

**UNDERSTANDING THE CREATIVE PROCESS:
PERSONAL SIGNATURES AND CROSS-DOMAIN INTERPRETATIONS OF
IDEAS**

by
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Abstract

This dissertation investigated to what extent the expression of personal creative style is recognizable within and across domains. It also investigated to what extent two pieces of art in disparate domains (e.g., a piece of music and a painting) resemble each other, when the first is used as inspiration for the creation of the second. The first set of studies tested the hypothesis that creative style is recognizable within and across domains. Art students who were shown sets of paintings by (1) five famous artists, and (2) their peers identified the artists at above-chance levels. Similarly, creative writing students were given passages by famous writers and by their peers and they identified the writers at significantly above-chance levels. When asked to produce works of art, the creative writing students were able to identify at above chance levels which peer produced each piece of art. Finally, when art students were asked to produce non-painting artworks, they identified which peer produced each non-painting artwork. These findings support the hypothesis that creative styles are recognizable not just within but also across domains.

The second study tested whether people were able to match creative outputs with the cross-domain stimuli that inspired them. Three expert painters created four paintings each. Each painting was the artist's interpretation of one of four different pieces of instrumental music. The participants were able to identify which paintings were inspired by which musical pieces at modestly above-chance levels. They rated similarities between every painting pair, every musical piece pair, and every painting-music pair. Also, all the paintings and musical pieces were rated using a set of psychological variables (e.g., arousal, complexity). When the artists' creative styles were clearly recognizable in their paintings, it was more difficult for participants to identify the musical pieces that inspired those paintings.

This dissertation demonstrates that both personal style and the core of a creative idea are to some extent independent of the domains in which they are initially expressed. This dissertation suggests that individuals have multiple avenues for the expression of personal style, and core ideas have multiple avenues for their creative manifestation.

Preface

All data for this dissertation were collected following a full-board ethics protocol review of the research methodology. Approval was granted by the University of British Columbia Okanagan Research Ethics Board Office of Research Services on February 10, 2012. The certificate number is H10-02344.

A version of Chapter Two and some background information used on pages 6 & 13 has been published as a journal article [Gabora, L., O'Connor, B., & Ranjan, A. (2012). The recognizability of individual creative styles within and across domains. *Psychology of Aesthetics, Creativity, and the Arts*, 6(4), 351-360]. I have received permission to include the journal article in my dissertation from the first author and also have copyright permission from the publisher. I contributed to the experiment design, carried out most of the data collection, and incorporated background research into this article.

Table of Contents

Abstract.....	i
Preface.....	iii
Table of Contents	iv
List of Tables	viii
List of Figures.....	viii
Acknowledgements	ii
Dedication	iv
1 Introduction.....	1
1.1 Research goals	2
1.2 Terminology.....	3
1.3 Theories and Background	4
1.3.1 Domain Specificity and Domain Generality.....	7
1.3.2 The Generation of Creative Ideas	11
1.3.3 The Honing Theory of Creativity	15
1.4 Personal Signature	17
1.5 Cross-Domain Interpretation of Ideas	20
1.5.1 Synesthesia	24

1.5.2	Cross-media style.....	26
1.5.3	Common Coding.....	27
1.5.4	Cross-modal Perception.....	29
1.6	Thesis Outline.....	30
2	Individual Creative Style Within and Across Domains	33
2.1	Overview	33
2.2	Study One: The Within-Domain Recognizability of Artistic Styles	35
2.2.1	Method.....	35
2.2.2	Results	38
2.3	Study Two: The Within-Domain Recognizability of a Writer's "Voice"	41
2.3.1	Method.....	41
2.3.2	Results	43
2.4	Study Three: The Recognizability of Creative Styles across Domains.....	46
2.4.1	Method.....	46
2.4.2	Results	47
2.5	Discussion.....	50
3	Cross-Domain Interpretation of Ideas.....	56
3.1	Overview	56

3.1.1	Cross-domain, Cross-sensory and Cross-media Interpretation in Arts.....	59
3.1.2	The Psychological Experience of Perceiving Art.....	61
3.1.3	Cross-Domain interpretation of Ideas.....	63
3.2	Methods.....	67
3.2.1	Phase One.....	67
3.2.2	Phase Two.....	71
3.2.3	Analytic Methods.....	77
3.3	Analysis and Results.....	78
3.3.1	Identification Task.....	78
3.3.2	Similarity Ratings Task.....	98
3.3.3	Experiential Ratings Task.....	109
3.4	Discussion.....	122
3.4.1	Identification Task.....	122
3.4.2	Similarity Ratings Task.....	126
3.4.3	Experiential Ratings Task.....	127
3.4.4	Ratios.....	128
3.4.5	Summary of the Findings.....	130
4	Conclusion.....	134

4.1	Limitations.....	140
4.2	Suggestions for Future Research.....	141
	References.....	146
	Appendices.....	165
	Appendix A: Examples of non-painting artworks used in study three, Chapter Two	165
	Appendix B: Consent form, demographics, used in phase two, Chapter Three	169
	Appendix C: Design 1- Identification Task (Instruction and sample pages).....	171
	Appendix D: Design 2 - Identification Task (Instruction and sample pages).....	174
	Appendix E: Design 3 - Similarity Ratings Task (Instruction and sample pages).....	177
	Appendix F: Design 4 - Similarity Ratings Task (Instruction and sample pages)	182
	Appendix G: Design 5 - Identification Task (Instruction and sample pages).....	185
	Appendix H: Design 6 - Experiential Ratings Task (Instruction and sample pages).....	187
	Appendix G: List of terms used	192

List of Tables

<i>Table 2.1</i> Study 1: Mean Hit Rates, t-Test values, and r Effect Sizes for the Within-Domain Recognizability of Artistic Styles.	40
<i>Table 2.2</i> Study 2 Mean Hit Rates, t-Test values, and r Effect Sizes for the Within-Domain Recognizability of a Writer's "Voice" for Study 2.	45
<i>Table 2.3</i> Study 3: Mean Hit Rates, t-Test values, and r Effect Sizes for the Recognizability of Creative Styles across Domains.	49
<i>Table 3.1</i> List of Variables Used for Rating the Musical Pieces.	69
<i>Table 3.2</i> Summary of the Six Designs with the Tasks They Included.	73
<i>Table 3.3</i> Analyses for Individual Artists - Mean Hit Rates, t-Test values, r Effect Sizes, SD, and P values for the Identification task.	81
<i>Table 3.4</i> Guessing Frequencies for Design 1.	84
<i>Table 3.5</i> Proportion Correct Mean Hit Rate (H), Mean Values, r Effect Size, and p Values for Randomization for Identification of Paintings Inspired by Pieces of Music for Design 1.	85
<i>Table 3.6</i> Proportion Correct Mean Hit Rate (HU), Mean Values, r Effect Size, p Values for Randomization and d Effect Size for Identification of Paintings Inspired by Pieces of Music for Design 1.	86
<i>Table 3.7</i> Guessing Frequencies for Paintings of Artist 1 in Design 2.	89
<i>Table 3.8</i> Proportion Correct Mean Hit Rate (H), Mean Values, r Effect Size, and p Values for Randomization for Identification of Paintings Inspired by Pieces of Music for Artist 1 in Design 2.	89

<i>Table 3.9</i> Proportion Correct Mean Hit Rate (HU), Mean Values, r Effect Size, and p Values for Randomization for Identification of Paintings Inspired by Pieces of Music for Artist 1 in Design 2.	90
<i>Table 3.10</i> Guessing Frequencies or Paintings of Artist 2 in Design 2.	90
<i>Table 3.11</i> Proportion Correct Mean Hit Rate (H), Mean Values, r Effect Size, and p Values for Randomization for Identification of Paintings Inspired by Pieces of Music for Artist 2 in Design 2.	91
<i>Table 3.12</i> Proportion Correct Mean Hit Rate (Hu), Mean Values, r Effect Size, and p Values for Randomization for Identification of Paintings Inspired by Pieces of Music for Artist 2 in Design 2.	91
<i>Table 3.13</i> Guessing Frequencies for Paintings of Artist 3 in Design 2.	92
<i>Table 3.14</i> Proportion Correct Mean Hit Rate (H), Mean Values, r Effect Size, and p Values for Randomization for Identification of Paintings Inspired by Pieces of Music for Artist 3 in Design 2.	92
<i>Table 3.15</i> Proportion Correct Mean Hit Rate (Hu), Mean Values, r Effect Size, and p Values for Randomization for Identification of Paintings Inspired by Pieces of Music for Artist 3 in Design 2.	93
<i>Table 3.16</i> Guessing Frequencies for Design 5.	95
<i>Table 3.17</i> Proportion Correct Mean Hit Rate (H), Mean Values, r Effect Size, and p Values for Randomization for Identification of Paintings Inspired by Pieces of Music in Design 5.	96

<i>Table 3.18</i> Proportion Correct Mean Hit Rate (Hu), Mean Values, r Effect Size, and p Values for Randomization for Identification of Paintings Inspired by Pieces of Music in Design 5.	97
<i>Table 3.19</i> Means of the Similarity Ratings Derived From Design 3 and Design 4 for the Pairs of Paintings, Painting-Music and Pairs of Pieces of Music.	99
<i>Table 3.20</i> Intraclass Correlation Coefficients for Single Ratings and Average Ratings for the Design 3 and Design 4.	100
<i>Table 3.21</i> The Creative style effect Ratio, Cross-domain Interpretation Ratio based on mean similarity ratings and the MDS coordinates.	108
<i>Table 3.22</i> List of 35 Variables for Experiential Ratings (similar list was used for the paintings by substituting the word painting for music).	110
<i>Table 3.23</i> Intra-class Correlations for Single Ratings and Means for the Design Four Experiential Ratings of Paintings a1p1, a1p2, a1p3, a1p4, a2p1, a2p2 and Music m1, m2.	112
<i>Table 3.24</i> Intra-class Correlations for Single Ratings and Means for the Design Four Experiential Ratings of Paintings a2p3, a2p4, a3p1, a3p2, a3p3, a3p4 and Music m3, m4.	114
<i>Table 3.26</i> The creative Style Effect Ratio, Cross-domain Interpretation Effect Ratio based on Euclidean Distances and the MDS coordinates.	121

List of Figures

<i>Figure 3-1</i>	Euclidian distance display for the 35 pieces of music.	70
<i>Figure 3-2</i>	A 2-dimensional multidimensional scaling scatterplot based on the mean similarity ratings.	102
<i>Figure 3-3</i>	A 3-dimensional multidimensional scaling scatterplot based on the mean similarity ratings.	103
<i>Figure 3-4</i>	A 3-dimensional multidimensional scaling scatterplot based on the experiential ratings.	118

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Dedication

This work is dedicated to my parents, Jyotirmayi and Himanshu Ranjan.

1 Introduction

Human creativity is the engine of society's growth. Creativity has been viewed as difficult to approach, highly mysterious, and unpredictable. With the advent of experimental psychology, creativity began to be treated as not a supernatural gift but as a human, high-level cognitive process. Further research on fundamental cognitive processes, such as attention, perception, motivation, emotion, and self-concept, has paved the way for research on the creative process. Creativity has been defined as the ability to come up with ideas or artifacts that are new, surprising, and valuable (Boden, 2004). It has been regarded as the capacity to produce original, novel work that fits with particular task constraints (Lubart, 1994). Despite the wide range of definitions of creativity, there is an agreement among researchers that creativity is about novelty and usefulness (Mumford 2003).

Creation of something novel and useful involves an interaction between a personal urge to create, and a socio-cultural context (Csikszentmihalyi, 1999). The variety in forms of creative expression and the unpredictable nature of the factors (e.g., affect, intelligence, and motivation) that influence the creative process make creativity challenging to study. Also, it is difficult to understand the creative process because the various creative domains (such as music, geometry, legal systems, and so forth) are widely thought to employ their own symbolic elements, rules, and systems of notation. People who want to make a creative contribution and seek to express themselves creatively are often constrained by the rules and content of their chosen domain.

In order to grasp the rules and acquire the skills in any domain one needs to spend enough time working in that domain. It is rare that people are highly creative in more than one domain as it is difficult to invest sufficient time in multiple domains to learn the specific

skills. However, the greater the extent to which creativity is domain-general, the greater the extent to which ideas from one domain can yield potential solutions and sources of inspiration in other domains. Therefore, it is important to understand whether constraints on cross-domain creativity simply reflect a lack of time or effort, or whether these constraints are intrinsic to how knowledge is represented and accessed during the creative process. In order to understand to what extent creative ideas go beyond these constraints, the present project investigated two aspects in which the creative process may be domain-general: (1) an individual's creative style, and (2) the cross-domain interpretations of ideas. Specifically, a set of studies examined (1) the extent to which an individual's unique and personal creative style transcends different domains, and (2) the extent to which works in one domain (e.g., music) are translated into another domain (e.g., painting).

In this introduction, I will first outline the goals of the dissertation and the terminology used. Then, I will discuss the theoretical framework of this research, including the domain specificity and generality debate about creativity, relevant theories of creativity, and relevant background research. Finally, I will describe my two separate lines of research, and how each provides a unique perspective on the domain-generality issue.

1.1 Research goals

This dissertation examined two important aspects of the creative process. First, it investigated the extent to which individuals imbue their creative works with a personal style that is recognizable within and across domains. Second, it investigated to what extent ideas that have been re-interpreted across domains (e.g., from music to art) are recognizable. As part of investigating this second aspect of the creative process, I also studied (1) whether participants perceive connections between sources of inspiration and their inspired products,

and (2) whether participants perceive similarities between products created by the same artists. More specifically, the goals of this dissertation were:

1. To determine the extent to which (1) an artist's personal creative style was recognizable, and (2) this creative style was reflected in domains other than the domain of his or her expertise.
2. To determine the extent to which a musical stimulus, when interpreted as a painting, suggested visual themes with characteristics that were thought to be 'similar' to the original musical stimulus.
3. To determine whether participants' psychological experiences when viewing the paintings were similar to their psychological experiences when listening to the musical pieces that inspired the paintings.
4. To determine the extent to which a painting could simultaneously reflect both the musical stimulus that inspired it and the unique personal style of the painter.
5. To determine whether naïve participants were able to identify which works of art were inspired by which musical pieces.

1.2 Terminology

Creative style and *personal signature* are both terms that are used in the literature on creativity to refer to an individual's unique artistic style. Personal signature or creative style is generally difficult to hide even if a conscious effort is made. However, it may sometimes appear contrived and conscious. In this dissertation, the terms 'creative style' and 'personal signature' are used interchangeably. The focus is not on kinds or dimensions of creative style, or the personality traits associated with a creative approach to tasks, or the artistic style

of works created during particular epochs (*e.g.*, Romantic, Gothic, Renaissance, and so forth). What I am interested in and what I mean by creative style is the extent to which an individual's creative output exhibits an identifiable character. I do not address how creative style is expressed, or what makes it recognizable; I imagine that one's choice of techniques (*e.g.*, heavy brush strokes) and numerous subtler factors are involved. I focus on whether creative style or personal signature is recognizable. Another aspect of the creative process that will be addressed is the re-interpretation of creative ideas. Since this dissertation focuses on artistic creativity, the word *idea* can mean different things depending on which domain (*e.g.*, painting, sculpting, writing, *etc.*) we are talking about. The word 'idea' may refer to a concept that can be expressed in a number of ways, such as a general style of writing or painting, a musical composition, the theme of a dance composition, or even a method of producing artifacts (Boden, 2010).

1.3 Theories and Background

Creativity has been studied as a process, a desired outcome, and a personality characteristic. The creative process has been investigated from various perspectives (*e.g.*, personality, developmental antecedents) and in various fields (*e.g.*, in the arts, in science). Psychological research on creativity has been conducted to evaluate the creativity of products, to understand the cognitive process that underlies the creation of an artwork or a scientific product, to describe the characteristics of creative persons, and to understand the environmental variables that influence the creative process (Sternberg, 1995). There are different psychological methods developed to capture creativity for the purpose of evaluation. For example, (1) aesthetic preferences, such as preference of complex figures (Eysenck, 1994), (2) performance on cognitive tests, such as listing alternate uses for a brick

(McCrae, 1987), and (3) correlation with internal traits (e.g., openness to experience; Feist, 1998, Rogers 1959). These operational definitions of creativity are claimed to be like real-life production. In this dissertation, it is argued that the criteria for creativity should not focus on excellence in a field but on how creativity amends one's life and how one uses different avenues to express oneself in a meaningful way.

From the perspective of a creative individual, the purpose of creativity is often to explore hidden aspects of the self (Sternberg, 1985). Expressing oneself through some type of creative product authenticates one's existence in a unique way. These instances are called P-creativity, where P stands for personal (Boden, 1990). On rare occasions, the idea is new to human history. This is known as H-creativity, where H stands for historical (Boden, 1990). Note that H-creativity is ultimately an instance of P-creativity, because any idea that becomes historically recognized is a first-time occurrence in the creator's mind.

For an artist, the creation of an artwork can be a means of personal fulfillment (Ball, 2002; Gorelick, 2005). When an artist creates, the transformation that occurs on canvas or on the written page is mirrored by a potentially therapeutic sense of internal personal transformation and self-discovery (Cropley, 1990; Gabora & Merrifield, 2013, Maslow, 1971; May, 1976; Rogers, 1961; Singer, 2010). Sometimes creative products also appear to reflect the individual personality of the artist (Dudek & Marchand, 1983). The character of a creative output may be influenced by the creator's experiences, his or her knowledge base, and how he or she goes about interacting with those elements of experience and knowledge (Cropley, 1999; Feldhusen, 1995, 2002; Munford & Gustafson, 1988; Sternberg & Lubart, 1995). Hence, ideas from several domains could influence an individual's creativity in a

significant way. The creative idea, to some extent, remains domain-independent and has the potentiality to be expressed in a unique way by the individual.

Creativity has been regarded as emerging from the process of a combination of mental representations which on a superficial level might seem disconnected (Koestler, 1967; Boden, 2004). Many great creative thinkers, such as Einstein and Poincare, have described their insights as resulting from a combination of representations in different contexts (Mednick, 1962). A lot of scientific discoveries and artistic creativity in varied domains (i.e., physics, dance, and music) show combinations of many representations and conceptual structures and also provide evidence that an evolving idea inspires many products across domains. For example, the discovery of electromagnetism made possible the invention of the radio and this invention further influenced many other creative products, such as the telephone and television, etc. Over time, creative ideas adapt to human needs and tastes, form complex interconnected niches for each other, and thereby fuel cultural evolution (Gabora, 1997, 2008, 2013). Hence, the development of creative ideas may involve interactions and interpretations between two or more domains.

The evidence for interactions between domains is also suggested by a study that shows artistic products often share stylistic features when they are from the same genre and time period. Works created during particular epochs (i.e., Romantic, Gothic, Renaissance) exhibit repeated features that make the genre style distinctive and recognizable (Hasenpus, 1978). This aspect of artistic creativity is in line with research that shows that our imagination is constrained, and that creativity in any domain is dependent on existing conceptual structures (Ward, 1994, 2002; Pavlik, 2002; Cruz & Smedt, 2010). We can modify, stretch, extend, and refine diverse stimuli in the natural environment in order to fit a single concept into a new

situation (Ward, Smith & Vaid, 1997). Creativity is thought to involve exploration grounded in a predetermined style (Boden, 2010) using existing conceptual structures (Ward, 1994). For example, when participants were asked to draw an animal from another galaxy they tended to create an animal with a similar physical appearance to an existing animal. Their imagination seems to be structured by a particular set of properties that are characteristic of the existing category (Ward, 1994).

I posit that this ‘structured’ aspect of the imagination plays a role in the cross-domain interpretation of ideas. Creativity may not be a general attribute in the sense that one is likely to be an expert in multiple domains (i.e., a dancer is also a scientist), but it is domain-general in the sense that our creative cognition allows us to take an idea from a domain and through the process of personal interpretation, to express it in a new domain. Specifically, the essence of the content and emotional tone of particular experiences and/or ideas from particular domains may be retained and transformed when the idea is adapted to the constraints of other domains.

Creative expression is diverse; one useful framework for discussing it is to review the debate on whether it is domain-general or domain-specific.

1.3.1 Domain Specificity and Domain Generality

In what has been a longstanding discussion about whether creativity is domain-specific or domain-general, support for domain-specificity is provided by several studies (e.g. Baer, 1991, 1993, 1994a, 1994b, 1998, 1996; Brown, 1989; Ruscio, Whitney, & Amabile, 1998; Tardif & Sternberg, 1988). According to Amabile’s (1982, 1983, 1996) Consensual Assessment Technique, the tendency for expertise or eminence with respect to one creative endeavor is only rarely associated with expertise or eminence with respect to another creative

endeavor. For example, creative scientists rarely become famous artists or dancers. Leonardo da Vinci is one of very few polymaths. He was a scientist, creative artist and inventor. On the other hand, there are examples such as Stephen Hawkins, and many others, who are highly creative in just one domain. There is support for the domain-specificity of creativity based on the rarity of examples of success in multiple domains.

This lack of genius-level creative accomplishments in multiple domains can be explained in part by the “ten year rule” (Hayes, 1989), which is the finding that even highly talented, creative individuals require approximately a decade of preparation before they are capable of generating a creative product that brings them recognition. However, the above-mentioned evidence for domain-specificity is not limited to eminent creators but includes studies of typical research participants. In both cases, though, the focus is on talent, which is treated as unidimensional, as opposed to creative style, which is multidimensional. The underlying question in most previous research is ‘are individuals talented in multiple domains?’ which stands in contrast to the underlying question in this dissertation, which is ‘can individuals (and creative ideas themselves) use multiple domains to meaningfully develop and express themselves?’ When the question is worded the second way, domain-generalty may be the rule rather than the exception. That is, creative individuals might have recognizable personal signatures that extend well beyond their area of expertise into other creative arenas, as well as daily chores and hobbies, such as how they dress, decorate, or prepare food (Gabora, O’Connor & Ranjan, 2012). This hypothesis regarding whether personal signatures can manifest across multiple domains was tested as part of my dissertation, and the results are discussed in Chapter Two.

