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Using Music to Influence Creative and Critical Thinking.

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Objectives of the Research

This paper investigates the hypothesis that listening to music may influence responsiveness to creative or critical thinking tasks.

It has been acknowledged that a driver's attitude can change as a result of choice of music played during a journey, but is such an influence observable with cognitive tasks of a creative or critical nature? Certain types of music have been claimed to aid cognitive ability and skill development, though a number of follow-up research programmes have called the reliability of some of these tests into question. The term 'Mozart Effect' has been used in reference to a growing claim that Mozart's music can influence cortical development and creative ability. However, the focus of this study was not cortical development, but mood and arousal regulation, where the individual's choice of music was proposed to influence cognitive responsiveness. It had been observed in industry that relaxing music played by a design team during the divergent, concept generation and development phases, was replaced by faster and heavier music during the convergent, more critical phases, suggesting a possible need for more fitting music.

The Method

The creativity test chosen for this investigation was 'Creative Fluency', simply requiring the generation of alternative uses for named objects. The 'Critical Review' test, which followed directly, required that the participants assess the ideas they had generated prior and mark those they considered original. Numbers of ideas, and ideas marked as original were averaged out to provide group/condition specific data.

Overall, this programme involved a combination of ethnological and psychological investigative techniques. The sample groups, of 10+ participants each, were mainly undergraduate students of Product/Industrial Design, from the United Kingdom, Sweden and Australia. The objectives were to: determine the participants favoured types of music; at what times they most enjoyed listening to these; and how they categorised these types of music. They were also asked what music they listened to by choice in situational environments, which included: the studio, the workshop, and home. The aim of these questions was to determine whether there were any patterns to listening preferences.

Each creative fluency and critical review condition, using a single type of music, lasted half an hour, where each creativity exercise was run for three minutes, and each critical review for one minute. This series of exercise results would then be examined for any time related differences. The creative fluency test was proposed to indicate increased creativity when a higher average number of alternative uses were suggested for a group-condition. Increased critical thinking was proposed would be indicated by a lower average number of ticks for originality.

An Indication of the Main Findings

The findings were that if an individual did not identify with a piece of music as a preferred track or type, their responsiveness to creative or critical thinking tasks was comparable to working to no music at all. There was also found to be comparable 'base-level' results when listening to preferred music that was energetic. However, there was found to be an improvement in responsiveness to both the creative and critical thinking tasks when individuals listened to their preferred relaxing music.

Using Music to Influence Creative and Critical Thinking.

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ABSTRACT.

This paper investigates the hypothesis that listening to music may influence responsiveness to creative or critical thinking tasks.

It has been acknowledged that a driver's attitude can change as a result of choice of music played during a journey, but is such an influence observable with cognitive tasks of a creative or critical nature? Certain types of music have been claimed to aid cognitive ability and skill development, though a number of follow-up research programmes have called the reliability of some of these tests into question. The term 'Mozart Effect' has been used in reference to a growing claim that Mozart's music can influence cortical development and creative ability. However, the focus of this study was not cortical development, but mood and arousal regulation, where the individual's choice of music was proposed to influence cognitive responsiveness. It had been observed in industry that relaxing music played by a design team during the divergent, concept generation and development phases, was replaced by faster and heavier music during the convergent, more critical phases, suggesting a possible need for more fitting music.

This study involved a combination of ethnological and psychological investigative techniques. The sample groups used were mainly undergraduate students, of Product/Industrial Design, and were sampled from collaborating Design Schools in: the United Kingdom, Sweden and Australia. 'Creative Fluency' and 'Critical Review' tests were used to record level of influence of a number of musical conditions. The conclusions were that if an individual did not identify with a piece of music as a preferred track or type, their responsiveness to creative or critical thinking tasks was comparable to working to no music at all. There was also found to be comparable 'base-level' results when listening to preferred music that was energetic. However, there was found to be an improvement in responsiveness to both the creative and critical thinking tasks when individuals listened to their preferred relaxing music.

INTRODUCTION.

This investigation developed from observations that individual choice and use of music was generally considered to aid the regulation of mood and/or arousal, and provide potential for improvement in the performance of various tasks. Links have been confirmed between listening to music and productivity in repetitive task workflow, Fox and Embrey (1972), but a number of reports of influence upon so-called 'creative ability' have been called into question. In addition to the issue of concrete proof of positive influence upon creativity, it was noted that there had been little consideration of influence upon critical thinking.

This study proposed that it is possible to regulate mood and arousal through choice and use of music, such that conditions more conducive of creative or critical thinking could be produced. In order to appreciate the investigative method used for this project, a context for the influence of music upon cognitive abilities and performance will now be described.

CONTEXT.

Creative and Critical Thinking.

Before describing the systemic context of claimed influences of music, the reference to creative and critical thinking should first be more clearly defined.

