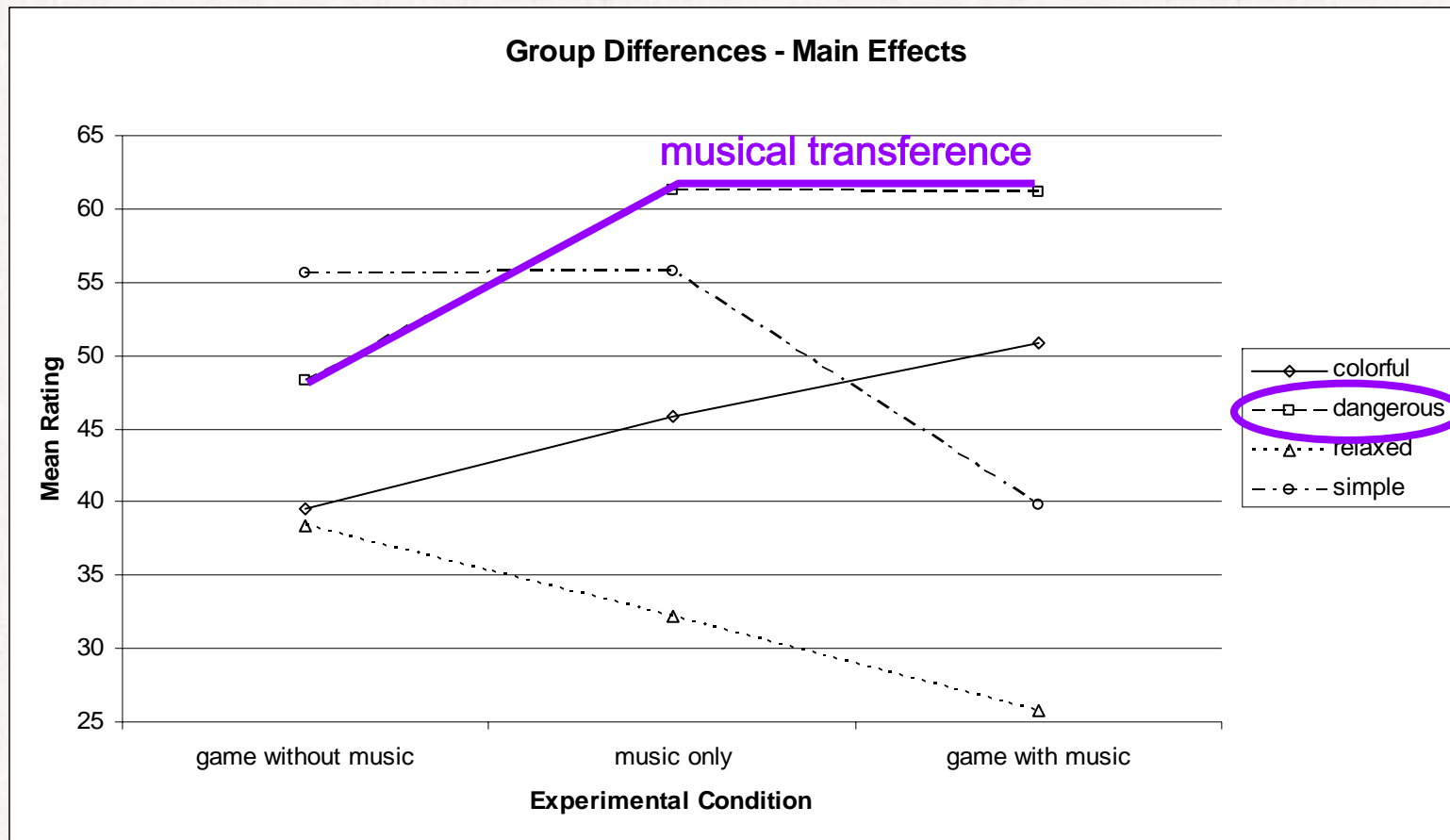
experimental condition main effect



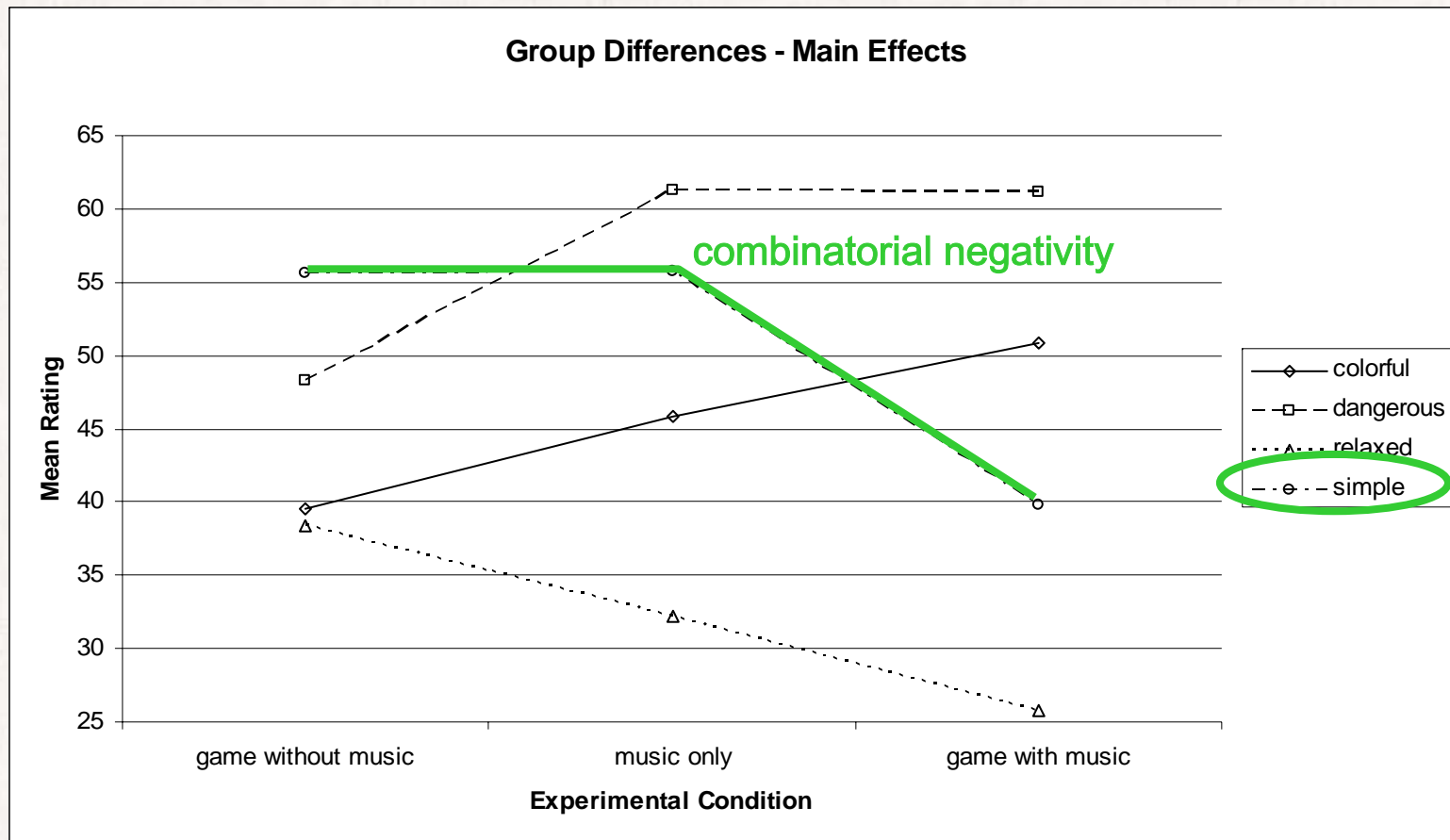
experimental condition main effect



experimental condition main effect



experimental condition main effect



research questions answered

- some, but not all, of the VAME scales exhibited a statistically significant difference due to the presence of a musical score
- both gender and age level were shown to be significant factors for some, but not all, of the VAME scales
 - recall that there were NO statistically significant differences in the main effects for these between-subjects variables