On the other hand, evidence for the domain-general theory is reported by Lubart and Guignard (2004), in studies involving self-report scales, creativity checklists, and other sorts of psychometric or personality data, which tend to support the view that creativity is domain-general (Hocevar, 1976; Kaufman, Cole, & Baer, 2009; Runco, 1987, 2005; Plucker, 1998). The relevance of the latter studies to the general versus specific debate has been questioned, because they do not actually measure creative outputs, but rather traits associated with the generation of creative output (Kaufman, Plucker, & Baer, 2008). However, cognitive reorganization and personality dynamics (e.g., wellbeing, self-discipline, or self-discovery) can be understood as the internal, less readily quantifiable, but equally significant counterparts to an external creative product.

Batey and Furnham (2006) reviewed models and approaches that intersect personality, creativity, and intelligence studies and provided a useful framework for understanding that the domain-general and domain-specific aspects of creativity are integrated. Theories that integrate domain-general and domain-specific aspects include Amabile's (1983, 1996) componential model, Kaufman and Baer's (2004) hierarchical model, and Eysenck's (1993) biologically inspired model. Eysenck distinguishes between originality as a dispositional trait or cognitive style, which he claims is general in its application, and exceptional achievement in a creative domain, which he claims is highly specific in its application. He posits that the dispositional trait of originality is one of many factors that are necessary for exceptional creative achievement.

Another model that proposes a middle ground between domain-specific and domain-general view is Plucker and Baghetto's (2004) model for development of domain-specificity. The model describes that a person gains domain-specific expertise with age and experience.

It also includes a domain-general trait, task commitment, which comes because of the creative interest of an individual. Task commitment is required in any domain and may further lead to domain-specificity in the area of interest in a particular domain. This model suggests that domain-specificity is due to one's choice that forces one to be domain-specific. When people become interested in a domain they have less time for other domains because they are cognitive misers.

Kaufman and Baer (2005) developed the Amusement Park Theoretical (APT) model that integrates domain-specific and domain-general views of creativity. This hierarchical model emphasizes some domain-general characteristics essential for being creative irrespective of the domain (e.g., motivation and base level of intelligence). Once those characteristics are there, one makes a personal choice for a particular domain to specialize in based on his or her interest. The analogy used is of an amusement park where one needs the tickets to enter, once the entry is made, one is exposed to several themes to choose from. These themes are analogical to the domains and micro-domains in real life. Working in the chosen domain based on one's interests will gradually lead to domain-specificity. Both these models (Plucker & Baghetto, 2004; Kaufman & Baer (2005) define creative products in terms of originality and usefulness. Most often the domain of the creative product, determines its originality and usefulness.

I find the distinction of originality is useful, at least as a first approximation, but the emphasis on the socially constructed yardstick of achievement presents problems. Many artists achieve success by generating variations on a successful theme instead of taking the risk of expressing themselves in an authentic and personally meaningful way, while others who do creatively express themselves in authentic and personally meaningful ways may go

unrecognized for some time. There are historical examples of creative geniuses who never achieved fame of any kind in their lifetimes, such as Emily Carr. Others may not have shared their creative work with anyone, and so remain unknown for good. Clearly, posthumous recognition does not transform an individual from being creative in an original, domain-general way to being creative in a successful, domain-specific way. Originality is an attribute of the person or product, and achievement is a measure of the social recognition of originality, skill, or both. Although it is unlikely that individuals will attain social recognition for achievements in multiple domains, individuals may be capable of fulfilling self-exploration and expression in multiple creative domains. The content and emotional elements of these explorations can be translated from one domain to another, a process that can be better explained by theories about the generation of creative ideas.

1.3.2 The Generation of Creative Ideas

The theory of generality in creativity suggests that creativity is a behavioral attribute that needs several factors for it to flourish. There are several factors that correlate with creative behavior, such as personality traits (e.g., openness to experience, McCrae, 1996; Feist, 1998), motivation (e.g., intrinsic motivation, Amabile, 1996), and cognitive abilities (e.g., associative thinking, Mendick, 1962). Although necessary, factors such as motivation and personality traits are not sufficient for creativity. Another important factor to consider when examining the theory of generality in creativity is the process of the generation of creative ideas. The focus here is whether ideas are to some extent domain-independent and to what extent the interpretation of ideas takes place across-domains. I will now focus on a few general theories that help us understand the process of the generation of creative ideas, i.e., how a full-fledged creative idea comes into existence.

General theories state that we should study creative people in general irrespective of their domain of expertise, rather than focusing on what leads to highly creative production in one or multiple domains. Here, the focus is on how one could use different avenues to express oneself. I will limit this discussion to three general theories of creativity that describe how humans generate creative ideas 1) creative cognition approach, 2) the Darwinian theory of creativity, and 3) Honing theory. These theories focus on the creative process and the significance of those external sources that might trigger creativity.

Many recent theories of creativity emphasize cognitive skills. They theorize that creativity is about how people think and hence mental processes are the essence of creativity. For example, the *creative cognition approach* (e.g., Finke, Ward, & Smith, 1992; Ward et al., 1999) draws heavily on research into creativity-relevant cognitive abilities, such as conceptual combination, associations, conceptual expansion, creative imagery, and metaphor. The “creative cognition” approach focuses on the cognitive processes that lead to creative output, but it does not involve assessment of talent. Central to this approach is the *Geneplore* (generate + explore) model, where creativity involves the formation of pre-inventive structures (i.e., early cognitive structures that are not well defined) for creative ideas in a *generative phase*. These pre-inventive structures may take the form of mental images, category exemplars, verbal combinations, schemas, *etc.* The generative phase is followed by an *exploratory phase*, which involves an interpretation of the pre-inventive structures. The exploratory phase involves processes, such as conceptual interpretation, functional inference, attribute finding, and hypothesis testing. These processes help determine whether the new idea is useful and whether it makes sense. Explorations that are successful may result in creative products. If exploration is not successful, the individual may return to the generative

phase. It is also suggested that when people have more domain knowledge, talent, and skill, they make quicker and wiser explorations, and hence produce more useful ideas (Finke, 1995).

A limitation of the creative cognition approach is that it fails to explain the process by which the pre-inventive structures transform into a full-fledged creative idea. Also, the creative cognition approach does not predict that creative individuals will develop a creative style or personal signature (although it could potentially be modified to do so). It also does not explain how individual differences play a role in different creative endeavors.

Another theory of creativity, the Darwinian Theory, proposes that new ideas are generated through “blind” variation and selective retention (BVSR) (Campbell, 1965; Simonton (1998, 1999a, b, 2010, 2011). Simonton views creativity as essentially a trial-and-error process in which the most promising “blindly” or randomly generated ideational variants are selected for development into a finished product. It is suggested that the role of expertise in the creative process is more to determine what variants are selected by excluding others. Expertise also helps individuals acquire “highly accurate and detailed internal representations of the external world” (Simonton, 2011, p. 162), which assists them in evaluating ideas. These two factors, the probability that certain ideas will be generated, and the expertise of the idea generator, are treated as independent variables. Unborn ideas are treated as concrete, well-defined entities.

This Darwinian theory provides some insight into how creative ideas arise, but it does not explain the psychological processes involved in the generation of an idea. According to Darwinian theory, the development of a creative idea is evolutionary. For example, out of six possible ideas, the artist would choose the most useful one. However, the attempt to apply

natural selection to creative thought has many limitations (Dasgupta, 2004; Eysenck, 1995; Gabora, 2005, Sternberg, 1998). Ideas are initially neither concrete nor well-defined; the Darwinian approach of selecting one idea out of many, based wholly on the criteria of utility, does not take into account the realities of the creative process. In short, during the creative process, most ideas are vague and unformed, and it is not initially possible to know how useful they will be. Most of the time, we refine an idea during the creative process, making it more tangible and well-defined.

The generation of an idea is influenced by the expertise of the idea generator. Ideas that evolve during creative processes are related to each other (Jaarsveld & Leeuwen, 2005) and in order to make an expert decision, it is important to establish a relationship between past and present situations (Klien, 1999). It has also been suggested that novices are less likely than experts to find solutions to problems, because the amount and quality of preparation, and the quality of the end product in a creative task (e.g., design), are related (Getzels & Csikszentmihalyi, 1976; Hayes, 1989a, 1989b). As well, the creative process may lead to multiple manifestations of a single core idea. More relevant to the present research, the possibility that creative styles should exist or be recognizable within and across creative domains is not clearly derivable from, or consistent with, the Darwinian framework.

My dissertation, in contrast to the Darwinian approach, suggests that there might not be a conscious selection process for concrete ideas because ideas are not concrete, independent entities. An individual's creative style may not necessarily reflect a conscious attempt to express style. Creative style may be a side effect of adapting cultural outputs to different needs, perspectives, and contexts, or it could be a reflection of a creator's idiosyncratic tastes and ideas. An ongoing research project, *Drawbots*, is investigating if one can actually remove

the personal signature of an artist (Brown, 2008). I investigated whether personal signatures are recognizable within and across the domains of expertise of the people.

The creative process involves not just accessing and combining knowledge, experiences and ideas, but also involves inspiration, translation and re-interpretation (Cropley, 1999; Feldhusen, 1995, 2002; Munford & Gustafson, 1988; Sternberg & Lubart, 1995). Components of a creative work may originate from oneself, from others with whom one has communicated directly or indirectly, or even from multiple individuals throughout the course of history, each of whom put their own interpretations to use. Inspiration may come from work in the same domain as the work it inspires (as when one popular dance move inspires an idea for another dance move). Alternatively, an idea may first be expressed by one individual in one domain, and subsequently be translated by someone else into another domain (as when a musical piece in one genre gets re-cast in another musical genre or even inspires a poem). These ideas are more fully supported by Honing theory (detailed below) than by the Darwinian and creative cognition theories.

1.3.3 The Honing Theory of Creativity

Honing Theory is a relatively new theory of creativity, which posits that creativity arises due to the self-organizing, self-mending nature of a worldview (Gabora, 2005). The term *worldview* refers to “an individual’s internal model of the world, as well as one’s values, attitudes, predispositions, and habitual patterns of response” (Gabora, 2008; Gabora & Aerts, 2009). The self-mending nature allows a worldview to reconcile and fill the gaps by resolving conflicts. It is posited that the creative process reflects the natural tendency of an individual to integrate his or her worldview with both its pre-existing and newly added components, including ideas, attitudes, or bits of knowledge. Unlike the Darwinian theory,

the external creative outcome and internal transformative effects of immersion in a creative task are viewed as flip sides of the same coin. That is, the creative product is viewed as the external manifestation of the internal cognitive restructuring and accompanying emotional shift that come about through engagement in a creative task. Each idea the creator comes up with is a different expression of his or her underlying core network of understandings, beliefs, and attitudes. Hence, initially the ideas cannot be concrete and distinct in nature as described in the Darwinian approach to creativity. A particular individual's worldview has a characteristic structure, and the creator's various outputs are different reflections of that structure. The creative process involves inspiration, translation, and interpretation of already existing ideas in order to come up with new ideas. Therefore, the outputs are related to one another, and potentially pave the way for one another. Also, since every individual has a unique worldview, that may provide a distinct style to his or her creations.

While, as we have seen, creativity can be portrayed as a process of generating, exploring, and selecting amongst candidate ideas that are assumed to exist in discrete, well-defined states, Honing theory suggests an alternative view. It proposes that creative individuals wrestle with ideas that are, for them, in a state of potentiality, meaning roughly that one or more elements are ill-defined (Gabora, 2005; Gabora & Saab, 2011). For example, an artist might wrestle with how to capture the feeling of a particular landscape, or a writer might wrestle with how events in an imaginary world would unfold. Over time, ideas that are in a state of potentiality become more fully actualized, or well defined, as they are considered from different perspectives in accordance with the constraints of their domain(s). In some instances a fully actualized idea is creative with respect to the creator's worldview. It should be noted that ultimately these instances of personal creativity in some cases might

become historically recognized, because any idea that becomes historically recognized is a first-time occurrence in the creator's worldview.

The hypothesis that an individual's creative style is recognizable not just within a domain but also across domains stems from the view that creativity is the process by which one both (1) integrates one's unique set of experiences into a cohesive understanding of reality, and (2) dynamically expresses this understanding of reality. The Honing Theory of creativity predicts that creative styles should exist and should be recognizable both within and across creative domains, since creative outputs are expressions of an underlying worldview or internal model of reality with a characteristic structure. Expertise in a creative domain indicates that one has become sufficiently well versed in it to use it as a vehicle for creative expression. Individuals, whose network of understandings is complex or unique, may be drawn to multiple avenues for self-expression.

I will investigate two aspects of the creative process: the recognizability of a personal signature within and across domains, and the interpretation of ideas from the domain of music to the domain of painting. I intend to demonstrate that those who appreciate the creator's work grasp at some level both the work and the ideas that inspired it, i.e., they glean the state of potentiality from which the work of art arose. Through examining the personal styles or signatures of creative works, we can get to know the uniqueness of the creator's worldview, and by examining cross-domain re-interpretations of a work of art we comprehend its underlying essence. This research is one of the first efforts I know of to study these two complex aspects of the creative process together in the laboratory.

1.4 Personal Signature

Personal signature was recognized as long ago as the beginning of the sixteenth century, when Giulio Mancini, an art collector and physician, held painting exhibitions in Rome, and there was disagreement about attribution of specific items (Ginzburg, 1992). Interest in personal signature then subsided until the nineteenth century. Many artworks had been gathered quickly in war-struck Europe without an effort to keep track of who created them. Many years later, personal signature was used to determine the identity of the artists of the largely anonymous artworks (Boden, 2010). Art connoisseurs insisted that art appreciators should become familiar with artists' personal creative styles. Different schools and artists were called upon to help attribute artifacts to one artist or another. Giovanni Morelli, an art historian and physician, was the first person to define the personal signature of an artist as the distinguishing features of the artist's work – “their manner of arranging drapery, the way they indicate light and shadow, the preference they give to pen and ink, or to black and red, etc.” (Boden, 2010). These clues were used to attribute artwork to the artists when the creators were unknown. It could be a deliberate effort on the part of the artist to self-advertise, akin to how directors, such as Alfred Hitchcock and Peter Jackson, played micro-parts in their own movies. However, it is easy to recognize the style of their movies, even without their brief appearances. So perhaps there is a deeper reason for personal signature than just self-advertising.

The concept of personal signature was popularized by art critics to distinguish between different artists within one school of art (Boden, 2004). An artist creates something, usually within the constraints of a culturally acceptable style, but there is always room for individual variation. An artist explores and creates a unique individual creation, constrained by the rules and tools of a particular genre. A work of art that does not fit current cultural norms and that

appears to be stylistically very different from other works of its time may not be perceived as a valuable creative contribution (e.g., Picasso's painting "Les Femmes d'Alger" was initially rejected but later became one of the most important paintings of the century). The artwork exhibits a personal artistic style that, while unintentional, nevertheless appears to be an intrinsic and indispensable element of the work (Boden, 2010). A recent study investigated whether if an individual's creative style is recognizable in one domain, it is recognizable, to a lesser degree, in other domains (Gabora, O'Connor, & Ranjan, 2012). This study is further discussed in detail in chapter two of this dissertation, which deals with personal creative style.

The recognizability of an artist's personal signature or creative style is a phenomenon that may seem obvious to artists themselves and to those who appreciate what they do, but psychologists have largely neglected the topic. Little empirical research is done on personal signature as a type of individual difference, and there is only one study that addresses the extent to which recurring stylistic features instill in the works an individual style that is reliably recognizable by others (Peretti, 1972). Moreover, as was discussed earlier in this chapter, the recognizability of creative styles is a phenomenon that is not consistent with, or predictable from, most theories of creativity.

Several studies (reviewed in Baer, 2010) have addressed a related but different question: whether an individual who is exceptionally talented in one creative domain is also exceptionally talented in other creative domains. By contrast, my research addresses the question of whether individuals exhibit not *talent* but *personal creative style* through multiple domains (Gabora, O'Connor, & Ranjan, 2012). We hypothesize that they do, based on the view that creative style is imparted by a core cognitive, personality structure that uses

creative domains as conduits for its expression. Thus, style is not expected to be unique to a given domain but to come through in other domains, including the micro-creative decisions involved in everyday life and interaction with others. Even if an individual is not exceptionally talented across domains, their personal style may come through across different domains.

Some scholars view creativity as an expression of human individuality (Runco, 2004; Gabora, 2005). It has been suggested that individual cultural style and unique *personal signature* is a result of information processing and the repeated use of mental schemas (Boden, 2010). Others emphasize that the artist's will is secondary to the art-making process he or she initiates. The artistic process imposes constraints that lead to other constraints, which lend a stylistic 'feel' to the artwork (Boden, 2010). It is possible that each creator develops a unique style that reflects their unique worldview, which is recognizable by others (Gabora, O'Connor, & Ranjan, 2012).

1.5 Cross-Domain Interpretation of Ideas

The re-interpretation of ideas is a common phenomenon that occurs in daily life as well as in artistic and scientific domains. Re-interpretation occurs when we get inspired by an experience in one domain and try to recreate that experience in another domain. In this section, I elaborate on the phenomenon of cross-domain interpretation in the arts and aesthetic appreciation. I discuss four related phenomena: synesthesia, cross-media style, common-coding, and cross-modal perceptions. These phenomena can provide insight into the mechanisms that underlie re-interpretation across sensory domains.

The Honing theory of creativity is in part inspired by artists' descriptions of their creative practices. There is a tradition in the arts of interpreting art from one medium (e.g.,

oil paint) into another (e.g., watercolor) and thereby coming to know its underlying essence. This creative process of interpretation across domains might involve articulating an idea that emerged in a state of potentiality, meaning that the idea is not yet actualized. We see this idea in practice through *ekphrastic* expression. In ekphrastic expression, artists attempt to have a more direct impact on an audience by translating one medium of art into another medium by capturing its essence or form. Correspondence between visual and musical arts became popular in the late nineteenth century. In some cases, musical terminology was used as titles for paintings, and in other cases music served as a direct inspiration for paintings (Zilczer, 1987). Modern day film composers attempt to compose music that conveys the emotional tone of the events portrayed in the film, thereby heightening the viewer's experience of these events.

These examples suggest that even though expertise, skills, and domain knowledge are crucial for creativity, it might be possible for creative individuals lacking domain knowledge to extract patterns of information from the constraints of the domains. Similar to ekphrasis, creative individuals may extract elements from the original domain of the source of inspiration, then interpret the original experience into a new product in another domain. While appreciating such art, a viewer might be able to perceive the connection between the source of inspiration and the inspired creative product. This connection may occur even if the source of inspiration and the new creative product are in different domains, (e.g., music and painting). It is possible because the artworks might have the same external influences (e.g., created in the same time period) and they can share abstract qualities, such as emotion and balance. Historically, there have been many examples of works in the visual arts that were highly influenced by specific pieces of music. Instances of cross-domain interactions and

influences can also be found in modern times. For example, the musical band Led Zeppelin cites the influence of Tolkien's *The Lord of the Rings* series on specific songs. Another present day example is Windows Media Player, which is designed to visually depict the music it is playing using disco-type lights reminiscent of a nightclub. In these instances, there appears to be an effort to facilitate or capitalize on cross-domain interactions that lead viewers to appreciate the re-interpreted idea in a new way.

There is a longstanding debate concerning whether it is possible to investigate art using scientific methods. Aesthetic perception stimulated by works of art may lead to complex psychological responses. These responses may be emotional, cognitive, behavioral, and/or physiological in nature. Works of arts possess considerable semantic complexity, making scientific investigation difficult (Becker, 1982; Luhmann, 2000). However, there have been major inroads into individual differences with respect to the kinds of artwork people prefer, the reasons for their aesthetic preferences, and whether their preferences correlate with personality variables (Child 1962, Child & Schwartz, 1966; Valentine, 1962; Hardiman & Zernich, 1977). This supports the tenet of Honing theory that creativity emerges from an individual's unique approach to understanding and operating in the world.

The field of empirical aesthetics began to expand in the late 19th Century, influenced by the work of Gustav Fechner, the father of experimental psychology. In the 1870s, his work on how art appeals to the senses became a starting point for empirical studies in aesthetics. This work also gave rise to the new experimental aesthetics approach by Berlyne (1974), who proposed a novel analytical approach to studying artwork. He extended the work based on structure and the grouping of elements in the perceived stimuli as proposed by the work of gestalt psychologists on the perception of stimulus. This approach concentrates on the many

attributes, elements, variables, and factors that influence aesthetic perception. Berlyne suggested that the *collative properties* of stimulus patterns can be defined as the subjective dimensions of “structural” or “formal” variables, such as familiar-novel, simple-complex, expected-surprising, and ambiguous-clear. His work has had a strong influence on other psychological studies of art appreciation (e.g., Cupchik, 1974; Martindale & Moore, 1988). Collative properties have been used as a basis for developing the emotional and arousal dimensions of art appreciation (e.g., Hagtvedt et al., 2008; Rowold, 2008). Furthermore, other studies have expanded on these variables to include a broader range in the dimensions of emotion and arousal. Berlyne’s empirical aesthetics research laid the ground for other studies that have focused on identifying the underlying dimensions of art appreciation (Silvia & Brown, 2007; Zentner, Grandjean, & Scherer, 2008).

Collative stimulus properties play a vital role in art appreciation. However, the overall impact of the work of art depends on how its elements are combined and arranged, and how its attributes interact with one another. In ekphrastic expression, or any other form of cross-domain interpretation of ideas in artistic domains, there might be some proportion of the collative variables that are transferred from the source of inspiration to the new artwork. My dissertation investigates whether people are able to identify the connections between the original piece of art (which functions as the inspiration for a new artistic product) and the new piece of art. As well, my dissertation asks the question “are the psychological experiences of viewing this painting similar to the psychological experiences of listening to this musical piece that inspired the painting?” The similarity of the psychological experiences is measured using a list of collative variables, as well as some other criteria.

The artistic creative process is not just a form of individual self-expression but it also involves significant cross-domain associations. People who are creative in one field will not necessarily transcend their creative ability in other domains. However, creativity is domain-independent in the sense that a creative idea in one domain can inspire a creation in another domain. To some extent, one needs to have domain-general interactions to make sense of the inspiration from other domain and to be able to meaningfully interpret the essence of the inspiration in one's own domain of expertise.