'Creative Thinking: Thinking that leads to an outcome that is novel (or unusual) and appropriate (or good).

Critical Thinking: The use of those cognitive skills or strategies that increase the probability of a desirable outcome. Thinking that is purposeful, reasonable and goal-directed.'

Halpern (2003)

Further to Halpern's (2003) summary definition, creative thinking is referred to in this paper as a divergent process, and critical thinking as a convergent process.

Motive.

Though mood is linked to motivation, it should be understood that mood is not the cause of action. The individual may certainly feel an increased or decreased will or readiness towards mental or physical action, but without an intrinsic or extrinsic motive there is no identifiable motivation. Upon the individual's acknowledgement of motive and intent, the decision then comes to hold or take action.

It is important to recognise that we each need a critical level of arousal before reaching the point of decision to act, and that each person's critical level can differ from one moment to the next dependent upon other influences. Listening to music is proposed to create a propensity, through direction of mood and level of arousal, for a variety of actions to take place including creative or critical thinking, provided other key factors are found to be conducive.

Extrovert and Introvert Personality.

A major contributor to individual differences in the level of arousal needed by people is personality, particularly between the poles of introversion and extroversion, which influence perceptions and attitudes. See figure 1. An

extrovert for instance needs far more stimulation than an introvert to reach a critical level of arousal to react positively or negatively.

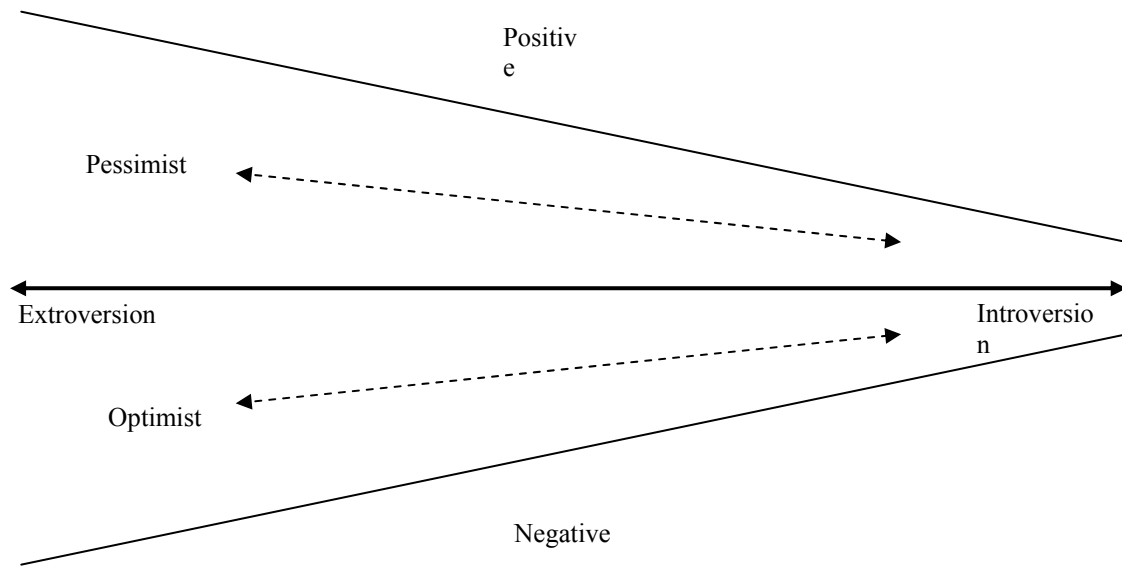


Figure 1. Extroversion Introversion need for stimulation. Hilton (2004).

Burt (1939) looked at the issue of listening preferences and used Eysenck's fourfold typology of personality, to determine preferred composers work. See figure 2.

Type	Preference	Composers
Stable Extroverts	Classical/Baroque	Handel, Mussorgsky, Brahms
Stable Introverts	Classical/Baroque	Bach
Unstable Extroverts	Romantics	Wagner, Strauss, Liszt, Berlioz
Unstable Introverts	Romantics	Debussy, Delius

Figure 2. Personality Types and Listening Preferences.

Cognitive Effort.

An individual's decision to act follows a consideration of resource requirements, and confirmation of sufficient ability and energy to complete the task. The individual's response to their recognition of a physical or mental desire to act, will conclude consciously or unconsciously in a prediction of effort. This prediction of effort is calculated intuitively alongside the forecast of risk and achievable reward, which helps determine the level of motivation. See figure 3.

$$\text{Motivation} = \text{Reward}/(\text{Risk}+\text{Effort})$$

Figure 3. Motivation Equation. Hilton (2002)

When rewards conflict with anticipation and prove disappointing, the motivation is reduced or replaced by stress, which may in turn redirect the individual's motivation to react defensively. 'Cognitive Dissonance' may occur when individuals attempt to justify poor or mistaken judgments. For instance, the individual may acknowledge that listening to certain songs conflicts with effective study, yet they may continue to listen because it makes the experience more enjoyable, and appear to require less effort. However, the reason such a situation would actually require more effort to concentrate effectively is because these songs could be a source of distractive cognitive load.