Conclusions

- confirm Yamada's conclusion that there is a highly complex and varied relationship between the musical component and the game playing experience
- identified specific *types* of relationships between music & other A-V components

types of music-visual relationships

- **additive**: rating for the GwoM is lowest with a higher rating for MO, but the GwM combination is rated highest
- **subtractive**: GwoM rating is highest and MO is lower, but GwM is the lowest
- **musical transference**: rating of GwM is nearly identical to MO condition, regardless of GwoM rating
 - *visual transference*: [hypothesized]
- **combinatorial negativity**: GwoM & MO ratings are nearly identical, but the combination (GwM) results in a significantly lower rating

future research

- series of studies using same method to determine to what extent these results can be generalized to other gaming contexts
 - other RPGs
 - other types of video games

Thank you for your attention

● Contact Information

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References

- Boltz M (2001). Musical soundtracks as a schematic influence on the cognitive processing of filmed events. *Music Perception*, 18(4): 427-454.
- Bullerjahn C, Güldenring M (1994). An empirical investigation of effects of film music using qualitative content analysis. *Psychomusicology*, 13: 99-118.
- Cohen AJ (2001). Music as a source of emotion in film. In Juslin PN, Sloboda J eds. *Music and emotion: Theory and research*. New York: Oxford University Press, 249-272.
- Dolby Laboratories (2004, May 19). Worldwide statistics. Retrieved June 14, 2004, from <http://www.dolby.com/stats/>.
- Hill D (2003, July). Four producers reinvent video-game sound design. *Remix*, 38-44.
- Iwamiya S (1994). Interactions between auditory and visual processing when listening to music in an audio visual context: 1. Matching 2. Audio quality. *Psychomusicology* 13: 133-153.
- Iwamiya S (1997). A computer-controlled experiment on the interaction between music and motion picture: The effects of various musical factors on the impression of audio-visual products. *Journal of Music Perception and Cognition* 3: 25-32.
- Iwamiya S, Johgetsu Y, Sugano Y (2001). The effects of musical and image factors on the impression of audio-visual contents. *Proceedings of Mecatronics '01, the 5th Franco-Japanese Congress and 3rd European-Asian Congress* (Besançon, France, October 9-11, 2001).
- Kendall RA, Carterette EC (1993). Verbal attributes of simultaneous wind instrument timbres: I. von Bismarck adjectives. *Music Perception*, 10(4): 445-467.

References

- Lipscomb SD (1995). Cognition of musical and visual accent structure alignment in film and animation. Unpublished doctoral dissertation, University of California, Los Angeles.
- Lipscomb SD (in press). The perception of audio-visual composites: Accent structure alignment of simple stimuli. *Selected Reports in Ethnomusicology* 12.
- Lipscomb SD, Kendall RA (1994). Perceptual judgment of the relationship between musical and visual components in film. *Psychomusicology*, 13(1): 60-98.
- Lipscomb SD, Tolchinsky DE (in press). The role of music communication in cinema. In Miell D, MacDonald R, Hargreaves D eds. *Musical communication*. Oxford: Oxford University Press.
- Marshall SK, Cohen AJ (1988). Effects of musical soundtracks on attitudes toward animated geometric figures. *Music Perception*, 6(1): 95-112.
- Osgood CE, Suci GJ, Tannenbaum PH (1957). *The measurement of meaning*. Urbana: University of Illinois Press.
- Rideout VJ (2004, March). [Summary of testimony]. Presented before the United States Senate Subcommittee on Competition, Infrastructure, and Foreign Commerce. Retrieved September 1, 2004 from <http://www.kff.org/entmedia/entmedia030204tst.cfm>.
- Thayer JF, Levenson RW (1983). Effects of music on psychophysiological responses to a stressful film. *Psychomusicology*, 3(1): 44-52.

References

- Thompson WF, Russo FA, Sinclair D (1994). Effects of underscoring on the perception of closure in filmed events. *Psychomusicology*, 13: 9-27.
- Yamada M (2002). In Stevens C, Burnham D, McPherson G, Schubert E, & Renwick J eds., *Proceedings of the 7th International Conference on Music Perception & Cognition*. Adelaide: Causal Productions, 340-343.
- Yamada M, Fujisawa N, & Komori S (2001). The effect of music on the performance and impression in a video racing game. *Journal of Music Perception and Cognition*, 7(2): 65-76.
- Zehnder SM, Lipscomb SD (in press). The role of music in video games. In Vorderer P and Bryan J eds. *Playing computer games: Motives, responses, and consequences*. Lawrence Erlbaum Associates, Inc.