I will now discuss four phenomena—synesthesia, cross-media style, common-coding, and cross-modal perception—which although not directly related to the proposed research, may influence or play a role in the mechanisms that underlie interpretations across domains. Juxtaposing these phenomena helps us understand and perceive some similarities in the creative process involved in cross-domain interpretations of ideas.

1.5.1 Synesthesia

Synesthesia is a condition in which individuals have an extraordinary experience in response to ordinary sensory input. Some individuals naturally and spontaneously translate stimuli into another sensory domain; for example, seeing particular letters and numbers in particular colors (Ramachandran & Hubbard, 2001), or sounds that may evoke colors (Ginsberg, 1923). Synesthetes, people who regularly experience synesthesia on a daily basis throughout their lives, have a neurological condition in which the stimulation of one sensory or cognitive pathway leads to automatic, involuntary experiences in a second sensory or cognitive pathway (Cytowic, 1995). Synesthesia is relatively uncommon, being found in about 4% of the population (Simner, et al., 2006). Artists, poets, and novelists are more likely to be synesthetes, which suggests that the synesthetically driven re-interpretation of inputs

from one modality to another, may play some role in these creative domains (Ramachandran & Hubbard, 2003). There have been some well-known, clinically diagnosed synesthetes, including the composers Olivier Messian (Bernard, 1986) and Alexander Scriabin (Peacock, 1985), the author Valdimir Nabokov, the painter David Hockney, and the physicist Feynman.

It has been argued that synesthesia, which collapses the barrier between sensory domains, is much more common in artists, poets, and novelists, because of a potentially increased hyper-connectivity in their brains (Ramachandran, 2003). Indeed, in the creation of an artwork, they may simply be translating and interpreting their experience into something tangible. This experience may go beyond the domain in which they are creating; it may also go beyond the sensory organ required for expressing the creative idea. Thus, works of art might be understood as an interpretation or transformation of ideas into tangible products. These transformations may have been inspired by different and even unrecognized sources. Creativity is typically considered to emerge with random associations that are adaptive in some way. People with synesthesia have better communication amongst the brain regions that allow them to make associations; they more easily relate seemingly unrelated concepts and ideas (Ramachandran & Hubbard, 2003). Synesthetes may more frequently have a source of inspiration for certain creative acts (e.g. visual arts) because they have access to a different knowledge base due to their atypical experience and this atypical experience allows them to make more meaningful associations (Ward, et al., 2008). The thought process involved in synesthesia has been considered similar to analogical thinking (Wicker & Holahan, 1978), and metaphorical thinking (Osgood, 1953).

It has also been suggested that everyone is potentially capable of synesthesia as it is an integral and important part of childhood cognition, but this primitive mode of perception

ceases for most adults (Mark, 1975; Werner, 1948). These studies indicate that there is a correlation between the cognitive process involved in creativity and in synesthesia. Synesthesia could be seen as a metaphorical problem-solving style that facilitates the generation of solutions to problems depending on the perception of similarities amongst elements that are conceptually dissimilar (Mendick, 1962).

There are many historical examples of how translating ideas across domains plays a role in the creative process. For example, during the late 19th century, translating music into color became popular. Some art critics advocated musical analogy, and color music had its roots in the phenomenon of synesthesia. Artists started to believe that paintings could be analogous to music. The related concepts of musical analogy, synesthesia, and color music, which became popular in the 19th Century, had a significant influence on 20th Century art (Zilczer, 1987).

Cognitive processes, similar to those involved in synesthesia, might take place when people appreciate art. The process of art appreciation is partly dependent upon the observed stimulus and partly dependent on the human cognitive processes, that includes seeing, interpreting, feeling, and making associations (Krampen, 1996). In the case of inspired art, when appreciating an artwork that was created as a cross-domain interpretation (e.g., a musical piece inspiring a painting) the observer might perceive the similarities between the reinterpreted elements from one domain to another in order to recognize the source of inspiration for an artwork. The phenomenon of synesthesia is not further investigated in this dissertation but it was tested whether people are able to perceive connections between source of inspiration and a piece of art that it inspires; this study is discussed in chapter three.

1.5.2 Cross-media style

Another phenomenon, which is similar to the interpretation of ideas across domains, is *cross-media style*. This refers to an artistic style that can be demonstrated by works of art in more than one medium. For example, the term *rococo* is applied to the painting, sculpture, literature, and music of that period. Cross-media styles can also be considered “forms” that make the mind interested in certain processes or arrangements in a particular piece of art (Burke, 1957).

Support for the existence of cross-media style comes from evidence that works of art in different media are similar in terms of psychophysical, collative, and ecological properties (Hasenfus, 1978). There is also a pattern in the choices of elements (i.e., colors, shapes, words, instruments) made by the artist to create a novel piece of music, painting or writing (Berlyne, 1971). Relatively naïve observers were able to categorize the artworks based on both cross-media styles (i.e., Baroque, Neoclassic, and Romantic) and period styles (i.e., works composed by artists born during the same time period) in four different art mediums (Hasenfus, 1983). Based on the study, the one conclusion is that people are able to decode similarities amongst artworks that belong to the same period.

1.5.3 Common Coding

When we perceive any action, it is stored in the form of symbolic codes, and these codes are used by the motor system to generate actions. Common coding theory is based on the assumption that there is a perceptual event that the action produces or the symbolic representation of actions, i.e., a common code that connects three representations in our brain: motor representations, perceptual representations, and the covert activation of motor and perceptual representations that occurs when we imagine movements (Prinz, 1992). Perception and action rely on the same representations. Prinz has provided empirical support

for the hypothesis by showing that one of these movement representations can automatically trigger the other two.

In recent years, the development of common-coding theory has been proposed to explain the mechanism underlying recognition of one's own actions. When we observe events resulting from discrete actions (for example, a dance move, or someone playing the piano), analogous motor codes are activated in the observer. When these motor codes cross a certain threshold, they are able to connect with the actions stored in memory (Prinz, 1997). Common coding and action simulation hypotheses have been used to explain the recognition of one's own dynamic trace, such as one's characteristic way of moving the hands while playing the piano (Repp & Knoblich, 2004) and clapping (Falch, Knoblich & Prinz, 2004). The same action system is involved in the generation of an action and its subsequent perception; hence the activation of the action system should be greatest when one perceives one's own action (Greenwald, 1970). The evidence for effective perception of one's own actions has been studied through experiments. Repp (1987) asked participants who were familiar with each other to clap at a self-selected rate, and later asked them to recognize each other's clapping from the recording. The participants could identify their own clapping much better than the clapping of their acquaintances. Thus, one is better able to recognize one's own action identity, or personal signature, than those of others. A next step is to investigate the interpretation of ideas between domains, and the recognition of the individual artists' creative styles. This has yet to be investigated.

My dissertation focuses on the recognition of dynamic source domains from other people's static traces (e.g., paintings and writings). The common coding hypothesis could thus also at least partially account for the ability to recognize the essence of ideas interpreted

across domains, and the personal signature of the creator. Also, in order to recognize the inspiration of an artwork or cross-media style, expertise in a domain might increase activation of the action system while the observer imagines how the artwork got created.

1.5.4 Cross-modal Perception

Different senses often assist one another in perceiving objects and events. Aesthetic perceptions stimulated by creative works may generate emotional, cognitive, behavioral, and/or physiological responses that are amenable to re-expression in another form. This may arise in part due to regular pattern with respect to the choice of elements (i.e., colors, shapes, words) and/or how they are used, e.g., in an orderly or chaotic manner (Berlyne, 1971). There is evidence of non-arbitrary mapping between properties of vision and sound (Palmer & Griscom, 2013; Mark 1975, Melara, 1989; Melara, & Marks, 1990; Melara & O'Brien, 1987; Palmer, Langlois, Tsang, Schloss, & Levitin, 2011; Ward et al. 2006). For example, auditory features, such as pitch and timbre, affect the processing of some visual features, such as spatial frequency and lightness (Mark, 1987). The second part of the dissertation studies a similar but more complex process of auditory and visual interaction. It examines two major aspects of the cross-domain interpretation of ideas. Firstly, I investigate whether, when an artistic work in one domain inspires creation in another, this new creation can be traced back to the creative work that inspired it (i.e., a painting inspired by a piece of music). Secondly, I examine to what extent people perceive a connection between the art appreciation experience of a newly created artwork and the original source that inspired it.

The summary of the four phenomena discussed in this section: (1) synesthesia involves the ability to do cross-sensory translations, (2) cross-media style is a distinct style that is evident across mediums (e.g., architecture, paintings, clothes etc.), (3) cross-modal

perception involves interaction between two sensory modalities, and (4) common coding theory suggests the interaction between the systems for action and perception. The four phenomena discussed above are not the focus of this dissertation, however, they shed light on the mechanisms underlying domain-general interactions and interpretations.

Cross-domain interaction in the creative process can range from precise to general. Sometimes, when a creative process in one domain is inspired by a work in another domain, there may be minimal blatant evidence of the original source in the new product. In other cases, the artist might actually aim for a close cross-domain mapping and/or translation of the original idea or product to the new creation. Yet on other occasions, there may be shades of both the precise translation for some elements, and the general influence of the source of inspiration reflected in other elements of the new product. Cross-domain interaction may also be contingent on the specific domains that are interacting; for example, in history, there are more instances of music-influenced visual artists than music-influenced writers.

1.6 Thesis Outline

This dissertation draws on elements of domain-generality to suggest that one could express oneself in more than one domain, not necessarily at the level of talent, as has been previously researched, but at the level of personally meaningful self-expression. Any creative product generated by a particular individual is a reflection of that individual's particular worldview, or understanding of and approach to life. The resulting product is therefore imbued with a stamp or personal signature of the creator's worldview. However, the uniqueness of a creative work partly reflects the unique creative style of the creator, but not completely. I wanted to know what factors, other than creative style, give rise to the uniqueness of a creative work. I hypothesized that in addition to the creator's personal style,

a creative work is affected by the inspirational source of the work. This dissertation also investigated the recognizability of the inspirational source in creative acts that involve the cross-domain interpretation of ideas. It is difficult to know every factor that played an inspirational role in a given creative work. However, in cases where the inspiration is a work of art in another domain, the role of the inspirational source is more straightforward and amenable to investigation.

My dissertation consists of two sets of studies that focus on cross-domain aspects of the creative process. The first set of studies, presented in Chapter Two, investigated whether the personal signatures of artists are reflected in the domains of their expertise and also across different domains. Creative writing and fine art students participated in these studies. I examined whether the creative process is domain general, not in the sense that creators, who excel in one domain excel in another, but in the sense that their personal creative signature might be reflected not just in the creator's primary domain but also in another domain.

The second study, presented in Chapter Three, investigated the cross-domain interpretation of ideas, where three visual artists were asked to create paintings illustrating their interpretations of pieces of music. This study was a follow-up to the studies described in Chapter Two. This second study examined (1) whether the creative styles of the artists are reflected in their paintings, when their paintings are inspired by specific pieces of music; (2) whether the essence of an idea from the source of inspiration is reflected across-domains (i.e. music to painting) and is recognizable; (3) whether the participants perceive similarities when listening to musical pieces, and when viewing the inspired paintings; and (4) whether the participants have similar psychological experiences when listening to musical pieces and when viewing the inspired paintings.

Chapter Four summarizes the conclusions of my dissertation regarding the two ways in which creativity could be domain general. First, the creator's personal creative style may be reflected in various domains of his or her expression, even though he or she may not be equally talented in several domains. Second, during the cross-domain interpretation of a creative idea, the essence of a creative idea may be transferred from the source of inspiration to the new product to a greater or lesser extent.

2 Individual Creative Style Within and Across Domains

2.1 Overview

This chapter investigates two hypotheses concerning personal signature or creative style. The first hypothesis is that creative style is a genuine construct, and that an individual's creative style is recognizable by others. The recognizability of creative styles is a phenomenon that may seem obvious to artists themselves and to those who appreciate what they do, but psychologists have largely neglected the topic. In order to understand the nature of artistic and other forms of creativity, it is essential to ask the question why personal creative styles exist (Boden, 2010). It has been shown that collections of art by a particular artist possess specific recurring stylistic features (Berlyne, 1971). However, there is little empirical, academic literature on this form of individual differences, and none that I know of that addresses the extent to which recurring stylistic features instill in the works an individual style that is reliably recognizable by others.

The second hypothesis investigated is that if an individual's creative style is recognizable in one domain, it should be recognizable, to a lesser degree, in one or more other domains. Several studies (reviewed in Baer, 2010) have addressed a related but different question: whether an individual who is talented in one creative domain is talented in other creative domains. The hypothesis that individuals exhibit not talent but personal creative style through multiple domains is derived from the view that creative style is imparted by a core cognitive / personality structure that uses creative domains as conduits for its expression. Thus, style is not expected to be unique to a given domain but to come

through in other domains, including the micro-creative decisions involved in everyday life and interaction with others.

The expression of personal creative style in the arts is a form of exploratory creativity. The artist embraces a culturally acceptable style, or conceptual space, and works within its rules/constraints to generate new structures (Boden, 2004). The predetermined style of a domain is a set of rules, guidelines, and/or culturally transmitted skill set that constrains the artist's work in an open-ended way and is therefore embedded in his/her creations. There are examples in history where the rules were broken or if the artist's idiosyncrasies outweighed the stylistic virtues and consequently viewers did not accept the creative product. Context and cultural values play an important role in the evaluation process of a creative product (Sternberg & Lubart, 1991, Simonton, 1984). Rule-breaking art or extremely idiosyncratic expression is so stylistically different that it is sometimes not appreciated. This assessment may be temporary; for example, Picasso's colleagues and friends initially rejected the painting *Les Femmes d'Alger* but later it became one of the most important paintings of the century. It is sometimes a challenge to maintain personal creative style and yet ground creative expression in the predetermined style of the period, genre, or domain.

Central to the view of creativity that inspired the studies reported in this chapter is the notion of a *worldview*. I use the term worldview in a broadly encompassing way that incorporates one's understanding of, perspective on, and feelings about one's reality. It has been posited that creativity arises due to the self-organizing, self-mending nature of a worldview (Gabora, under revision). Through the creative process, one both (1) assimilates experiences into a more cohesive worldview, and (2) expresses or manifests this worldview.

Thus this notion of worldview emphasizes the internal cognitive and emotional restructuring brought about by the creative process and its impact on the individual. Since the raw experiences one has are to a degree unique, and there are individual differences in the manner in which individuals assimilate and express their experiences, a worldview is expected to develop a characteristic structure, and the creator's outputs are different expressions of that structure. Therefore, creative outputs are typically related to one another because they are different expressions of one's worldview, and potentially pave the way for one another. Thus the view that creativity involves mending and redefining one's unique cognitive / personality structure leads to the hypothesis that creative styles not only exist but are recognizable, within a domain and across domains.

2.2 Study One: The Within-Domain Recognizability of Artistic Styles

The first study tested the hypothesis that individuals who are familiar with the art of a given artist (*e.g.*, paintings or other visual artworks) will recognize other works of art by that artist that they have not encountered before.

2.2.1 Method

2.2.1.1 Participants

The participants were 39 undergraduate fine arts majors at The University of British Columbia. They were divided into three groups of consisting of 10, 14, and 15 students, respectively. The members of each group had been taking a studio art class together for at least one month in which they interacted extensively and engaged in both group and one-on-one discussions of their art. All students claimed to be highly familiar with the art of the

other students within their group. They also claimed to be highly familiar with five well-known artists.

2.2.1.2 Materials and procedure

The participants were presented with two sets of paintings. For the first set, they were first shown three well-known paintings by each of five well-known artists as a refresher: Picasso, Monet, Van Gogh, Dali, and Andy Warhol. These artists were chosen because previous discussion with the students indicated that they were all familiar with these artists, but they each had a body of work that was large enough that we could find works the students would be highly unlikely to have encountered. The teachers also confirmed that the students had learned about the artists in class. So as not to bias the students' perceptions of the artists' styles with our own observations about their styles, there was no discussion with the students at any point about the particular styles of these artists. No paintings by artists other than these five were shown (i.e., no 'fillers'). The students were then shown ten unfamiliar works from the five artists – two by each artist – that they had not studied in class. The participants were told that there might be several paintings by one artist and none by another; each painting had an equal chance of being done by each artist. There was no discussion with the students either before or during the study about the particular styles of these artists.

For the second set, the participants were shown paintings by their fellow students that they had never seen before. Again, they were not told that there would be one painting by each classmate; each painting had an equal chance of being done by each classmate. The data for the three groups were kept separate for all of the analyses, including the analyses of the famous artists' data. This was done for two reasons: (1) it would be less confusing to readers

than a mixture of collapsed and non-collapsed findings for the groups, and (2) the findings for separate groups could provide evidence for the replicability of the data patterns across groups of respondents. (This practice was also used in Studies 2 and 3).

A black bar covered the signatures on all of the artworks. The participants were given a questionnaire that asked them to guess which famous artists were responsible for the paintings in the first set, and which classmates were responsible for the paintings in the second set. For each answer, they were also asked to state whether it was possible that they had encountered the work before. If this was the case, their data was discarded from the analyses. The percentage of guesses that were discarded for this reason ranged between 18% and 36% for the three groups.

2.2.1.3 Analytical Methods

For each set of paintings (*i.e.*, for paintings by famous artists and for paintings by fellow students), two hit rate statistics were computed for each participant. The first was the simple hit rate, H , which is the proportion of correct guesses. Although intuitively meaningful, simple hit rates should be corrected for chance guessing and for response bias, such as the tendency to use particular response categories more or less than other response categories. The unbiased hit rate, H_u , corrects for both problems (Wagner, 1993). The H_u statistic is based on analytic methods from signal detection theory and involves the creation of a confusion matrix for each respondent, from which the H_u statistic is derived. For the present studies, we report both the mean simple hit rates (H) and the mean unbiased hit rates (H_u).

A data randomization procedure (Edgington, 1995; Good, 2005; Manly, 2007) was then used to assess the statistical significance of the mean H and H_u values. Specifically, for

each set of paintings, each participant's guesses were randomly rearranged 1000 times, and the H and Hu values were computed for each random data trial. The significance level was the proportion of trials that yielded H (or Hu) values greater than or equal to the H (or Hu) values for the real, non-randomized data. The mean H and Hu values for the random data sets were also used as the H and Hu values that would be expected on the basis of chance. These values served as the reference points for regular, parametric one-sample t-tests. Although there were slight differences in the p values for the data randomization and t-test procedures, the pattern of significant and non-significant findings was identical for the two kinds of significance tests for all three studies described in this article. The r correlation coefficient equivalent effect size for each t value was computed following Rosenthal and Rosnow (1991).

Multilevel modeling was used to assess the mean H and Hu values for the pooled data from the three groups. As described above, the 39 participants were divided into groups of 10, 14, and 15 for the second set of paintings (by classmates). When individuals are nested within groups in this way, their responses are potentially interdependent, and adjustments must be made for the statistical interdependence whenever data from different groups are pooled (de Leeuw & Meijer, 2008). An intercept-only mixed-effects model, using the nlme package in R, was used to obtain the adjusted mean H and Hu values (i.e., the intercepts and their significance tests) for the pooled data.

2.2.2 Results

2.2.2.1 Recognition of works by famous artists

The results for the within-domain recognizability of artistic styles are presented in Table 2.1. For the first group, the mean hit rates regarding which famous artist was responsible for which painting were $H = .79$ and $H_u = .75$. The mean hit rates that would have been obtained on the basis of random guesses for these questions were .20 and .14, respectively. Both hit rates were statistically significant, and the r effect sizes were large, .98 and .98. For the second group, the mean hit rates were high, $H = .76$ and $H_u = .68$, statistically significant, and the effect sizes were large, $r = .97$ and $r = .95$. For the third group, the mean hit rates were high, $H = .74$ and $H_u = .64$, statistically significant, and the effect sizes were large, $r = .98$ and $r = .95$. The pooled data hit rates were $H = .76$ and $H_u = .69$, both of which were statistically significant. The art students were thus able to indicate, at above-chance levels, which famous artists created which pieces of art that they had not seen before.

2.2.2.2 Recognition of artworks by classmates

For the first group, the mean hit rates regarding which classmate was responsible for which painting were $H = .71$ and $H_u = .80$, both of which were statistically significant with large effect sizes, $r = .91$ and $r = .94$. Similar findings emerged for the second group (mean $H = .60$, mean $H_u = .65$, with $r = .81$ and $r = .81$) and for the third group (mean $H = .33$, mean $H_u = .55$, with $r = .86$ and $r = .83$). The pooled data hit rates were $H = .55$ and $H_u = .66$, both of which were statistically significant. The art students thus also identified their classmates' art at above-chance levels.

Table 2.1 Study 1: Mean Hit Rates, t-Test values, and r Effect Sizes for the Within-Domain Recognizability of Artistic Styles.

	Mean Hit Rate	Chance Hit Rate	t (df)	r Effect Size
Art Students Recognition of Artworks By Famous Artists:				
Group 1 Hit Rate (<i>H</i>)	0.79	0.20	13.1 (9)	0.98
Group 1 Unbiased Hit Rate (<i>Hu</i>)	0.75	0.14	14.3 (9)	0.98
Group 2 Hit Rate (<i>H</i>)	0.76	0.20	15.2 (13)	0.97
Group 2 Unbiased Hit Rate (<i>Hu</i>)	0.68	0.16	10.7 (13)	0.95
Group 3 Hit Rate (<i>H</i>)	0.74	0.20	18.5 (14)	0.98
Group 3 Unbiased Hit Rate (<i>Hu</i>)	0.64	0.12	12.4 (14)	0.96
Pooled Data Hit Rate (<i>H</i>)	0.76	0.20	27.4 (35)	0.98
Pooled Data Unbiased Hit Rate (<i>Hu</i>)	0.69	0.14	18.1 (35)	0.95
Art Students Recognition of Artworks By Classmates:				
Group 1 Hit Rate (<i>H</i>)	0.71	0.10	6.5 (9)	0.91
Group 1 Unbiased Hit Rate (<i>Hu</i>)	0.80	0.17	8.2 (9)	0.94
Group 2 Hit Rate (<i>H</i>)	0.60	0.17	5.0 (13)	0.81
Group 2 Unbiased Hit Rate (<i>Hu</i>)	0.65	0.21	4.9 (13)	0.81
Group 3 Hit Rate (<i>H</i>)	0.33	0.07	6.2 (14)	0.86
Group 3 Unbiased Hit Rate (<i>Hu</i>)	0.55	0.11	5.6 (14)	0.83
Pooled Data Hit Rate (<i>H</i>)	0.55	0.11	3.8 (35)	0.54
Pooled Data Unbiased Hit Rate (<i>Hu</i>)	0.66	0.16	7.2 (35)	0.77

Note. $p < .05$ for all mean hit rates and t values.