Cognitive Load.

Cognitive load refers to the level of demand produced by tasks or stimuli. Increases in cognitive load reduce spare processing capacity within working memory. A series of experiments conducted by Konecni (1982), investigated performance in terms of loud-arousing music and soft-unarousing music, on both simple and difficult tasks. The results concluded that arousal produces cognitive load. Performance was worst with loud-arousing music on a difficult task, and best with soft-unarousing music on a simple task.

Arousal and Altered States of Consciousness.

The work of Newburg and d'aquili (2000) suggested that the experience of a shift in state of mind is down to arousal and quiescence competing for governance of the nervous system. However, interaction between the two systems is more complex than a simple regulation of balance, as Gellhorn and Kiely (1973) discovered that over-stimulation of one system actually increases the activity of the other. This is referred to as 'Spillover'. In some cases of extreme quiescence or hyper-quiescence, for example in meditation, overwhelming calmness can lead to an eruption of the arousal system, referred to as 'Active Bliss'. This relates to Altered States of Consciousness (ASC's), which have been noted to be induced by rhythmic drumming, some enabling people to lose their self-awareness, which has been experienced by listening to techno/rave music under certain conditions. There are a number of these ASC's, which may be categorised by brainwave range:

'It has been demonstrated repeatedly: Brainwaves can be modified by both music and self-generated sounds. Ordinary consciousness consists of beta waves, which vibrate from 14 and 20 hertz. Beta waves occur when we focus on daily activities in the external world, as well as when we experience strong negative emotions. Heightened awareness and calm are characterised by alpha waves, which cycle from 8 to 13 hertz. Periods of peak creativity, meditation and sleep are characterised by theta waves, from 4 to 7 hertz, and deep sleep, deep meditation and unconsciousness produce delta waves, ranging from .5 to 3 hertz. The slower the brainwaves, the more relaxed, contented, and peaceful we feel.'

Campbell (1997)

In studies of music and emotion, by Becker (2001), arousal was found to make the heart beat faster, pulse rise, breathing to become shallower, skin temperature to rise, and brain wave patterns to become less regular. Any or all of these bodily reactions are potential influences upon changes in thinking.

'Mood might interact with the extent of processing. Specifically, music that induces a positive mood might lead to more simplified, heuristic processing. This might be more likely when differences between decision alternatives are small, when the individual is not clear about his or her preferences, or there is so much information available that the costs of detailed processing are high. In these circumstances music might have a significant impact on decision-making..... Music induced happiness might lead to heuristic strategies or adopting a less stringent criterion for reaching a decision either because the mood disrupts processes or makes less working memory capacity available for them, or because there is little motivation to invest effort in any detailed processing of information.'

Crozier (1997)

Klimesch (1996) found that the upper band of the brain's alpha waves was connected with the retrieval of semantic long-term memory information. Suggesting contribution to problem-solving and reasoning performance. However, Campbell (1997) proposed that for optimal creativity, and tackling issues requiring non-linear solutions, Jazz from the likes of Miles Davis, John

Coltrane and John Cage was recommended. The chaotic nature of jazz was claimed to shift the listener into 'theta' consciousness, more effective for associative thinking activity, whereas Mozart's works and other more melodic music was claimed only to achieve 'alpha' consciousness and relaxed thinking activity.

METHOD.

The creative industries hold no clear definition of creativity, and with this dilemma comes the constant risk of miscommunication, which is why definition of both creative and critical thinking was provided in the introduction. However, in terms of effective research method a further issue must be raised.

Error can and has occurred in the secondary dissemination of test results, such as those relating to the 'Mozart Effect'. The primary dissemination of the Rauscher *et al* (1995) investigation of the Mozart Effect referred to changes in performance of temporal-spatial abilities. However other's secondary dissemination promoted the Mozart Effect as having proven enhancement of creative ability, a much broader context. It is important to recognise that such experiments are tests of types of intelligence, and resources for thinking processes. A true test of creative processes would be divergent in nature.

The creativity test chosen for this investigation was 'Creative Fluency', simply requiring the generation of alternative uses for named objects. The 'Critical

Review' test, which followed directly, required that the participants assess the ideas they had generated prior and mark those they considered original. Numbers of ideas, and ideas marked as original were averaged out to provide group/condition specific data.