2.3 Study Two: The Within-Domain Recognizability of a Writer's "Voice"

The second study tested the hypothesis that individuals who are familiar with the works of particular writers will recognize other works by those writers that they have not encountered before.

2.3.1 Method

2.3.1.1 Participants

The participants were 29 creative writing students who were familiar with five well-known writers and with each other's writing.

2.3.1.2 Materials and procedures

The procedure for the writers study was similar to the procedure described above for Study 1. Two sets of writings were presented to the participants. For the first set, they were first given three well-known written passages by each of ten well-known writers as a refresher. The well-known writers were Ernest Hemingway, Douglas Coupland, Emily Dickinson, Walt Whitman, Allen Ginsburg, Jack Kerouac, T.S. Eliot, Jane Austen, George Orwell, and Franz Kafka. These writers were chosen because previous discussion with the participants indicated that all students were familiar with these writers. We chose passages that were characteristic of the author's style without containing any obviously identifying information. The word limit of the written passages ranged from 50 to 150 words. Passages with proper nouns were included only if the proper noun was not associated with the author

and not revealing of the author's identity (such as the name Amy). To illustrate, the refresher passage for Emily Dickinson was as follows:

“You ask of my companions. Hills, sir, and the sundown, and a dog large as myself, that my father bought me. They are better than beings because they know, but do not tell; and the noise in the pool at noon excels my piano. I have a brother and sister; my mother does not care for thought, and father, too busy with his briefs to notice what we do. He buys me many books, but begs me not to read them, because he fears they joggle the mind. They are religious, except me, and address an eclipse, every morning, whom they call their "Father." (Dickinson, p. 254).”

There was no discussion with the students either before or during the study about the particular styles of these writers. The participants were then shown twenty rare passages – two from each of the ten famous writers – that they had not studied in class. To illustrate, the rare passage for Ernest Hemmingway was as follows:

“He was a very complicated man compounded of absolute courage, all the good human weaknesses and a strangely subtle and very critical understanding of people. He was completely dedicated to his family and his home and he loved more to live away from them.” (Hemmingway, 1999, p. 1).

The participants were told that there might be two by one writer and none by another; each passage had an equal chance of being written by each writer. Passages were chosen in such a way as to avoid proper nouns that would be associated with a particular writer.

For the second set, the participants were shown a piece of writing by each of their fellow classmates that they had never seen before. Again, they were told that each piece of writing had an equal chance of being done by each classmate. In order to make sure that

participants were familiar with each other's work, the 29 participants were divided into groups of eight, seven, six, and eight for the second set of writings. We requested that students avoid proper nouns and any identifying information in their passages. The participants were given a questionnaire that asked them to guess which famous writers were responsible for the writings in the first set, and which classmates were responsible for the writings in the second set. For each answer, they were also asked to state whether they might have encountered the passage before. Whenever this was the case, their data were discarded from the analyses. The percentage of guesses that were discarded for this reason ranged between 2% and 14% for the four groups. The analytic methods for Study 2 were the same as those used for Study 1.

2.3.2 Results

2.3.2.1 Recognition of writings by famous writers

The results for the within-domain recognizability of a writer's "voice" are presented in Table 2.2. Similar results were obtained for the four groups of participants in their attempts to identify passages of text written by famous writers. They are easily summarized. The simple hit rate values, H , ranged between .31 and .41. The unbiased hit rates, H_u , ranged between .22 and .43. All of the hit rates were well above their corresponding chance hit rates and were statistically significant. The r effect sizes were all large, ranging between .82 and .94. The pooled data hit rates were $H = .37$ and $H_u = .29$, both of which were statistically significant. The creative writing students thus identified, at above-chance levels, the authors of passages of text written by famous writers that they had not encountered before.

2.3.2.2 Recognition of writings by classmates

Similar results were obtained for passages written by the four groups of the students themselves. The simple hit rate values, H , ranged between .32 and .67. The unbiased hit rates, H_u , ranged between .23 and .67. All of the hit rates were well above their corresponding chance hit rates and were statistically significant, and the r effect sizes were substantial, ranging between .47 and .86. The pooled data hit rates were $H = .41$ and $H_u = .41$, both of which were statistically significant. Thus the creative writing students also identified, at above-chance levels, passages of text written by their classmates that they had not read before.

Table 2.2 Study 2 Mean Hit Rates, t-Test values, and r Effect Sizes for the Within-Domain Recognizability of a Writer's "Voice" for Study 2.

	Mean Hit Rate	Chance Hit Rate	<i>t</i> (<i>df</i>)	<i>r</i> Effect Size
Writing Students Recognition of Text By Famous Writers:				
Group 1 Hit Rate (<i>H</i>)	0.31	0.10	7.4 (7)	0.94
Group 1 Unbiased Hit Rate (<i>Hu</i>)	0.22	0.06	4.9 (7)	0.88
Group 2 Hit Rate (<i>H</i>)	0.34	0.10	4.8 (6)	0.89
Group 2 Unbiased Hit Rate (<i>Hu</i>)	0.22	0.06	3.9 (6)	0.85
Group 3 Hit Rate (<i>H</i>)	0.40	0.10	4.7 (5)	0.90
Group 3 Unbiased Hit Rate (<i>Hu</i>)	0.28	0.05	3.7 (5)	0.86
Group 4 Hit Rate (<i>H</i>)	0.41	0.10	4.2 (7)	0.85
Group 4 Unbiased Hit Rate (<i>Hu</i>)	0.43	0.11	3.8 (7)	0.82
Pooled Data Hit Rate (<i>H</i>)	0.37	0.10	9.5 (24)	0.89
Pooled Data Unbiased Hit Rate (<i>Hu</i>)	0.29	0.07	4.2 (24)	0.65
Writing Students Recognition of Text By Classmates:				
Group 1 Hit Rate (<i>H</i>)	0.32	0.13	4.0 (7)	0.83
Group 1 Unbiased Hit Rate (<i>Hu</i>)	0.23	0.07	4.4 (7)	0.86
Group 2 Hit Rate (<i>H</i>)	0.33	0.14	3.0 (6)	0.78
Group 2 Unbiased Hit Rate (<i>Hu</i>)	0.37	0.17	3.2 (6)	0.79
Group 3 Hit Rate (<i>H</i>)	0.67	0.34	2.2 (5)	0.70
Group 3 Unbiased Hit Rate (<i>Hu</i>)	0.67	0.36	2.0 (5)	0.67
Group 4 Hit Rate (<i>H</i>)	0.34	0.13	1.7 (7)	0.55
Group 4 Unbiased Hit Rate (<i>Hu</i>)	0.41	0.19	1.4 (7)	0.47
Pooled Data Hit Rate (<i>H</i>)	0.41	0.17	2.9 (24)	0.51
Pooled Data Unbiased Hit Rate (<i>Hu</i>)	0.41	0.19	2.6 (18)	0.47

Note. $p < .05$ for all mean hit rates and *t* values.

2.4 Study Three: The Recognizability of Creative Styles across Domains

Our third study tested the hypothesis that familiarity with an individual's creative work in one domain aids the recognition of that individual's creative work in another domain.

2.4.1 Method

2.4.1.1 Participants

There were six sets of participants in Study 3. The first four sets (Ns = 7, 7, 6, & 8) consisted of undergraduate students in different sections of an advanced creative writing class. The two remaining sets of participants (Ns = 13 & 15) consisted of undergraduates majoring in art.

2.4.1.2 Materials and procedure

The creative writing students were asked to submit one or more piece of covered, unsigned art prior to the study. They were explicitly asked not to submit art with anything that would obviously identify them as the artist. (For instance, in one class, following the suggestion of the professor of that class, the example was given that a particular member of the class who was obsessed with surfing should not give any indication of that obsession.) The creative writing students were familiar with each other's writing, but not with each other's artwork. The artworks were brought to a subsequent meeting of the class and the students were shown the unsigned art done by their classmates.

The art students were asked to submit one or more non-painting artwork prior to the study. The art students were familiar with each other's paintings, but not with each other's

non-painting artworks. The non-painting artworks they submitted included poetry, a scarf, a clay pot, a jute wall-hanging, a photograph, and a stuffed toy.

The instructor of the class brought all of the artworks to class and the students were shown the unsigned art done by their classmates. The participants were given a questionnaire and asked to guess which classmate did which piece of art. For each answer, they were also asked to state whether it was possible that they had encountered the work before. Whenever this was the case their data was discarded from the analyses. The percentages of guesses that were discarded for this reason ranged between zero% and 19% for the six groups. The analytic methods for Study 3 were the same as those used for Study 1.

2.4.2 Results

2.4.2.1 Creative writing students' recognition of artworks by classmates

The results for the recognizability of creative styles across domains are presented in Table 2.3. There was some variation in the findings across the four groups, with the results for Group 1 and Group 3 being very similar and statistically significant, which was in contrast with positive but non-significant results for Group 2 and Group 4. Specifically, for Groups 1 and 3, the H and H_u values ranged between .59 and .74, they were statistically significant at the .05 level, and the r effect sizes ranged between .76 and .81. For Groups 2 and 4, the hit rates were notably lower ($H = .22$ and $H_u = .24$ for Group 2; and $H = .19$ and $H_u = .25$ for Group 4), non-significant at the .05 level, and the effect sizes were weaker (.33 and .20 for Group 2, and .38 and .33 for Group 4). However, the pooled data hit rates, $H = .43$ and $H_u = .48$, were both statistically significant. The findings thus provide mixed evidence at the group level, but clear evidence at the pooled data level, that creative writing

students can identify, at above-chance levels, which of their classmates created a given work in a domain other than writing.

2.4.2.2 Arts students' recognition of non-painting artworks

For Group 1, the mean hit rates were $H = .53$ and $H_u = .64$, and the hit rates that would have been obtained on the basis of random guesses were $H = .16$ and $H_u = .21$. Both mean hit rates were statistically significant, and the r effect sizes were large, $.71$ and $.77$. Similarly, for Group 2 the hit rates were $.36$ and $.73$, both of which were statistically significant, and the effect sizes were $.78$ and $.84$. The pooled data hit rates were $H = .44$ and $H_u = .69$, both of which were statistically significant. Thus the art students were thus able to identify, at above-chance levels, which of their classmates created a given work in a domain other than painting.

Table 2.3 Study 3: Mean Hit Rates, t-Test values, and r Effect Sizes for the Recognizability of Creative Styles across Domains.

	Mean Hit Rate	Chance Hit Rate	t (df)	r Effect Size
Writing Students Recognition of Art By Classmates:				
Group 1 Hit Rate (H)	0.59	0.17	3.2 (6)	0.80
Group 1 Unbiased Hit Rate (Hu)	0.70	0.22	3.4 (6)	0.81
Group 2 Hit Rate (H)	0.22	0.16	0.9* (6)	0.33
Group 2 Unbiased Hit Rate (Hu)	0.24	0.20	0.5* (6)	0.20
Group 3 Hit Rate (H)	0.72	0.34	2.9 (5)	0.79
Group 3 Unbiased Hit Rate (Hu)	0.74	0.39	2.6 (5)	0.76
Group 4 Hit Rate (H)	0.19	0.13	1.1* (7)	0.38
Group 4 Unbiased Hit Rate (Hu)	0.25	0.19	0.9* (7)	0.33
Pooled Data Hit Rate (H)	0.43	0.19	1.8 (23)	0.35
Pooled Data Unbiased Hit Rate (Hu)	0.48	0.24	1.8 (23)	0.34
Art Students Recognition of Non-Painting Works By Classmates:				
Group 1 Hit Rate (H)	0.53	0.16	3.5 (12)	0.71
Group 1 Unbiased Hit Rate (Hu)	0.64	0.21	4.0 (12)	0.77
Group 2 Hit Rate (H)	0.36	0.08	4.6 (14)	0.78
Group 2 Unbiased Hit Rate (Hu)	0.73	0.19	5.8 (14)	0.84
Pooled Data Hit Rate (H)	0.44	0.12	3.9 (25)	0.61
Pooled Data Unbiased Hit Rate (Hu)	0.69	0.20	6.9 (25)	0.82

2.5 Discussion

The results support the hypothesis that creative individuals have a distinctive style or ‘voice’ that is recognizable both within and across creative domains. Art students were able to identify at above-chance levels, which famous artists created which pieces of art they had not seen before. They also identified their classmates’ art at above-chance levels. Similarly, creative writing students were able to identify, at above-chance levels, passages of text written by famous writers that they had not encountered before, and passages of text written by their classmates that they had not encountered before. Furthermore, creative writing students were generally able to identify works of art produced by classmates that they had not seen before, and art students who were familiar with only the paintings of other art students were able to identify non-painting artworks by the other students at above-chance levels.

The ability of creative writing students to identify works of art produced by classmates that they had not seen before occurred at a statistically significant level for two of our four groups of participants. The mean hit rates for the remaining two groups were in the correct direction but they were two-to-three times lower than the hit rates for the other two groups. We suspect that the weaker effects in two of the groups were due to the presence of a small number of persons who performed extraordinarily poorly. The mean hit rate for the pooled data was nevertheless significant, indicating an overall effect. The lack of statistical significance for two of the groups should be considered in its proper context. Small groups were required to ensure that the students were familiar with each other’s work, but small *N*s reduce statistical power. The non-significant effect sizes that emerged for our small groups were nevertheless on par with effect sizes typically reported in psychological research. It is

also highly unusual for researchers to report findings for small sub-groups of their data sets, as we have done. Researchers typically report findings only for their pooled data, and the pooled-data findings in the present studies were all statistically significant.

We also found that the effect sizes for the within-domain recognizability of artistic styles (Study 1) were notably stronger than the effect sizes for the within-domain recognizability of a writer's "voice" (Study 2). A possible reason for the difference in effect sizes is that more information about a creator's style is available in artworks than in short passages of text. Also, longer passages consisting of more than 50 to 150 words could have had a better portrayal of the creator's style for the readers.

Although it may be possible to account for these results with existing theoretical frameworks for creativity, the results are not predicted by other theories, and it is not straightforward how they would be accommodated by most theories, particularly those that emphasize chance processes or the accumulation of expertise. Such theories provide no reason to expect that the works of a particular creator should exhibit a unique and recognizable style. Nor do they account for findings reported elsewhere that the act of creation leads to an enhanced sense of self (Fleith et. al., 2002; Garailordobil & Berrueco, 2007; MacKinnon, 1962). These findings are, however, predicted by the view that creativity is the process by which a worldview is forged and expressed, according to which personal style reflects the uniquely honed structure of an individual's worldview. The fact that creative writing students were able to identify which of their classmates created a given work in a domain other than writing, and that art students were able to identify the creators of non-painting artworks that they had not seen before, supports the prediction that individuals exhibit styles that are recognizable not just within a domain but also across domains,

although still within what Baer and Kaufman (2005) identify as the same thematic cluster, i.e., the arts.

A related finding is that artistically naïve individuals can perceive cross-media stylistic similarities, and group together instances of art by different individuals done in the same genre or from the same temporally defined period, *e.g.*, Neoclassical (Hasenpus, Martindale & Birnbaum, 1983). Of perhaps even greater interest with respect to the results of Study Three is Peretti's (1972) finding that music students were able to match paintings by Paul Klee with the musical selections that inspired Klee to paint them. Since Klee did not compose the music himself, this study does not address cross-domain individual style. It does, however, speak to the complexity of the phenomenon, and specifically, the possibility that style may be subject to many subtle influences, including exposure to works in seemingly unrelated domains.

The evidence reported here that creative artifacts are manifestations of an underlying personal style highlight the importance of a view of creativity that balances internal and external effects of the creative process. The two are expected to be related, and there is evidence that they are. For example, self-report measures of the ability to experience original, appropriate combinations of emotions (referred to as emotional creativity) are correlated with laboratory and self-reported creativity measures (Ivcevic, Brackett, & Mayer, 2007). However, focusing on the product and neglecting the internal change brought about by the creative process can lead to a distorted view of creativity. For example, it is commonly assumed that the creative individual is compelled "to transform the creative idea into a creative product" (Thrash, Maruskin, Cassidy, Fruer & Ryan, 2010, p. 470). This may be the case, but to the intrinsically motivated creator, the product may function primarily as a way

of tracking the progress of the idea; its worldly value may be of secondary importance. Indeed while the tradition in the West is to focus almost exclusively on creativity as the process by which a new and useful or entertaining product is generated, Eastern conceptions focus more on creativity as a process that can bring about therapeutic change (Niu & Sternberg, 2001), *i.e.*, that expresses, transforms, solidifies, or unifies the creator's understanding of and/or relationship to the world. In the extreme, the external creative work can be viewed as a mere byproduct of the internal transformation brought about through engagement in a creative task.

A theory of creativity that focuses on external results of the creative process cannot explain common attitudes toward creative artifacts, such as that while an original masterpiece is viewed as creative, a reproduction or imitation of the masterpiece is generally not. A view of creativity that balances internal and external aspects can make sense of this. Only the original masterpiece provided humanity with a newfound roadmap to understanding or expressing something. Once the focus shifts from the products resulting from the creative process to its transformative effects, the success of a creative venture cannot be measured in purely objective terms. A creative venture may be successful though it does not generate something of external value if it facilitates the discovery and expression of the individual's potentially unique and thus recognizable patterns of thought or emotion.

The present studies also provide a new perspective on the controversy over whether creativity is domain-general or domain-specific. It is widely assumed that the question of whether creativity is domain-specific or domain-general can be resolved by determining to what extent ratings of expertise in one domain are correlated with ratings of expertise in another. Measurements of expertise are assumed to be sufficient to detect any quality that

might characterize or unify an individual's creative ventures, and creative outputs are assumed to be objectively comparable. This study differs from previous research that addresses the domain-specificity / generality question in that the focus has been not on talent but on personal creative style. Creative achievement can be characterized in terms of not just expertise or eminence but the ability to express what we genuinely are through whatever media we have at our disposal at a given time. One might expect that an artist's or scientist's personal style will be evident in how he or she prepares a meal, decorates a room, or expresses a personal experience, what creativity researchers refer to as little-c creative activities (Gardner, 1993).

The present studies suggest that it is appropriate to incorporate into our understanding of the interplay between domain-specific and domain-general mechanisms an underlying unified yet multi-faceted personality structure and way of assimilating and responding to the world, which characterizes an individual's creative output. The expertise that is required for creative success makes it likely that creativity will appear domain-specific when the focus is on the usefulness or entertaining features of creative products. But creative products should nevertheless have a style that is recognizable within and across creative domains that reflects the worldviews of their creators. Higher cognition may be domain-general, not in the sense that expertise in one enterprise guarantees expertise in another, but in the sense that there are multiple interacting venues for creative expression open to an individual, and through which that individual's worldview may be gleaned.

The support obtained here for the hypothesis that domain generality manifests as not (necessarily) talent in multiple domains, but as the expression of personal style through multiple domains, is of social significance, for it has potential implications for both education

and our understanding of the factors involved in wellbeing. If individuals have multiple interacting avenues open to them for creative self-expression, and if the creative process is of value to the extent that it not just (1) yields products deemed by experts to be of high quality, but (2) exerts a positive, transformative effect on the creator, opportunities for domain general learning are potentially of significant social consequence. It may be that our capacity for cross-domain learning is just beginning to be exploited, through ventures such as the Learning through the Arts program in Canada, in which students, for example, learn mathematics through dance, or learn about food chains through the creation of visual art. If knowledge is presented in compartmentalized chunks, then students may end up with a compartmentalized understanding of the world. If knowledge were presented more holistically, a more integrated kind of understanding may be possible.

The creative styles phenomenon also provides a relatively novel and challenging form of individual differences for personality researchers. Most dimensions of individual differences are introduced with descriptions of the relevant characteristics of persons at the high and low ends of a latent trait continuum. A trait is usually expected to have a near-normal distribution, and a measure of the trait is typically provided to stimulate research. But creative styles and worldviews are like multidimensional fingerprints. They are characterized by unique blends or constellations of features. Single measures and normal distributions are not likely or relevant. The creative styles phenomenon is idiographic and perhaps very difficult to measure with self-report questionnaires. The present research nevertheless indicates that creative styles are clearly recognizable from creative outputs, both within and across creative domains.

3 Cross-Domain Interpretation of Ideas

3.1 Overview

This chapter further explores the implications of having a self-mending and self-organizing worldview as described in Chapter Two. In addition to the recognizability of an individual's creative style in their creative outputs, this chapter focuses on the interpretation of creative ideas from one domain to another and the influence that creative ideas may have in a new domain. According to the Honing theory of creativity, creative output is the external reflection of the internal cognitive and emotional restructuring of an individual's worldview. Assimilating experiences into a more cohesive worldview brings about internal changes. In essence, the creative process brings about both internal changes to the worldview and that also leads to external changes, which are reflected in the creative product. Each individual has diverse experiences and weaves them into a distinct understanding of reality, complete with different ways of responding to and coping with their experiences: a unique "worldview." Therefore, a creative product is characterized by personal signature or creative style that arises from the unique self-mending and self-organizing of one's worldview. This creative style is a form of an individual difference, which gets reflected in any product the individual, creates not just in their domain of expertise but in other domains as well (Gabora, O'Connor & Ranjan, 2012).

Creativity arises from the natural tendency of a worldview to seek a stable state by resolving conflicts (Gabora & Merrifield, 2012). In the process of honing an ill-defined idea into a final creative product, an individual both refines the idea and cognitively restructures his or her worldview. The Honing theory suggests that emotional and cognitive restructuring

is not just concerned with a creative task but with the worldview as a whole, and thus the creative process is considered to be therapeutic. The need to resolve conflicts makes an individual self-mend and self-organize his or her worldview. This restructuring is essential to resolving conflicts and bringing the worldview to a stable state. For example, a life changing experience such as being part of a social movement or moving to a new country might create conflicts and discomfort in the artist. The artist's worldview gradually restructures to assimilate these changes and resolve the discomfort. This change in the artist's worldview will also be reflected in his or her art (creation). The unique way of transforming an idea into a creative product is reflected as one's creative style. The transformative process of restructuring a worldview involves interpretation, abstraction, and translation across domains, in order to make sense of the changes occurring. External factors (i.e., a past memory, a specific object, or an experience, etc.) that influence an individual's worldview can trigger a creative idea or response.

There is a possibility that if any two works of art created by different artists are similar, then artists' worldviews might have undergone a similar restructuring, which gets reflected in their final products. Works of art created in the same time period (Hasenbus, 1978), or inspired by the same source (Pereitti, 1972), share stylistic similarities. As well, if two people have conversations over time, or collaborate on a project together, and during these interactions they challenge each other's opinions and share ideas, the result of these conversations or collaborations are eventually reflected in the restructuring of their individual worldviews. In the restructuring process, the experiences with objects and situations, and interactions with others (i.e. with worldviews of other people) shape the self and thus shape the worldview (Koltko-Rivera, 2004).

The restructuring of an artist's worldview implies that to a certain extent, ideas in one domain may inspire and influence creative products in other domains, mainly because one's worldview is not domain specific and it entails an overall understanding of the world. Additionally, for domain-specific creative production, though the final product is generated within the constraints of a specific domain, the nascent idea might be domain independent or originate from a different domain. For example, the experience of riding a bike in the woods may be creatively manifested as a poem that takes shape in such a way that it obeys the rules for the number of syllables in a line and the number of lines in a stanza. Similarly, a painter could create a painting that is inspired by a dance performance, or a mathematical equation could be visualized as a work of art. When a work of art is inspired by another work of art from a different domain, the two works may be recognizably related because of a shared deep structure or the similar restructuring they bring about in the creator's worldview. In the current study, it was hypothesized that viewers perceive such resemblances.

This part of the dissertation elaborates on the studies discussed in Chapter Two by exploring personal signatures or creative styles in relation to cross-domain inspiration. More specifically, I investigated to what extent the essences of inspirational creative ideas from one domain (i.e., music) are carried forward to a new domain of expression (i.e., painting). The study had three primary objectives. The first objective was to investigate whether viewers perceive similarities between the paintings and the pieces of music that inspired the paintings. The second objective was to investigate whether the psychological experiences when viewing the paintings were similar to their psychological experiences when listening to the pieces of music that inspired the paintings. The third objective was to investigate whether participants are able to identify which pieces of music inspired which paintings. Before

providing details of the study, I will outline some background research that demonstrates the existence of several cross-domain interactions and interpretations occurring as part of our cognition in everyday life. Some of these processes might also be part of the creative process.

3.1.1 Cross-domain, Cross-sensory and Cross-media Interpretation in Arts

Most of us experience and appreciate art in some form in our everyday lives (Leder, Gerger, Dressler, & Schabmann, 2012). Sometimes art acts as a means to communicate complex ideas across domains indirectly. There are examples of inspiration and the ekphrastic interpretation of creative ideas across domains, as discussed earlier; for example, translating the idea in an oil painting into a sculpture, or even from visual art to music and vice versa. The presence of music-influenced artists is well established. For example, Abstract Expressionist Jackson Pollock openly included jazz music among his artistic influences. Pop artist Andy Warhol was deeply influenced by the rock band The Velvet Underground. This suggests that items from different domains, such as music and painting, can share abstract qualities.

The interpretation and translation of creative ideas could be cross-sensory too. Wolfgang Kohler (1910) conducted an experiment to investigate whether humans are capable of mapping a connection between speech and shape. In this study, participants were asked to associate the names ‘Baluba’ and ‘Takete’ with two shapes. One shape was jagged and sharp and the other was organic and round. The results of the study showed that to the majority of the participants, ‘Babula’ reminded them of the round shape. Later, more experiments were conducted with variations in names but the results still remained consistent with the original study (Kohler, 1947; Ramachandran and Hubbard, 2001; Maurer et al., 2006). These studies clearly indicate that people experience a cross-sensory translation between visual and

auditory information. As discussed in Chapter One, the ability to translate attributes of sensation from one sensory domain to another is called *synesthesia*. Cross-sensory interpretations are evident in the work of many creative individuals (Domino, 1989; Ramachandran & Hubbard, 2003). A possible explanation for the association between synesthesia and creativity is that in synesthesia there are excessive cross-sensory interactions and communications between different brain regions. This excess communication allows for the association of seemingly unrelated ideas and concepts, which aids creativity. Synesthesia has also been linked to both visual and verbal intelligence, and to the capacity for metaphor (Ramachandran & Hubbard, 2003).

Another phenomenon, that may play a role in the abstraction of similar properties across media (e.g., Baroque, Gothic, Rococo, and Romantic), is cross-media style. Cross-media styles are stylistic features that are exhibited by works of art in more than one medium and these works of art are also created roughly during same epochs. The existence of cross-media style indicates that people share similar psychological experiences while viewing different artistic stimuli, as works of art share common characteristics (Hasenbus, 1978). These findings indicate that the essence of an idea could be interpreted across domains.

As mentioned earlier, a painter could create a painting that is inspired by a dance performance and in order to do this an inter-sensory, cross-modal comparison may be taking place at an abstract level in the mind of the creator (i.e., a static visual image translating into dynamic dance moves capturing the colors and emotions). Greene (1940) identified the three most important inter-medial characteristics that can be used to differentiate between works of arts as complexity, integration, and rhythm. These characteristics can vary less between media than between different compositions. Burke (1957) argues that the basis of cross-

media style is innate and he described it as “a set of various potentialities of the human mind for being interested by certain processes or arrangements which produce crescendo, contrast, comparison, balance, repetition, disclosure, reversals, contractions, expansion, magnification, series and so on.”

It has also been suggested that artistic styles undergo periods of popularity, followed by periods in which they fall out of favor. Hence works of art in all media can be rated on evaluative dimensions that change over time (i.e., good-bad) and these evaluations appear to transcend the particular media (Kroeber, 1944). According to the *reflectionist theory* of cross-media style, art reflects society. Reflections of the same society are seen across different kinds of works of art, which can be expected to have characteristics in common.

3.1.2 The Psychological Experience of Perceiving Art

There has been a longstanding interest in understanding art, art appreciation, and the association of art with psychological variables. After the establishment of experimental psychology and experimental aesthetics in the late 1800s, there was a resurgence of interest in the field of experimental aesthetics in the 1960s and 1970s (Berlyne, 1974). It has been suggested that art helps gain access to the viewers’ unconscious (Knapp & Greeno, 1960). There are properties of artworks that should correlate with personality or other cognitive variables, and art preferences reflect the viewer’s personality (Furnham & Walker, 2001).

Cross-domain interactions may occur during the creative process when a source from one domain inspires a creative product in another domain. The final product and original inspiration might show cross-modal similarities because the essence of the idea from the inspiration is carried forward to the final creative product. According to Berlyne (1971), any work of art has three types of properties: psychophysical properties (i.e., loudness of sound,

hue, and pitch), collative stimulus patterns (i.e., ambiguity, novelty, surprise, and complexity), and ecological properties (i.e., meaning or value). All three types of properties described by Berlyne have gathered substantial attention in studies of aesthetic perception and art appreciation.

These cross-modal similarities can be studied using the variables proposed by Berlyne (1971) which describe the collative properties (i.e., ambiguity, novelty, surprise, complexity) of stimulus patterns, and the participants' internal states, i.e., their reactions or moods experienced while exposed to the artwork. For example, novelty is described based on a comparison between the present and the past. Uncertainty is described as a comparison of simultaneous incompatible expectations. Conflict is described as a comparison of simultaneous incompatible response tendencies. Some of these variables are also covered in the set of variables used by circumplex dimensions of emotional meaning, defined by axes of affective valence and arousal (Russel, 1980; Watson & Tellegen, 1985). All these properties are applicable in other domains, such as architecture, music, painting, writing etc. Hence, works of art from different domains can be matched based on some of these collative properties (Hasenpus, 1978).

The psychophysical experiences of perceiving art also involve cross-sensory and cross-domain associations. Some studies have shown that despite individual differences, people on an average show systematic color preferences consisting of combinations of the three primary dimensions of color, hue (basic color), saturation (vividness, purity, or chroma), and lightness (brightness or value) (e.g., Hurlberl & Ling, 2007; Ou et al., 2004; Palmer & Schloss, 2010). These color preferences have also been analyzed in musical contexts. Palmer, Schloss, Xu, and Prado-León (2013) studied how colors were associated

with classical orchestral music composed by Bach, Mozart, and Brahms. The results showed that there is a cross-modal relationship between music and color and this relationship is strongly mediated by the emotions that are commonly associated with specific kinds of music and color (i.e., faster tempos paired with saturated and yellower colors). There is strong evidence that higher degrees of brightness and higher levels of auditory pitch are generally matched together (Galeyev, 2007, 2003; Klapetek, Ngo, & Spence, 2012). These studies shed light on cross-domain aspects of aesthetic perception.

3.1.3 Cross-Domain interpretation of Ideas

When we consider highly recognizable artistic products or focus on highly successful individuals, creativity may appear domain-specific. However, our ability to achieve cross-modal, cross-domain, and cross-media abstraction significantly enriches the creative process, and indicates that creativity involves cross-domain interactions. Core ideas might exist domain-independently in the sense that they may originate in one domain and then cross domains to inspire other creative product. Chapter Two focused on personal styles as one of two domain-general aspects of the creative process studied in this dissertation. This chapter explores the second aspect: the cross-domain interpretation of ideas.

I designed a set of experiments to test the existence of the unique cognitive restructuring of worldviews and the evidence for cross-domain interpretations occurring during the creative process. The current study required individual artists to create paintings that were inspired by musical pieces. It tested whether people perceive associations between works by artists inspired by the same creative product from another domain. The perception of such associations would presumably be due to structural similarities in the artists'

worldviews, as the works resulted from the same source of inspiration. Before I describe the experiments in detail, I will describe two relevant studies.

In the first such study, Peretti (1972) used a group of paintings by Paul Klee and the music pieces that inspired them to test whether participants were able to match the paintings to the musical inspirations. He used the same musical stimuli as a previous study carried out by Wehner (1966). Participants matched musical pieces to paintings and picked one emotion from a list of six emotions that most accurately described the mood of both the painting and the musical piece. Each of the six emotions on the list were associated with the mood of the six paintings. Peretti found that the participants were able to match the music and paintings and were able to pick the emotion that correctly described the mood of both. Music majors performed significantly better at this task than naïve participants. This study suggests that when music inspires paintings there is an emotional theme shared between the music and paintings and that leads to similar psychological experiences while viewing the paintings and listening to the music.

In the second study, which perhaps comes closest in approach to my dissertation, composers wrote musical pieces inspired by four simple line-drawn shapes: a square, a lightning bolt, a curvy shape, and a jagged shape (Willmann, 1944). The participants rated pairs of musical pieces in terms of similarity: some pairs of musical pieces were inspired by the same shape and other pairs were inspired by different shapes. Musical pieces inspired by the same shape were rated more similar to each other than were musical pieces inspired by different shapes with respect to tempo, melodic pattern, mood, and other characteristics. Participants could also match a musical piece to the shape that inspired it at above-chance levels. However, the music in Willmann's study could not be said to be reinterpretations of

creative works. The impoverished nature of the stimuli undoubtedly limited the scope for creative expression. Willmann's use of the line drawings controlled for the emotional and aesthetically stimulating aspects of the inspiration used for writing the music.

My study, reported on in this chapter of the dissertation, is the inverse of Willmann's study; it investigated, not music inspired by art, but art inspired by music. This was done to test whether participants would still be able to perceive the connection between art and music when a piece of piano music was translated to a painting. My study also went beyond the perceptual aspect of the stimuli and it used a richer set of stimuli to deliberately and realistically explore the emotional and aesthetic aspects of inspiration. It aimed to study the overall psychological experiences and not just the emotions of the viewers. The study also explored whether viewers were able to perceive similarities between the sources of inspiration and inspired products. These similarities might be due to the resemblance in the restructured worldview of the creators and due to the shared themes in the works.

Despite these differences, the current study is in line with the Willmann and Peretti studies discussed above, as both of these studies focus on the cross-domain aspects of aesthetic perception in the domains of art and music. The current study tested to what extent participants are able to perceive similarities between paintings and the musical pieces that inspired them. It also tested whether participants had similar psychological experiences when experiencing the source of inspiration and the inspired product. It tested the participants' ability to recognize and match the twelve paintings and the four musical inspirations.

The study included matching of the musical pieces and paintings but it differed from the previous studies in the following two ways. First, in the current study, artists were asked to create paintings, which were interpretations of pieces of instrumental music. Whereas the

previous studies have either used line drawings or existing artworks that were perhaps inspired by music. Second, unlike the previous studies, I examined whether participants have similar psychological experiences when listening to the musical pieces and viewing the inspired paintings (the “experiential ratings” task). The research questions addressed in the current study of the cross-domain interpretation of ideas are based on three specific sets of dependent variables.

1. **Correct or incorrect guesses/identifications:** Participants were asked to identify the source of inspiration of an artwork that was interpreted from one domain to another (i.e., from the domain of music to painting).
2. **Similarity ratings:** Participants were asked to rate similarities between paired paintings, paired pieces of music, and paintings paired with pieces of music.
3. **Experiential ratings:** Participants rated each musical piece and each painting on 35 descriptive variables, each on a five point Likert scale. The experiential variables used in the current study cover the cognitive and emotion variables for art appreciation discussed in past experimental aesthetics literature (Berlyne, 1974; Russel, 1980; Watson & Tellegen, 1985). Some new variables were added to the list. These new variables were borrowed from the list that was created based on data collected in an honors thesis project (Carbert, N. honors thesis, 2012) that focused on measures of art appreciation and on adjectives from reviews of music and paintings.

These three dependent variables, described above, were used to investigate the process of interpreting ideas across domains (i.e., music to painting) from three different aspects. First, I investigated whether participants will assign similar experiential ratings and

similarity ratings to the paintings and the musical pieces that inspired them, even if they are not able to identify which musical pieces inspired the paintings. Second, I investigated whether participants will assign similar experiential ratings and similarity ratings to paintings created by the same artist. Third, I investigated whether participants will be able to recognize the source of inspiration for an artwork when it is an interpretation of a musical piece.

3.2 Methods

The above stated goals were met by conducting a two-phase study. In phase one, expert visual artists created four paintings, each of which was the artist's interpretation of one of four different pieces of instrumental music. Each artist was provided with the same four musical pieces. In phase two, participants attempted to determine which musical piece was used as the source of inspiration for each painting; to rate the similarities between the paintings and musical pieces; and to rate the paintings and the musical pieces with respect to 35 descriptive experiential variables. The details of the two phases are provided below.

3.2.1 Phase One

3.2.1.1 Participants

Three female, expert visual artists, each with approximately 25 years of experience in the field of painting, were recruited for this study. Gender was not a criterion for the selection. Each artist was a professional with an official studio in Kelowna, British Columbia. The artists had each held more than 10 exhibitions of their paintings. The average age of the artists was 45 years. They each received \$50 for their participation.

3.2.1.2 Musical Stimuli

Four pieces of piano music, from commercially produced soundtrack CDs, with no vocal tracks and no other instrumentation, were used as the stimuli that inspired the pieces of art. These piano musical pieces were selected from a pool of 35 pieces chosen as exemplary of different musical styles: Baroque Classical, Romantic, Jazz, and Contemporary. The following selection procedure was used in order to avoid subjective biases in the selection of music. Each of the original 35 pieces of music was cropped to three minutes' duration, and then rated by three raters on 64 descriptive adjectives using a five point Likert scales. The adjectives were derived from previous research on the collative properties of stimulus patterns, specifically, measures of affective reactions to artwork (Berlyne, 1974). Adjectives were also derived from the affective circumplex model, which proposes that all affective states arise from two fundamental dimensions, one related to valence (a pleasure–displeasure continuum) and the other to arousal, or alertness (Russel, 1980; Watson & Tellegen, 1985). The raters had no previous musical training. The list of the 64 descriptive adjectives is provided in Table 3.1.

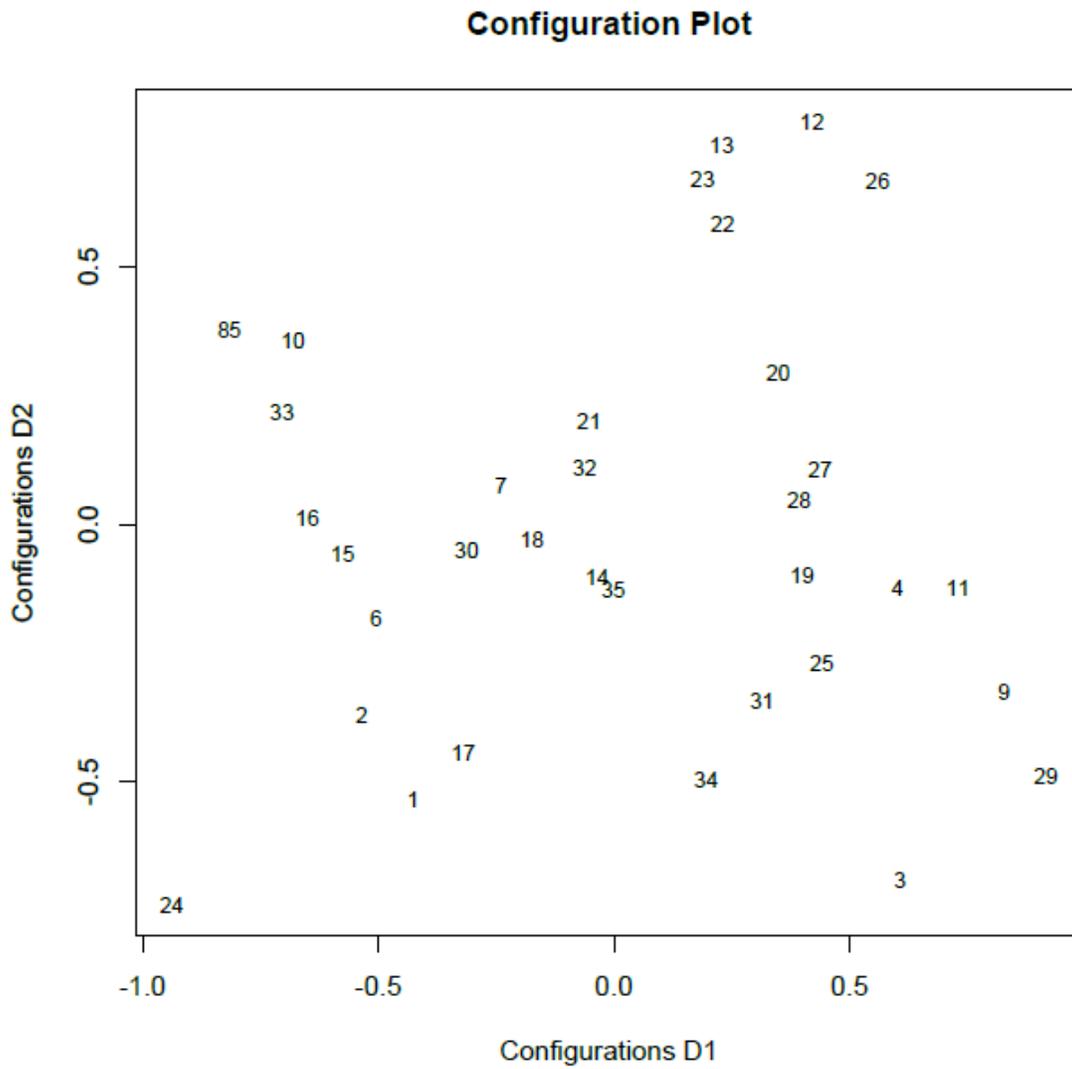
Multidimensional scaling (MDS) was used to reveal the number of basic dimensions of aesthetic experience in the ratings, and to reveal how the 35 musical pieces were dispersed in the dimensional space. The purpose of using multidimensional scaling was to ensure that the four musical pieces chosen from the pool of 35 were highly dissimilar. The MDS coordinates for musical stimuli across the dimensional spaces were used to select four dissimilar musical pieces from different regions (see Figure 3.1). The four selected pieces of music were those that are numbered 22, 24, 29, and 33 in Figure 3.1. The titles of the four selected musical pieces (now numbered as one to four) are as follows:

1. 'Love is a Mystery' by Ludovico Einaudi

2. 'Grande Sonate Number 29 B Flat Major', by Ludwig van Beethoven
3. 'Circus Gallop' by Marc-André Hamelin
4. 'All of Me' by Jon Schmidt

Table 3.1 List of Variables Used for Rating the Musical Pieces.

weak	interesting	elated	serene
warm hearted	Intense	dull	sad
uninteresting	Inactive	drowsy	relaxed
unhappy	Idle	droopy	quiet
ugly	Happy	distressed	profound
tranquil	Grouchy	disorderly	powerful
tired	Gloomy	dislike	pleased
surprised	Glad	delighted	peppy
superficial	Anxious	content	passive
strange	at ease	complex	orderly
stimulated	Active	cheerful	not strange
still	Annoyed	calm	nervous
sluggish	Fearful	bored	miserable
simple	Excited	blue	lively
astonished	Euphoric	beautiful	like
aroused	Enthusiastic	at rest	jittery



5.

Figure 3-1 Euclidian distance display for the 35 pieces of music.

3.2.1.3 Creation of Artworks

Each of the three artists created one painting for each of the four pieces of piano music, for a total of 12 paintings. On days that paintings were to be created, each artist was provided with a single musical piece and asked to reinterpret it as a painting, i.e., to paint what the music would look like if it were a painting. They were instructed to paint while listening to the music, and they were encouraged to listen to it as many times as they wished while they painted. They were allowed to use whatever painting supplies they thought could most effectively express the music (*e.g.*, watercolors, oils, and acrylics were all acceptable). They were instructed to complete their paintings in one sitting without interruption, and to take up to a maximum of 120 minutes to listen to the music and complete the painting. The reason they were given this time limit was to control for the possibility that the amount of time spent painting would influence the style of the artwork. The time duration was based on consultation with professors of painting classes at the Department of Fine Arts, The University of British Columbia. The paintings were created in the artists' personal studios. In order to limit the influence of the previous pieces of music on new paintings, the artists were instructed not to listen to the musical piece after the painting was completed, and there was a gap of four days between each painting session.