Overall, this programme involved a combination of ethnological and psychological investigative techniques. The sample groups, of 10+ participants each, were mainly undergraduate students of Product/Industrial Design, from the United Kingdom, Sweden and Australia. The objectives were to: determine the participants favoured types of music; at what times they most enjoyed listening to these; and how they categorised these types of music. They were also asked what music they listened to by choice in situational environments, which included: the studio, the workshop, and home. The aim of these questions was to determine whether there were any patterns to listening preferences.

Each creative fluency and critical review condition test lasted half an hour, where each creativity exercise was run for three minutes, and each critical review for one minute. The creative fluency test was proposed to indicate increased creativity when a higher average number of alternative uses were suggested for a group/condition. Increased critical thinking was proposed would be indicated by a lower average number of ticks for originality.

A number of test conditions were set up. These included:

1. Classical (Played to group)
2. Techno (Played to group)
3. Jazz (Played to group)
4. Preferred Relaxing Music (On personal stereos)
5. Preferred Energetic Music (On personal stereos)
6. No Music

RESULTS.

The analysis of the ethnographical data provided a sense of contemporary choice of music and preferences, which allowed a degree of cross-cultural comparison to be undertaken. There was found to be a variety of favoured types of music globally across the sample groups, but no common pattern concerning preference of what was listened to when or where. A number of participants commented from personal experience that loud music and music with lyrics was a very obvious distraction to them, a prediction that had previously led the researchers to base test conditions 1 – 3 on instrumental examples.

The tests showed similar levels of creativity and critical thinking, for classical, techno, jazz, and preferred energetic music. In fact the results repeatedly equated with those for the 'no music' condition, where an average of 8 ideas were generated, of which an average of 4 (50%) were considered to be original. A further analysis was made using the additional feedback data where 'like' and

'dislike' of the controlled music had been indicated, but once again no difference was found.

The only condition to indicate any difference in the average was for preferred relaxing music, where both the creative and the critical thinking indicated an improvement, with results of 12 ideas, of which 4 (33%) were considered original.

DISCUSSION.

In review of the results of this experiment, and the proposed contribution of music to the creative and critical processes, we might first consider the following findings: In an investigation of favoured means of mood regulation, Thayer (1996), noted that music came second only to exercise, from an extensive list of activities. In an investigation of gender differences in listening to music, North *et al* (2000) found that girls were more likely to report that music could be used as a means of mood regulation, whereas boys reported that music could be a means of creating an external impression with others. Then in a study by Sloboda and O'Neill (2001), participants were asked to regularly self-report on activities they were involved in, and it turned out that 'listening to music' only made up 2% of activities. Nevertheless there has been a strong sense that there is a connection between music and creative thinking. Individual focus and diffusion of attention, by means of music listening, has been indicated to influence creative resources.

'Individuals who cast broad attentional nets are more likely to capture unexpected cues and to generate remote associations than are those whose cognitive resources are more narrowly focused.'

'We predict that those who have a propensity to diffuse their attention are more likely to benefit from an incubation period than are those whose attentional resources are narrowly focused.'

Ansburg and Hill (2003)

In terms of the findings of this investigation, individual data indicated a wide range of responses, from each of the three countries, holding very much to the recognition of individual differences in taste. However, other than the preferred relaxed music condition, the averaging of results from groups generally showed little concrete evidence of influence. But in view of the other researchers findings, it is suggest that individuals who do sense a greater influence from music should consider personally investigating the affect of music usage upon their creative and critical thinking responsiveness and effectiveness.

It should be made clear that the aim of this study was to determine an influence upon Creative Fluency and Critical Review as cognitive tasks, through the regulation of mood and arousal using music. This should in no way be confused as an attempt to evidence influence of 'effectiveness' in creative and critical thinking. To achieve a measure of effectiveness would require a number of longitudinal studies, using assessment panels to judge the effectiveness of the process stage outputs. However, the findings of this study certainly suggest opportunities for further research, possibly with introvert and extrovert individuals, or using practical instead of mental tests of creative and critical thinking.

CONCLUSION.

In the review of ethnographic data there was found to be a variety of favoured types of music across the sample groups, but no common pattern concerning preference of what was listened to when or where. A number of participants commented that loud music and music with lyrics was a very obvious distraction to them.

The tests showed no evidence of difference for creative fluency or critical review tasks generally for any music condition other than the individually preferred relaxing music, using personal stereos. In that condition the idea count increased from the 'base-level' by a factor of 50% and the review of originality may be considered to have become more critical at 30% of the generated ideas. Some individuals had commented that loud music and music with lyrics was a negative distraction. This suggests that those individuals observed in industry listening to loud energetic music at the critical final phase of their design work, may have kept their levels of arousal up, but would have been unlikely to have aided effective thinking due to the increased cognitive load. It would appear to have served their purpose better to have continued with their earlier choice of relaxing music.

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