3.2.2 Phase Two

Phase two of the study used the twelve paintings created in the previous phase and the four pieces of music. Participants were provided with a website where they were directed through the steps of the study. Due to the time constraints on gathering large amounts of data, this phase was partitioned into six designs. The details of the designs are provided below. A

new set of participants was recruited for each of the six designs. There were three key tasks that the participants completed in this phase (although, due to time constraints, not all of the tasks were involved in each design):

1. **Identification task:** In this task, participants were asked to identify which musical pieces inspired which paintings.
2. **Similarity ratings task:** In this task, participants were asked to rate the similarities between paired paintings, paired musical pieces, and paintings paired with musical pieces. Each painting was paired with every other painting, each musical piece was paired with every other musical piece, and each musical piece was paired with every painting. In total there were 66 pairs of paintings, 6 pairs of musical pieces, and 16 pairs of paintings and musical pieces (for each artist).
3. **Experiential variables rating task:** In this task, participants rated the musical pieces and the paintings on a five point Likert scale with respect to 35 descriptive variables. These variables described the psychological experiences of viewing the paintings and listening to the four pieces of music individually. The list of the 35 descriptive variables used in this study is provided in Table 3.3.

To simplify the presentation of the findings below, the paintings were named as follows: a1p1, a1p2, a1p3, and a1p4 (paintings created by Artist 1); (paintings created by Artist 2) a2p1, a2p2, a2p3, a2p4; (paintings created by Artist 3) a3p1, a3p2, a3p3, a3p4 and the musical pieces were named m1, m2, m3, m4. The paintings a1p1, a2p1, a3p1 were interpretations of musical piece m1. The paintings a1p2, a2p2, a3p2 were interpretations of musical piece m2. The paintings a1p3, a2p3, a3p3 were interpretations of musical piece m3. The paintings a1p4, a2p4, a3p4 were interpretations of musical piece m4.

This phase of the study was partitioned into six designs due to the time constraints on gathering large amounts of data. The purpose of the six designs was to gather data for (1) the similarity ratings task for all the possible pairs of the twelve paintings, pairs of musical pieces, and pairs of paintings and musical pieces (2) the experiential ratings task for all the paintings and musical pieces, and (3) the identification task to test whether participants were able to identify the musical pieces that inspired the paintings, when all the painting by the three artists were presented in a randomized order and when participants were provided with groups of paintings by individual artists. Each design involved only one task from the ones described above. Each design involved a different set of participants. The designs are outlined in Table 3.2. The data for all six designs was collected online through web pages. Below is a description of each of the six designs.

Table 3.2 Summary of the Six Designs with the Tasks They Included.

Design	Identification	Similarity Ratings	Experiential Ratings
Design 1	✓	-	-
Design 2	✓	-	-
Design 3	-	✓	-
Design 4	-	✓	-
Design 5	✓	-	-
Design 6	-	-	✓

3.2.2.1 Design 1: Identification Task

Participants: 150 undergraduates who were enrolled in psychology courses at The University of British Columbia. They received partial course credit for their participation.

Materials and procedure: This design included the identification task. There were twelve paintings created by three artists in phase one. Each painting was displayed with all four pieces of music on one page. Participants were asked to identify which musical piece had inspired the painting by listening and selecting one of the four audio options given on the screen (i.e., m1, m2, m3, and m4).

3.2.2.2 Design 2: Identification Task

Participants: 65, 88, and 55 undergraduates who were enrolled in psychology courses at The University of British Columbia participated in three distinct parts of this design. They received partial course credit for their participation.

Materials and procedure: There were three parts to this design. In each part of the design there were four paintings created by each artist. Each painting was displayed with all four pieces of music. A different group of participants took part in each of the three parts. This design included the identification task in all three parts. The participants were asked to identify which musical pieces had inspired the paintings by listening and selecting one of the four audio options given on the screen (i.e., m1, m2, m3, and m4). This design differed from Design 1 as the paintings by one artist were included in one part. Hence, there were three parts to this design.

3.2.2.3 Design 3: Similarity Ratings Task

Participants: 70 undergraduates who were enrolled in psychology courses at The University of British Columbia. They received partial course credit for their participation.

Materials and procedure: This design included the similarity ratings task. It consisted of the 66 pairs of paintings and 6 pairs of music. Each of the twelve paintings created by the three artists was paired together with every other painting. Similarly, each of the four pieces of music was paired with every other piece of music. On each screen one pair of either the paintings or the pair of musical pieces was displayed. In the case of the music, participants were provided with the audio files. Participants were asked to rate the similarity of each pair on a five point Likert scale provided on the same screen.

3.2.2.4 Design 4: Similarity Ratings Task

Participants: 29 undergraduates who were enrolled in psychology courses at The University of British Columbia. They received partial course credit for their participation.

Materials and procedure: This design also had three parts, the same as Design 2. However, unlike Design 2, this design included the similarity ratings task. Each part of the design involved the painting created in response to each of the 4 pieces of music by a particular artist. Each of the four paintings was paired with the musical piece that inspired it, and with all other musical pieces. For each artist out of the 16 pairs, four pairs were correct matches i.e., paintings paired with the musical pieces that inspired the paintings. The other twelve pairs consisted of incorrect matches of musical pieces and paintings, i.e., paintings paired with music that did not inspire them. On each screen, a painting and a musical piece (the audio file) were displayed. Participants were asked to view the painting and listen to the audio file and then rate the similarity of the pair on a five point Likert scale provided on the same screen.

3.2.2.5 Design 5: Identification Task

Participants: 42 undergraduates who were enrolled in psychology courses at The University of British Columbia. They received partial course credit for their participation.

Materials and procedure: This design included the identification task. All twelve paintings by the three artists were displayed on one screen. The audio files of the four pieces of music were also provided on the same screen. Participants were asked to identify which musical piece inspired each of the paintings by selecting the appropriate option (from the drop-down menu given below each painting). Participants could also indicate by selecting the option ‘none’ if they thought that none of the pieces of music matched the painting. This design differed from Design 1 in the following two ways. First, in the identification task, participants could choose the option ‘none’ when they were not sure which of the four pieces of music inspired the painting. Second, the paintings of all the artists were displayed as a group, rather than individually.

3.2.2.6 Design 6: Experiential Ratings Task

Participants: 56 and 68 undergraduates who were enrolled in psychology courses at the University of British Columbia. They received partial course credit for their participation.

Materials and procedure: This design included the experiential rating task. There were two parts of this design. Each part consisted of six paintings and two pieces of music. The first part consisted of paintings a1p1, a1p2, a1p3, a1p4, a2p1, a2p2, and musical pieces m1 and m2. The second part consisted of paintings a2p3, a2p4, a3p1, a3p2, a3p3, a2p4, and musical pieces m3 and m4. Under each painting and musical piece, 35 statements were displayed. They are listed in Table 3.2. Each statement was about one experiential variable.

Participants were asked to provide their degree of agreement on a five point Likert scale about each statement in reference to the painting/musical piece displayed on the screen.

3.2.3 Analytic Methods

In order to determine whether participants were able to identify which musical pieces inspired which paintings, for each of the paintings (*i.e.*, twelve paintings created by three artists in phase one of the study), two hit rate statistics were computed. Similar analyses were performed individually for each artist including all the paintings by that artist. The first statistic was the simple hit rate, H , which is the proportion of correct guesses. Although intuitively meaningful, simple hit rates should be corrected for chance guessing and for response bias, such as the tendency to use particular response categories more or less than other response categories. The second statistic was the unbiased hit rate, H_u , which corrects for both problems (Wagner, 1993). The H_u statistic is based on analytic methods from signal detection theory and involves the creation of a confusion matrix for each respondent, from which the H_u statistic is derived. For the present study, we report both the mean simple hit rates (H) and the mean unbiased hit rates (H_u).

A data randomization procedure (Edgington, 1995; Good, 2005; Manly, 2007) was then used to assess the statistical significance of the mean H and H_u values. Specifically, for each set of paintings, each participant's guesses were randomly rearranged 1000 times and the H and H_u values were computed for each random data trial. The significance level was the proportion of trials that yielded H (or H_u) values greater than or equal to the H (or H_u) values for the real, non-randomized data. The mean H and H_u values for the random data sets were also used as the H and H_u values that would be expected on the basis of chance. These values served as the reference points for regular, parametric one-sample t-tests. The r

correlation coefficient equivalent effect size for each t value was computed following Rosenthal and Rosnow (1991).

Multidimensional scaling analyses were conducted on the similarity ratings and on the experiential ratings to identify which paintings and pieces of music were perceived as being closer to each other. In order to visually display how closely the paintings and pieces of music were rated on similarity and on the experiential variables; MDS scatter plots were created. These scatterplots display the MDS coordinates derived from the mean-similarity and the experiential ratings provided by the participants. The results of an MDS analysis consists of a spatial configuration that graphically displays the relations among the objects as reflected through the original set of proximities (Fitzgerald & Hubert, 1987). MDS is a non-metric technique that presents relationships between variables in the form of a scatterplot with distances between points representing the strength of associations. The scatter plots can be two dimensional as well as three-dimensional.

3.3 Analysis and Results

This section summarizes the analyses that were conducted on the data gathered from Designs 1 to 6. The results are organized according to each of the three tasks (the identification task, the similarity ratings task, and the experiential ratings task).

3.3.1 Identification Task

The identification task was designed to test whether participants could determine the musical inspirations for each of the twelve paintings. The data gathered in this task was analyzed in two ways. First, the H and Hu statistics were computed individually for each artist (i.e., putting together the data obtained from all four paintings of the artist). Second, the

H and H_u values were obtained individually for each of the twelve paintings. The purpose of the analysis was to investigate (1) paintings of which artists were identified at above chance levels, (2) which of the twelve paintings were identified at above chance levels (i.e., which musical pieces inspired which paintings).

The identification task helped us to investigate whether the inspiration (i.e., the musical piece) is recognizable in the new product (i.e., the painting). Designs 1, 2 and 5 incorporated the identification task in three different ways. Design 1 displayed the twelve paintings in a randomized sequence, Design 2 displayed the paintings in a randomized sequence but organized according to the artists they were painted by, and Design 5 displayed all the twelve paintings together on one screen. The results of the identification task in Designs 1, 2 and 5 are discussed below, for the both the individual artists and individual paintings.

First, the raw frequencies of the responses were computed separately for all three designs. These raw frequencies are the responses provided by the participants on each of the options for every painting (i.e., options were m1, m2, m3, m4). Second, both the mean simple hit rates (H) and the mean unbiased hit rates (H_u) were computed for each of the paintings for Designs 1, 2 and 5 separately based on the raw frequencies. Third, a data randomization procedure for both mean simple hit rates (H) and unbiased hit rates (H_u) was used to assess the statistical significance of the mean H and H_u values. These are the four statistical parameters reported: mean hit rates, reference hit rates, p-values for randomized data, and r-effect sizes.

3.3.1.1 Design 1

Analyses for Individual Artists

For paintings by each artist, two hit rates statistics were computed for each participant (judge). The first was the simple hit rate, H , which is the proportion correct guesses. The second was the unbiased hit rate, H_u , which corrects for chance guesses and for response bias.

The results for within-artist identifications of the musical pieces that inspired the paintings are presented in Table 3.26 For Artist 1, the mean hit rates regarding which musical pieces inspired which paintings were $H = .36$ and $H_u = .37$. The mean hit rates that would have been obtained on the basis of random guesses were $H = .25$ and $H_u = .25$. Both hit rates were statistically significant, and the r effect sizes were low, $.39$ and $.40$. For Artist 2, the mean hit rates were $.31$ and $.32$, statistically significant, and the effect sizes were low, $.25$ and $.24$. For Artist 3, the mean hit rates were $.43$ and $.45$, statistically significant, and the r effect sizes were $.55$ and $.56$. The pooled data hit rates were $H = .36$ and $H_u .21$, both of which were statistically significant. The participants were thus able to indicate, at above-chance levels, which musical pieces inspired which paintings for all the three Artists.

Table 3.3 Analyses for Individual Artists - Mean Hit Rates, t-Test values, r Effect Sizes, SD, and P values for the Identification task.

	Mean Hit Rate	Chance Hit Rate	SD	t	p-rand	r Effect Size
Design 1:						
Pooled Data Hit Rate (H)	0.36	0.25	0.16	8.50	0	0.57
Pooled Data Unbiased Hit Rate (Hu)	0.21	0.12	0.14	8.30	0	0.56
Artist 1 Hit Rate (H)	0.36	0.25	0.26	5.16	0	0.39
Artist 1 Unbiased Hit Rate (Hu)	0.37	0.25	0.29	5.33	0	0.40
Artist 2 Hit Rate (H)	0.31	0.25	0.22	3.18	0	0.25
Artist 2 Unbiased Hit Rate (Hu)	0.32	0.25	0.25	3.15	0	0.24
Artist 3 Hit Rate (H)	0.43	0.25	0.27	8.08	0	0.55
Artist 3 Unbiased Hit Rate (Hu)	0.45	0.25	0.30	8.18	0	0.56
Design 2:						
Artist 1 Hit Rate (H)	0.26	0.25	0.19	0.51	0.35	0.06
Artist 1 Unbiased Hit Rate (Hu)	0.26	0.25	0.19	0.60	0.31	0.08
Artist 2 Hit Rate (H)	0.26	0.25	0.19	0.67	0.30	0.07
Artist 2 Unbiased Hit Rate (Hu)	0.27	0.25	0.20	0.77	0.26	0.08
Artist 3 Hit Rate (H)	0.38	0.25	0.36	2.73	0	0.35
Artist 3 Unbiased Hit Rate (Hu)	0.38	0.25	0.37	2.55	0	0.33
Design 5:						

	Mean Hit Rate	Chance Hit Rate	SD	t	p-rand	r Effect Size
Pooled Data Hit Rate (H)	0.19	0.21	0.13	-0.936	0.861	0.14
Pooled Data Unbiased Hit Rate (Hu)	0.23	0.26	0.18	-1.005	0.842	0.15

Analyses for Individual Paintings

The raw frequencies obtained from Design 1 are displayed in Table 3.3 along with the corresponding correct responses. Although Design 1 does not classify paintings by artists, the results for each of the paintings are displayed categorically for each artist in Table 3.3. The H and Hu values for the identification of paintings for all three artists in Design 1 are displayed in Tables 3.4 and 3.5.

The mean hit rate (H) for all of the 12 paintings was found to be 0.36, while the mean hit rate that would have been obtained on the basis of random guesses for these paintings was 0.25. Significant difference was found between the mean H value for randomized data and the mean H value, for the real, non-randomized data. The r effect sizes were large, 0.99 (see Table 3.4). A similar result was found when comparing the actual Hu values and those obtained using randomized guesses (see Table 3.5).

Individually, most of the paintings by Artists 2 and 3 were accurately identified at above chance levels for both simple hit rates (H) and unbiased hit rates (Hu). Overall, the hit rates (H and Hu) were statistically significant (see Tables 3.4 and 3.5), and well above the corresponding reference hit rates. This implies that participants matched each painting to its corresponding musical piece for all artists at above chance levels.

Table 3.4 Guessing Frequencies for Design 1.

Paintings	Music 1	Music 2	Music 3	Music 4	Correct guesses for the paintings
Artist One					
1	43	13	29	66	Music 1
2	65	68	6	12	Music 2
3	25	20	70	36	Music 3
4	58	50	8	35	Music 4
Artist Two					
5	18	12	63	58	Music 1
6	33	51	24	43	Music 2
7	12	8	62	69	Music 3
8	43	23	30	55	Music 4
Artist Three					
9	63	52	6	30	Music 1
10	53	81	5	12	Music 2
11	25	26	72	28	Music 3
12	57	35	18	41	Music 4

Table 3.5 Proportion Correct Mean Hit Rate (H), Mean Values, r Effect Size, and p Values for Randomization for Identification of Paintings Inspired by Pieces of Music for Design 1.

Paintings	Mean	Ref-Mean	Ref-SD	p-rand	r-effsiz
Artist One					
1	0.29	0.25	0.04	0.18	0.72
2	0.45	0.25	0.04	0	0.98
3	0.46	0.25	0.04	0	0.99
4	0.23	0.25	0.04	0.32	-0.48
Artist Two					
5	0.12	0.25	0.03	0	-0.97
6	0.34	0.25	0.04	0.01	0.93
7	0.41	0.25	0.04	0	0.98
8	0.36	0.25	0.04	0	0.95
Artist Three					
9	0.42	0.25	0.04	0	0.97
10	0.54	0.25	0.04	0	0.99
11	0.48	0.25	0.04	0	0.99
12	0.27	0.25	0.04	0.29	0.54
Mean (H) All Three Artists	0.36	0.25	0.01	0	0.99

Table 3.6 Proportion Correct Mean Hit Rate (HU), Mean Values, r Effect Size, p Values for Randomization and d Effect Size for Identification of Paintings Inspired by Pieces of Music for Design 1.

Painting	Mean	Ref-Mean	Ref-SD	p-rand	r-effsiz
Artist One					
1	0.03	0.02	0.01	0.24	0.56
2	0.07	0.02	0.01	0	0.99
3	0.08	0.02	0.01	0	0.99
4	0.02	0.02	0.01	0.20	-0.64
Artist Two					
5	0	0.02	0.01	0	-0.95
6	0.04	0.02	0.01	0	0.95
7	0.07	0.02	0.01	0	0.99
8	0.04	0.02	0.01	0	0.96
Artist Three					
9	0.05	0.02	0.01	0	0.98
10	0.09	0.02	0.01	0	0.99
11	0.09	0.02	0.01	0	0.99
12	0.02	0.02	0.01	0.35	0.32
Mean (Hu) All Three Artists	0.05	0.02	0	0	0.99

3.3.1.2 Design 2

Analyses for Individual Artists

For Artist 1, the mean hit rates were .26 and .26, both of which were not significant. Similarly for Artist 2, the mean hit rates were .26 and .27, statistically not significant. For Artist 3, the mean hit rates were .38 and .38, statistically significant, and the effect sizes were low, .35 and .33 (see Table 3.26)

Analyses for Individual Paintings

Similar to Design 1, simple hit rates (H) and unbiased hit rates (Hu) were again computed from the raw frequencies for each artist, but in this design they were computed separately for each of the three artists' four paintings. The raw frequencies are reported in Tables 3.6, 3.9 and 3.12 for Artists 1, 2 and 3 respectively.

For Artist 1, the mean hit rate (H) for all the 4 paintings was 0.26, while the mean hit rate that would have been obtained on the basis of random guesses for these paintings was 0.24. The difference between the H values for randomized data and for the real, non-randomized data was not significant (see Table 3.7). However, the difference between the Hu values for randomized data (0.16) and for the real, non-randomized data (0.01) was statistically significant; the r effect sizes were large (0.93) (see Table 3.8). This means that the participants were able to identify which paintings of Artist 1 were inspired by which musical pieces at above chance levels only for the Hu (unbiased hit rates).

For Artist 2, the mean hit rate (H) and random mean hit rate was 0.26 and 0.25 respectively. As with Artist 1, the difference between the H value for randomized data and the H value, for real, non-randomized data was not significant (see Table 3.10). The unbiased hit rate (Hu) for each of the paintings created by the Artist 2 was 0.09. The mean hit rate that

would have been obtained based on random guesses for these questions was 0.06. The difference between H_u values for the randomized data and for the real, non-randomized data, was statistically significant, and the r effect sizes were large 0.94 (see Table 3.11). As with the results for Artist 1, the participants were able to identify which paintings of Artist 2 were inspired by which musical pieces at above chance levels only for the H_u (unbiased hit rates).

The mean hit rate (H) and the random mean hit rate for all the 4 paintings of Artist 3 were 0.38 and 0.25 respectively (see Table 3.13). Unlike Artists 1 and 2, the simple hit rates were statistically significant for Artist 3, with a large r effect size (0.98). The mean unbiased hit rate (H_u) for the real, non-randomized data for Artist 3 was 0.16, and for the randomized data it was 0.07. The difference between these two mean unbiased hit rates (H_u) was statistically significant, which is in line with the above result of simple mean hit rate (H) (see Table 3.14). This means that the participants were able to identify which paintings of Artist 3 were inspired by which musical pieces at above chance levels for both the H (simple hit rate) and H_u (unbiased hit rates).

Statistically, the unbiased hit rates (H_u) are considered to be more accurate than proportion correct simple hit rates (H). For all the Artists, H_u values for the real, non-randomized data are statistically different from that of the randomized data. Therefore, it can be inferred that when analyzed for individual paintings, overall, participants identified the correct musical pieces that inspired the twelve paintings at above chance levels. Although the statistical effect sizes were large, the differences between the real hit rates and the randomized hit rates were small. The reason for these apparently contradictory findings lies in the nature of effect size indices. The raw levels of correct identifications (e.g., proportions correct) were statistically significant but quite low in real magnitudes. The fact that the

corresponding statistical effect sizes were large indicates that very few of the random data identification statistics were as high as the (low) real data identification statistics, thus resulting in large statistical effect sizes. More precisely, the standard deviations of the random data identification rates were very small, resulting in a large statistical effect sizes for the real data identification rates.

Table 3.7 Guessing Frequencies for Paintings of Artist 1 in Design 2.

Painting	Music1	Music2	Music3	Music4
1	8	0	19	38
2	30	27	3	5
3	13	12	26	14
4	29	28	1	7

Table 3.8 Proportion Correct Mean Hit Rate (H), Mean Values, r Effect Size, and p Values for Randomization for Identification of Paintings Inspired by Pieces of Music for Artist 1 in Design 2.

Painting	Mean	Ref-Mean	Ref-SD	p-rand	r-effsiz
1	0.12	0.25	0.05	0.01	-0.92
2	0.42	0.25	0.05	0	0.95
3	0.40	0.25	0.05	0.01	0.94
4	0.11	0.25	0.06	0.01	-0.93
Mean (H) All Four Paintings	0.26	0.25	0.03	0.34	0.42

Table 3.9 Proportion Correct Mean Hit Rate (HU), Mean Values, r Effect Size, and p Values for Randomization for Identification of Paintings Inspired by Pieces of Music for Artist 1 in Design 2.

Paintings	Mean	Ref-Mean	Ref-SD	p-rand	r-effsiz
1	0.01	0.07	0.02	0	-0.91
2	0.17	0.06	0.02	0	0.97
3	0.21	0.06	0.02	0	0.987
4	0.01	0.07	0.03	0	-0.90
Mean (Hu) All Four Paintings	0.10	0.06	0.01	0.01	0.93

Table 3.10 Guessing Frequencies or Paintings of Artist 2 in Design 2.

Painting	Music1	Music2	Music3	Music4
1	7	3	55	23
2	33	39	8	8
3	15	9	23	41
4	42	19	3	24

Table 3.11 Proportion Correct Mean Hit Rate (H), Mean Values, r Effect Size, and p Values for Randomization for Identification of Paintings Inspired by Pieces of Music for Artist 2 in Design 2.

Painting	Mean	Ref-Mean	Ref-SD	p-rand	r-effsiz
1	0.08	0.25	0.05	0	-0.97
2	0.44	0.25	0.05	0	0.97
3	0.26	0.25	0.05	0.46	0.23
4	0.27	0.25	0.05	0.36	0.41
Mean (H) All Four Paintings	0.26	0.25	0.02	0.30	0.53

Table 3.12 Proportion Correct Mean Hit Rate (Hu), Mean Values, r Effect Size, and p Values for Randomization for Identification of Paintings Inspired by Pieces of Music for Artist 2 in Design 2.

Painting	Mean	Ref-Mean	Ref-SD	p-rand	r-effsiz
1	0.01	0.06	0.02	0	-0.94
2	0.25	0.06	0.02	0	0.99
3	0.07	0.06	0.02	0.42	0.17
4	0.07	0.07	0.02	0.41	0.12
Mean (Hu) All Four Paintings	0.09	0.06	0.01	0.00	0.94

Table 3.13 Guessing Frequencies for Paintings of Artist 3 in Design 2.

Painting	Music1	Music2	Music3	Music4
1	19	12	0	24
2	22	23	4	6
3	5	10	27	13
4	11	9	20	15

Table 3.14 Proportion Correct Mean Hit Rate (H), Mean Values, r Effect Size, and p Values for Randomization for Identification of Paintings Inspired by Pieces of Music for Artist 3 in Design 2.

Painting	Mean	Ref-Mean	Ref-SD	p-rand	r-effsiz
1	0.35	0.25	0.06	0.06	0.85
2	0.42	0.25	0.06	0.01	0.94
3	0.49	0.25	0.06	0	0.97
4	0.27	0.24	0.06	0.39	0.38
Mean (H) All Four Paintings	0.38	0.25	0.03	0	0.98

Table 3.15 Proportion Correct Mean Hit Rate (Hu), Mean Values, r Effect Size, and p Values for Randomization for Identification of Paintings Inspired by Pieces of Music for Artist 3 in Design 2.

Painting	Mean	Ref-Mean	Ref-SD	p-rand	r-effsiz
1	0.12	0.07	0.03	0.05	0.89
2	0.18	0.07	0.03	0	0.97
3	0.3	0.07	0.03	0	0.99
4	0.07	0.07	0.03	0.37	0.22
Mean(Hu) All Four Paintings	0.16	0.07	0.02	0	0.98

3.3.1.3 Design 5

Unlike Designs 1 and 2, Design 5 included all the paintings created by the three artists in random order displayed together on one screen. In the identification task for this design, participants were provided with five options to select from: m1, m2, m3, m4 and none, for each painting.

The results for the pooled data of all three artists for each participant (judge) are displayed in Table 3.26. Both the mean hit rates were not significant. This means that the participants were not able to identify which musical pieces inspired which paintings in Design 5, where the paintings by all three artists were displayed together.

The raw frequencies, along with the corresponding correct responses obtained from Design 5, are displayed in Table 3.15. The hit rates (H and H_u) for the identification of the three artists' paintings in Design 5 are displayed in Tables 3.16 and 3.17. The mean hit rate (H) for all of the 12 paintings was 0.18, while the mean hit rate based on random guesses for these paintings was 0.02. The difference was not statistically significant (see Table 3.16). Also, for the unbiased hit rate (H_u) the values were not found to be significant, which means that in Design 5, participants were not able to identify, at above chance levels, which musical pieces inspired which paintings.

Table 3.16 Guessing Frequencies for Design 5.

Painting	Music1	Music2	Music3	Music4	NA	Correct guesses for the paintings
Artist One						
1	8	12	11	7	7	Music 1
2	11	8	8	10	8	Music 2
3	14	9	9	6	7	Music 3
4	11	7	12	11	4	Music 4
Artist Two						
5	12	8	9	9	7	Music 1
6	12	5	9	13	6	Music 2
7	9	10	9	8	9	Music 3
8	13	15	5	5	7	Music 4
Artist Three						
9	8	9	8	9	11	Music 1
10	10	7	7	11	10	Music 2
11	6	9	11	10	9	Music 3
12	14	6	6	8	11	Music 4

Table 3.17 Proportion Correct Mean Hit Rate (H), Mean Values, r Effect Size, and p Values for Randomization for Identification of Paintings Inspired by Pieces of Music in Design 5.

Painting	Mean	Ref-Mean	Ref-SD	p-rand	r-effsiz
Artist One					
1	0.18	0.20	0.06	0.43	-0.37
2	0.18	0.20	0.06	0.45	-0.30
3	0.20	0.20	0.06	0.58	-0.02
4	0.24	0.20	0.06	0.27	0.62
Artist Two					
5	0.27	0.20	0.06	0.18	0.75
6	0.11	0.20	0.06	0.07	-0.85
7	0.20	0.20	0.06	0.57	-0.04
8	0.11	0.20	0.06	0.10	-0.83
Artist Three					
9	0.18	0.20	0.06	0.44	-0.35
10	0.16	0.20	0.06	0.29	-0.61
11	0.24	0.20	0.06	0.27	0.60
12	0.18	0.20	0.06	0.44	-0.35
Mean (H) All Three Artists	0.18	0.20	0.02	0.23	-0.61

Table 3.18 Proportion Correct Mean Hit Rate (Hu), Mean Values, r Effect Size, and p Values for Randomization for Identification of Paintings Inspired by Pieces of Music in Design 5.

Painting	Mean	Ref-Mean	Ref-SD	p-rand	r-effsiz
Artist One					
1	0.01	0.02	0.01	0.27	-0.58
2	0.01	0.02	0.01	0.40	-0.37
3	0.02	0.02	0.01	0.54	-0.10
4	0.03	0.02	0.01	0.21	0.60
Artist Two					
5	0.03	0.02	0.01	0.21	0.60
6	0.01	0.02	0.01	0.05	-0.80
7	0.02	0.02	0.01	0.54	-0.11
8	0.01	0.02	0.01	0.06	-0.79
Artist Three					
9	0.01	0.02	0.01	0.28	-0.57
10	0.01	0.02	0.01	0.25	-0.61
11	0.03	0.02	0.01	0.19	0.60
12	0.04	0.02	0.01	0.37	-0.42
Mean (Hu) All Three Artists	0.02	0.02	0	0.14	-0.72

3.3.2 Similarity Ratings Task

This task was designed to follow from the identification task. It was meant to test whether (1) paintings that were inspired by the same musical piece were perceived as similar to each other, and (2) paintings created by same artist were perceived to be more similar to each other than to other paintings. This task was incorporated in Designs 3 and 4. Design 3 displayed all possible pairs of the twelve paintings and pairs of the 4 pieces of music. Design 4 displayed each of the paintings paired with the four pieces of music and organized by each artist. So for each artist, the painting-music pairs included paintings paired with musical pieces that inspired them, as well as paintings paired with musical pieces that did not inspire them. The data from both the designs were merged together to produce a 16 by 16 matrix (see Table 3.19).

Table 3.19 Means of the Similarity Ratings Derived From Design 3 and Design 4 for the Pairs of Paintings, Painting-Music and Pairs of Pieces of Music.

	a1p1	a1p2	a1p3	a1p4	a2p1	a2p2	a2p3	a2p4	a3p1	a3p2	a3p3	a3p4	m1	m2	m3	m4
a1p1	0	3.1	3.76	3.49	4.21	4.37	3.4	4.4	2.66	3.74	3.62	3.56	2.94	3.53	3.28	2.28
a1p2	3.1	0	3.71	3	4.35	3.75	4.21	4.57	1.94	1.85	4.13	2.93	1.84	2.09	4.38	3.03
a1p3	3.76	3.71	0	3.66	3.51	3.44	3.63	4.04	4.32	3.07	2	2.16	3.31	3.28	2.78	3.13
a1p4	3.49	3	3.66	0	4.16	4.03	4.03	4.22	3.46	3.57	4.07	2.91	2	2.13	4.41	3.13
a2p1	4.21	4.35	3.51	4.16	0	1.71	1.44	1.91	4.41	4.57	4.04	4.09	3.91	4.13	2.72	2.81
a2p2	4.37	3.75	3.44	4.03	1.71	0	2.13	1.79	4.5	4.16	4.22	4.16	2.81	3.19	3.34	3.16
a2p3	3.4	4.21	3.63	4.03	1.44	2.13	0	2.35	4.18	4.5	3.93	3.93	3.69	3.97	2.53	2.53
a2p4	4.4	4.57	4.04	4.22	1.91	1.79	2.35	0	4.59	4.29	3.96	3.97	3.09	3.38	3.06	3.16
a3p1	2.66	1.94	4.32	3.46	4.41	4.5	4.18	4.59	0	2.35	3.74	2.78	2.25	2.53	4.41	2.47
a3p2	3.74	1.85	3.07	3.57	4.57	4.16	4.5	4.29	2.35	0	2.41	2.31	2.53	2.38	4.44	3.66
a3p3	3.62	4.13	2	4.07	4.04	4.22	3.93	3.96	3.74	2.41	0	2.16	3.13	3.44	3.34	2.97
a3p4	3.56	2.93	2.16	2.91	4.09	4.16	3.93	3.97	2.78	2.31	2.16	0	2.59	2.78	3.44	2.78
m1	2.94	1.84	3.31	2	3.91	2.81	3.69	3.09	2.25	2.53	3.13	2.59	0	2.46	4.31	3.44
m2	3.53	2.09	3.28	2.13	4.13	3.19	3.97	3.38	2.53	2.38	3.44	2.78	2.46	0	4.34	3.47
m3	3.28	4.38	2.78	4.41	2.72	3.34	2.53	3.06	4.41	4.44	3.34	3.44	4.31	4.34	0	3.43
m4	2.28	3.03	3.13	3.13	2.81	3.16	2.53	3.16	2.47	3.66	2.97	2.78	3.44	3.47	3.43	0

Prior to the analyses of the similarity ratings obtained in Design 3 and 4, intraclass correlation coefficients (ICC) were computed to assess the inter-rater reliability. The ICCs for single and average ratings are reported in Table 3.20. The single rater ICC is an index for the reliability of the ratings for one, typical, single rater. The average rating ICC is an index for the reliability of different raters averaged together. The single rater ICCs were rather low, but it is the averaged ICC values that were most relevant in the present study because we conducted our analyses on similarity ratings that were averaged across the raters. The intraclass correlation coefficients (ICCs) for averaged ratings in Design 3 were .98 (for paintings) and .97 (for music) and .92 (for paintings) in Design 4. The high ICCs for the averaged ratings indicated that the similarity ratings could be meaningfully collapsed for the MDS analyses, as the ratings provided by all the raters were reliable.

Table 3.20 Intraclass Correlation Coefficients for Single Ratings and Average Ratings for the Design 3 and Design 4.

Designs	Items Rated	ICCS for single ratings	ICCS for average ratings
Design 3	Paintings	0.47	0.98
	Music	0.30	0.97
Design 4	Paintings	0.24	0.92

Multidimensional scaling (MDS) analyses were then conducted seeking two dimensions and respectively three dimensions. The purpose of using MDS analyses was to obtain a visual display of all 16 items (i.e., 12 paintings and 4 pieces of music) to see which items were rated similarly. The means of the similarity ratings derived from Designs 3 and 4 for the paired paintings, paired pieces of music, and paintings paired with pieces of music are

presented together in Table 3.19. The MDS coordinates were derived from the similarity means, which denote distance measures or dissimilarities. Two-dimensional and three-dimensional scatterplots for the multidimensional scaling analysis are presented in Figures 3.2 and 3.3. Items closer together in these plots were more similar to one another. Greater distances indicate greater dissimilarities.

The scatterplots in Figures 3.2 and 3.3 provide insight into two important effects: (1) cross-domain interpretations (i.e., interpretations of musical pieces into paintings), and (2) creative styles of the artists (i.e., the distinctive personal signatures of the artists reflected in the paintings). If there is a major cross-domain interpretation effect and a minor creative style effect, then the groupings on the MDS plot should occur based on the pieces of music that inspired the paintings and not based on the artists who created them. In contrast, if there is a major creative style effect and a minor cross-domain interpretation effect, then the plot groupings should be based on artists and not on the inspiring pieces of music. Although the dimensions in the two-dimensional and three-dimensional scatterplots are not in themselves meaningful, they do help us visualize the proximity of the 16 items. The results of both the scatterplots are described below.

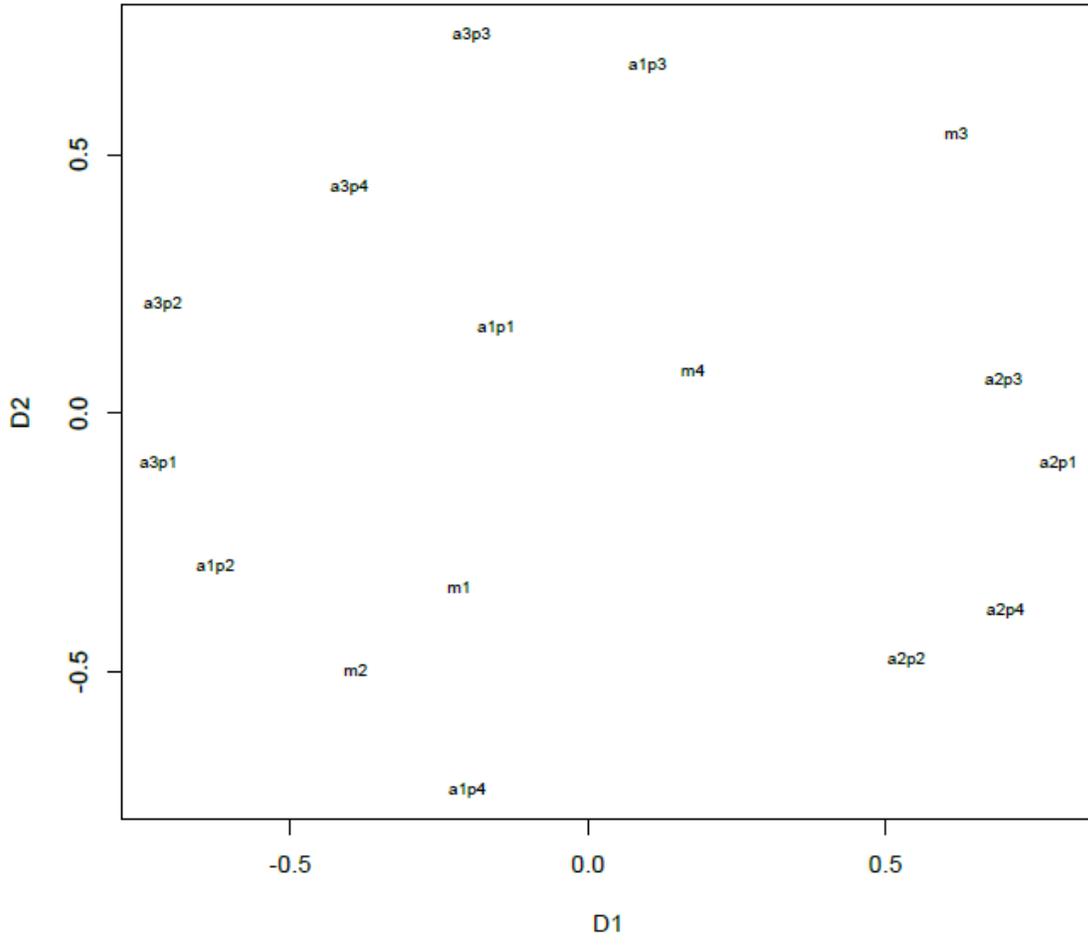


Figure 3-2 A 2-dimensional multidimensional scaling scatterplot based on the mean similarity ratings.

3-D MDS Scatterplot of Similarity Ratings

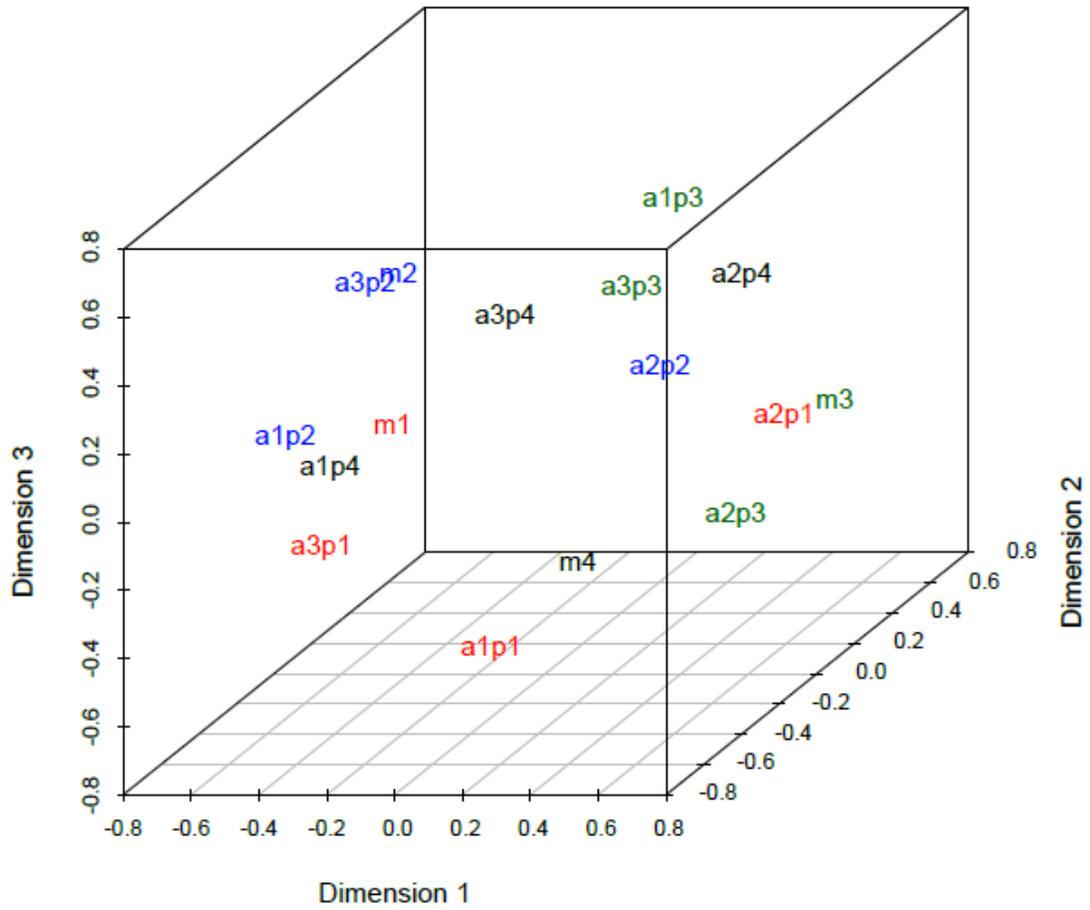


Figure 3-3 A 3-dimensional multidimensional scaling scatterplot based on the mean similarity ratings.

3.3.2.1 Two dimensional MDS plot

In Figure 3.2 the paintings of Artist 2, a2p1, a2p2, a2p3, and a2p4, are bunched together on the scatterplot indicating a strong personal style for Artist 2. The paintings of Artist 1, a1p1, a1p2, a1p3, and a1p4, are the farthest apart from each other, indicating that Artist 1 was incorporating or experimenting with diverse stylistic elements and therefore has a creative style that is difficult to recognize. The paintings of Artist 3, a3p1, a3p2, a3p3, and a3p4, are somewhat spread out but they are nevertheless on the same side of the scatterplot, indicating a moderately distinctive creative style.

Paintings a1p3 and a3p3 are relatively close to musical piece m3. Similarly, painting a1p2 is close to musical piece m2. Music piece m4 appears to be farthest away from all the paintings. Hence, the clustering in the scatterplot seems to be based more on the proximity between paintings by the same artist (i.e., creative style) than on the proximity of the paintings to the musical pieces that inspired them (i.e., cross-domain interpretation).

3.3.2.2 Three-dimensional MDS plot

In addition to the two dimensions described in the two-dimensional plot (i.e., horizontal and vertical), there is another dimension represented on the depth plane of the three-dimensional MDS plot. In Figure 3.3, first dimension coordinates served to locate the paintings and the pieces of music in horizontal space. Painting a1p2 is at the extreme left, and painting a2p1 and musical piece m3 are on the extreme right. Second dimension coordinates represent the height dimension of the figure. Painting a1p1 is at the greatest distance from a1p3 on the height dimension. Third dimension coordinates are represented on the depth plane of the figure. We see that a3p4 and a3p2 appear at the greatest depth from a2p3.

Similar to the display of the two-dimensional plot, the four paintings by Artist 2 cluster together quite noticeably. Raters judged these four paintings as being relatively similar to one another, and as rather dissimilar to the other artists' paintings. Artist 2 had the most distinctive creative style. Hence, the paintings were judged relatively similar regardless of which musical pieces inspired them. The paintings of Artist 3 appear close together in the figure; a3p1 and a3p2 appear on the same side of the plot, and a3p2, a3p4 and a3p3 are also clustered close to each other. This indicates the moderate effect of the creative style of Artist 3. The paintings of Artist 1 appear far apart, except for the two paintings a1p2 and a1p4, indicating the minimal effect of the artist's creative style.

There were only a few cases where the musical piece that inspired the painting appeared close to it in the plot. For example, in Figure 3.3, musical piece m2 and painting a3p2 overlap. Also, musical piece m3 appears close to a2p3. However, no consistent cross-domain interpretation effect was observed for all the paintings.

Overall, both the MDS scatterplots indicated that the participants did not perceive similarities between the paintings and the pieces of music that inspired the paintings. Nevertheless, the creative styles of the artists did appear to influence similarity ratings, at least in the case of two artists (i.e., Artist 2 and Artist 3).

3.3.2.3 Similarity Ratings Ratio

In addition to the visual display of the MDS scatterplots, two ratios were computed to further investigate the relative magnitudes of the effects of creative style and cross-domain interpretation. These two ratios, based on similarity ratings, will be addressed here as the creative style effect ratio (S) and the cross-domain interpretation effect ratio (I). As described earlier, there were two ways that paintings were paired together in the similarity ratings task.

In the first group of pairings, only paintings created by the same artist were paired together (within-artist). In the second group of pairings, paintings created by all three artists were paired together so that each painting was paired with every other painting (between-artists). A creative style ratio (S) was computed by dividing the mean of the similarity ratings for the within-artist by the mean of the similarity ratings for the between-artists. The ratio is a comparison of average dissimilarities between the paintings of one artist and the average dissimilarities between any two paintings by any of the three artists. Thus, values less than 1 are evidence for a creative style effect. A cross-domain interpretation (I) ratio was calculated by dividing the mean of the dissimilarity ratings for correct pairings of paintings and musical pieces by the mean of the dissimilarity ratings for incorrect pairings. Correct pairs were ones where a painting was paired with the musical piece that inspired it and the rest of the pairs were incorrect pairs. Values less than 1 for this ratio are evidence of a cross-domain interpretation effect. These ratios were computed for each artist and they are provided in Table 3.21.

Overall, the results of the ratio analyses point to the existence of both a creative style effect (S) and a cross-domain interpretation effect (I). All values were found to be less than 1. Artist 1 appeared to have a small creative style effect (.99) and a moderate cross-domain interpretation effect (.90). Artist 2 showed a strong creative style effect (.54) and small cross-domain interpretation effect (.99). Artist 3 also showed a moderate creative style (.75) and cross-domain interpretation effect (.84). These results are in line with the descriptions provided for the MDS plots.

The same ratios were also computed for the MDS plot coordinates (rather than for the actual similarity ratings). These ratios provide better descriptions of the MDS scatter plots for

each of the artists. The results are displayed in Table 3.21. Artist 1 showed little or no creative style effect (1.05) and a moderate cross-domain interpretation effect (.71). Artist 2 showed a strong creative style effect (.46) and a small cross-domain interpretation effect (.99). Artist 3 showed a moderate effect for both creative style (.67) and cross-domain interpretation (.72).

Table 3.21 The Creative style effect Ratio, Cross-domain Interpretation Ratio based on mean similarity ratings and the MDS coordinates.

	Similarity Ratings		MDS coordinates	
	Creative style effect (S) ratio	Cross-domain Interpretation (I) ratio	Creative style effect (S) ratio	Cross-domain Interpretation (I) ratio
Artist One	0.99	0.90	1.05	0.71
Artist Two	0.54	0.99	0.46	0.99
Artist Three	0.75	0.84	1.67	0.72

3.3.3 Experiential Ratings Task

The experiential ratings task in Design 6 investigated which paintings and musical pieces led to similar psychological experiences. This task consisted of a list of 35 variables that described the psychological experiences of viewing the paintings and listening to the pieces of music. Mean values of the ratings were computed for each variable. There were 35 mean values obtained from the ratings (i.e., for the 35 variables) for each painting and each musical piece. Euclidean distances were then calculated based on the mean experiential ratings provided for each of the 35 psychological variables for all the 16 objects (twelve paintings and four pieces of music) (see Table 3.22). Due to time constraints on gathering large amounts of data, Design 6 was divided into two parts, each containing 6 paintings and 2 pieces of music.

Table 3.222 List of 35 Variables for Experiential Ratings (similar list was used for the paintings by substituting the word painting for music).

List of variables for experiential ratings

<p>1. The music is annoying.</p> <p>3. The music makes me fearful.</p> <p>5. The music makes me jittery.</p> <p>7. The music makes me feel enthusiastic.</p> <p>9. The music makes me excited.</p> <p>11. The music is lively.</p> <p>13. The music is abstract.</p> <p>15. The music is thought-provoking.</p> <p>17. The music is absurd.</p> <p>19. The music is captivating.</p> <p>21. The music is intolerable.</p> <p>23. The music is strong.</p> <p>25. The music is powerful.</p> <p>27. The music is profound.</p> <p>29. The music is creative.</p> <p>31. The music is rough.</p> <p>33. The music is orderly.</p> <p>35. The music is predictable.</p>	<p>2. The music is distressing.</p> <p>4. The music makes me nervous.</p> <p>6. The music makes me anxious.</p> <p>8. The music makes me elated.</p> <p>10. The music is euphoric.</p> <p>12. The music is peppy.</p> <p>14. The music is complex.</p> <p>16. The music is mind-blowing.</p> <p>18. The music is beautiful.</p> <p>20. The music is delightful.</p> <p>22. The music is disturbing.</p> <p>24. The music is dominating.</p> <p>26. The music is deep.</p> <p>28. The music is unique.</p> <p>30. The music is bold.</p> <p>32. The music is raw.</p> <p>34. The music is polished.</p>
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Prior to computing the means and prior to the MDS analyses, it was important to determine whether there was sufficient agreement between raters for their ratings to be collapsed (averaged). As described above, the single rater ICC is an index for the reliability of the ratings for one, typical, single rater. The average rater ICC is an index for the reliability of different raters averaged together. The intraclass correlations for the single and average ratings are listed in Tables 3.23 and 3.24. Table 3.23 shows the intraclass correlation coefficients for six paintings and two pieces of music (i.e., a1p1, a1p2, a1p3, a1p4, a2p1, a2p2, m1 and m2). Table 3.24 displays intraclass correlation coefficients for the other six paintings and for the other two pieces of music (a2p3, a2p4, a3p1, a3p2, a3p3, a2p4, m3, and m4). The averaged rater ICCs were sufficiently high for means to be computed for each experiential variable indicating the ratings were reliable.

Table 3.23 Intra-class Correlations for Single Ratings and Means for the Design Four Experiential Ratings of Paintings a1p1, a1p2, a1p3, a1p4, a2p1, a2p2 and Music m1, m2.

Items	ICCS for single ratings	ICCS for average ratings
1. The music/painting is annoying.	0.25	0.96
2. The music/painting is distressing.	0.09	0.87
3. The music/painting makes me fearful.	0.10	0.89
4. The music/painting makes me nervous.	0.10	0.88
5. The music/painting makes me jittery.	0.22	0.95
6. The music/painting makes me anxious.	0.10	0.89
7. The music/painting makes me feel enthusiastic.	0.16	0.93
8. The music/painting makes me elated.	0.16	0.93
9. The music/painting makes me excited.	0.22	0.95
10. The music/painting is euphoric.	0.20	0.94
11. The music/painting is lively.	0.37	0.98
12. The music/painting is peppy.	0.32	0.97
13. The music/painting is abstract.	0.16	0.93
14. The music/painting is complex.	0.04	0.75
15. The music/painting is thought-provoking.	0.06	0.82
16. The music/painting is mind-blowing.	0.06	0.81
17. The music/painting is absurd.	0.16	0.93
18. The music/painting is beautiful.	0.24	0.96
19. The music/painting is captivating.	0.16	0.93

Items	ICCS for single ratings	ICCS for average ratings
20. The music/painting is delightful.	0.24	0.96
21. The music/painting is intolerable.	0.17	0.94
22. The music/painting is disturbing.	0.18	0.94
23. The music/painting is strong.	0.10	0.89
24. The music/painting is dominating.	0.09	0.87
25. The music/painting is powerful.	0.10	0.88
26. The music/painting is deep.	0.12	0.91
27. The music/painting is profound.	0.09	0.86
28. The music/painting is unique.	0.03	0.66
29. The music/painting is creative.	0.06	0.82
30. The music/painting is bold.	0.07	0.84
31. The music/painting is rough.	0.12	0.90
32. The music/painting is raw.	0.07	0.84
33. The music/painting is orderly.	0.18	0.94
34. The music/painting is polished.	0.20	0.94
35. The music/painting is predictable.	0.03	0.70

Table 3.24 Intra-class Correlations for Single Ratings and Means for the Design Four Experiential Ratings of Paintings a2p3, a2p4, a3p1, a3p2, a3p3, a3p4 and Music m3, m4..

Items	ICCS for single ratings	ICCS for average ratings
1. The music/painting is annoying.	0.17	0.93
2. The music/painting is distressing.	0.10	0.89
3. The music/painting makes me fearful.	0.10	0.89
4. The music/painting makes me nervous.	0.07	0.83
5. The music/painting makes me jittery.	0.05	0.77
6. The music/painting makes me anxious.	0.07	0.85
7. The music/painting makes me feel enthusiastic.	0.08	0.85
8. The music/painting makes me elated.	0.12	0.90
9. The music/painting makes me excited.	0.12	0.90
10. The music/painting is euphoric.	0.14	0.92
11. The music/painting is lively.	0.23	0.95
12. The music/painting is peppy.	0.20	0.95
13. The music/painting is abstract.	0.24	0.96
14. The music/painting is complex.	0.10	0.89
15. The music/painting is thought-provoking.	0.12	0.90
16. The music/painting is mind-blowing.	0.04	0.75
17. The music/painting is absurd.	0.12	0.90
18. The music/painting is beautiful.	0.22	0.95

Items	ICCS for single ratings	ICCS for average ratings
19. The music/painting is captivating.	0.14	0.92
20. The music/painting is delightful.	0.18	0.94
21. The music/painting is intolerable.	0.11	0.90
22. The music/painting is disturbing.	0.12	0.90
23. The music/painting is strong.	0.13	0.91
24. The music/painting is dominating.	0.07	0.85
25. The music/painting is powerful.	0.14	0.92
26. The music/painting is deep.	0.25	0.96
27. The music/painting is profound.	0.21	0.95
28. The music/painting is unique.	0.07	0.84
29. The music/painting is creative.	0.02	0.54
30. The music/painting is bold.	0.05	0.78
31. The music/painting is rough.	0.14	0.92
32. The music/painting is raw.	0.07	0.83
33. The music/painting is orderly.	0.10	0.89
34. The music/painting is polished.	0.20	0.95
35. The music/painting is predictable.	0.04	0.75

The Euclidian distances are displayed in Table 3.25. MDS was conducted on the Euclidean distances and the resulting three-dimensional scatterplot is provided in Figure 3.4. The twelve paintings and the four pieces of music are represented in the plot as points in the three-dimensional space. Paintings a2p3 and a2p4 appear to overlap, indicating that participants had similar psychological experiences while viewing these two paintings, which were both created by Artist 2. Paintings a3p2 and a3p3 are also located on same side of the plot, indicating that viewers had similar psychological experiences to those of a2p3 and a2p4.

The four pieces of music, m1, m2, m3, and m4, are far apart in the three dimensional figure, indicating that they were perceived by listeners as being very different from each other. This also supports the selection process of the four difference pieces of music (as described in section 3.2.1.2). In Figure 3.4, paintings inspired by the same piece of music (such as a2p2 and a3p2; a3p3 and a1p3; a2p4 and a3p4) appear to overlap. This means that the paintings in question and the musical piece that inspired them were rated as similar to each other based on the 35 psychological variables.

Table 3.25 Euclidean Distances between the Means of the Ratings on the 35 Experiential Rating Items for the 16 Objects (Twelve Paintings and Four Pieces of Music).

	a1p1	a1p2	a1p3	a1p4	a2p1	a2p2	a2p3	a2p4	a3p1	a3p2	a3p3	a3p4	m1	m2	m3	m4
a1p1	0	4.86	5.32	3.7	2.87	4.21	3.12	3.39	2.37	4.95	4.33	3.93	5.03	4.14	5.32	4.06
a1p2	4.86	0	2.97	1.86	3.77	2.55	4	3.23	2.87	2.32	2.51	2.23	3.7	1.73	5.24	5.23
a1p3	5.32	2.97	0	3.42	3.16	1.68	4.08	3.56	3.88	2.04	1.4	3.2	5.38	3.3	3.75	6.4
a1p4	3.7	1.86	3.42	0	3.27	2.8	3.38	2.62	1.77	2.7	2.52	1.91	3.56	1.81	5.12	4.3
a2p1	2.87	3.77	3.16	3.27	0	2.13	2.21	2.12	2.45	3.53	2.33	2.76	4.84	3.53	3.68	4.74
a2p2	4.21	2.55	1.68	2.8	2.13	0	3.33	2.73	2.86	1.93	1.25	2.57	4.79	2.53	3.82	5.55
a2p3	3.12	4	4.08	3.38	2.21	3.33	0	1.27	2.55	4.53	3.12	2.1	3.52	3.9	4.1	3.18
a2p4	3.39	3.23	3.56	2.62	2.12	2.73	1.27	0	2.16	3.85	2.51	1.39	3.2	3.2	4.07	3.24
a3p1	2.37	2.87	3.88	1.77	2.45	2.86	2.55	2.16	0	3.34	2.78	2.11	3.52	2.21	5.06	3.75
a3p2	4.95	2.32	2.04	2.7	3.53	1.93	4.53	3.85	3.34	0	1.87	3.3	5.37	2.45	4.7	6.34
a3p3	4.33	2.51	1.4	2.52	2.33	1.25	3.12	2.51	2.78	1.87	0	2.22	4.63	2.67	3.82	5.44
a3p4	3.93	2.23	3.2	1.91	2.76	2.57	2.1	1.39	2.11	3.3	2.22	0	2.74	2.46	4.54	3.7
m1	5.03	3.7	5.38	3.56	4.84	4.79	3.52	3.2	3.52	5.37	4.63	2.74	0	3.58	6.23	2.9
m2	4.14	1.73	3.3	1.81	3.53	2.53	3.9	3.2	2.21	2.45	2.67	2.46	3.58	0	5.3	4.86
m3	5.32	5.24	3.75	5.12	3.68	3.82	4.1	4.07	5.06	4.7	3.82	4.54	6.23	5.3	0	5.99
m4	4.06	5.23	6.4	4.3	4.74	5.55	3.18	3.24	3.75	6.34	5.44	3.7	2.9	4.86	5.99	0

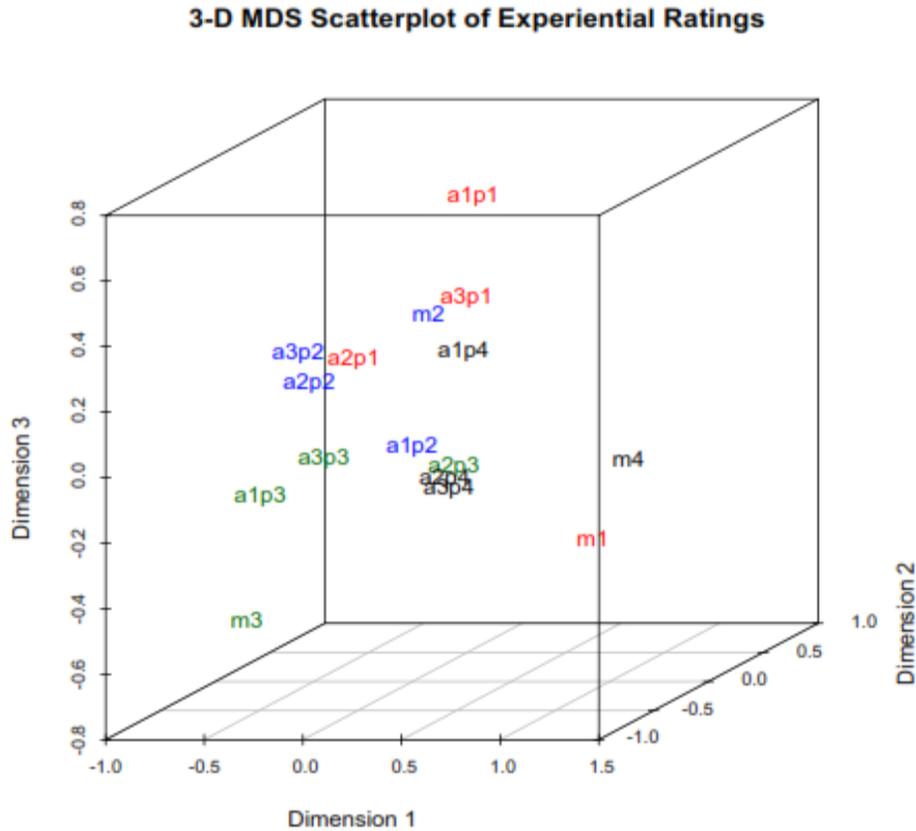


Figure 3-4 A 3-dimensional multidimensional scaling scatterplot based on the experiential ratings.

3.3.3.1 Experiential Rating Ratio

As with the similarity ratings task, ratios were computed to further investigate the relative magnitudes of the creative style and cross-domain interpretation effects in the Euclidian distances obtained from the experiential ratings. As described earlier, the Euclidian distances were computed for all the 16 items displayed in Table 3.25 (i.e., twelve paintings and four musical pieces). In order to compute the ratio, two mean values were computed: (1)

the mean Euclidian distance for the paintings created by same artist (within-artist) (2) the mean Euclidian distance for all the paintings created by the three artists. A creative style (S) ratio was computed by dividing the mean of the within-artist Euclidian distance by the mean of the between-artists painting Euclidian distance. Values less than 1 indicate a creative style effect. A cross-domain interpretation (I) ratio was calculated by dividing the mean Euclidian distance of the correct pairs of paintings and musical pieces divided by the mean Euclidian distance of the incorrect pairs of paintings and musical pieces. Correct pairs were ones where a painting was paired with the musical piece that inspired it. Values less than 1 for this ratio are evidence of a cross-domain interpretation effect. These ratios were computed for each artist and they are provided in Table 3.26.

The cross-domain interpretation effect would show similarities between the psychological experiences of viewing the paintings and listening to the pieces of music that inspired those paintings. On the other hand, a creative style effect would show similarities in the psychological experiences of viewing paintings created by the same artist. The ratio calculations indicated that Artist 1 appeared to have no creative style effect (1.28) and a moderate cross-domain interpretation effect (.69). Artist 2 showed a moderate creative style effect (.80) and a small cross-domain interpretation effect (.94). Artist 3 also shows a low creative style effect (.90) and moderate cross-domain interpretation effect (.81).

Similar ratios were also computed for the MDS coordinates (rather than for the Euclidian distances). These MDS coordinates were used to create the MDS scatterplot for the experiential ratings task and so they provide a better understanding of the MDS scatter plots for each of the artists. The results are displayed in Table 3.26. The ratio calculations indicated that Artist 1 appears to have no creative style effect (1.31) and a moderate cross-

domain interpretation effect (.65). Artist 2 showed a moderate creative style effect (.78) and a small cross-domain interpretation effect (.93). Artist 3 also showed a low creative style effect (.92) and a moderate cross-domain interpretation effect (.77).

Table 3.256 The creative Style Effect Ratio, Cross-domain Interpretation Effect Ratio based on Euclidean Distances and the MDS coordinates.

	Euclidian Distances		MDS coordinates	
	Creative style effect (S) ratio	Cross-domain Interpretation (I) ratio	Creative style effect (S) ratio	Cross-domain Interpretation (I) ratio
Artist One	1.28	0.69	1.31	0.65
Artist Two	0.80	0.94	0.78	0.93
Artist Three	0.90	0.81	0.92	0.77

3.4 Discussion

This study's results provide evidence for the cross-domain interpretation of ideas during the creative process. People were able to perceive a resemblance between the sources of inspiration and the inspired products. Overall, the cross-domain interpretation effect was not found to be consistently strong. One possible reason could be the dominant creative style of individual artists. Overall, the results support Honing theory, indicating that creativity is a manifestation of an individual's worldview. When a creative product is inspired by another artistic work, the artist's worldview undergoes similar cognitive restructuring as that of the artist for the original artistic work, that can lead to stylistic resemblances in the two works of art. I will now discuss how each of the three tasks of identification, similarity rating and experiential rating helped me understand the process of interpreting ideas across domains (i.e., music to painting) from three different aspects.

3.4.1 Identification Task

The current study indicates that in case of the analyses done for each artist, the results were significant for all the artists in Design 1. Hence, the participants were able to identify which paintings were inspired by which musical pieces. In Design 2, only for Artist 3 were the results found to be significant. The results were not significant for Design 5 (see Table 3.26).

When the H and Hu statistics were computed for individual painting, in Designs 1 and 2, the overall essence of the core idea was recognizable when re-expressed in a new domain. Participants identified at above-chance levels the music pieces that inspired the paintings for both Designs 1 and 2 (see Tables 3.4 & 3.5). This indicates that reflections of

the original sources of inspiration were evident in the paintings of the three artists and that participants were able to identify them at above chance levels. The findings also support the hypothesis that when musical pieces are interpreted as paintings, naïve participants are able to identify, at above chance-levels, the musical pieces that inspired the paintings. However, the results were not significant for Design 5, thus indicating only partial support for the guiding hypothesis.

Although, the source of inspiration (i.e., musical piece) and the inspired product (i.e., painting) were from different domains, the essence of the original idea was discernible in the new inspired product. Cross-domain interactions are necessary to allow for the meaningful interpretation of a musical piece as a painting. These results are in line with the previously reviewed studies, which indicate that the source of inspiration is recognizable even when the final creative product and the source of inspiration are in two different domains i.e., auditory and visual (Willmann, 1944; Peretti, 1966). The findings for Designs 1 and 2 provide support for the Honing theory of creativity. As discussed earlier in the chapter, this theory posits that creativity arises as a consequence of the self-mending nature of the worldview of an individual. An individual might draw inspiration from ideas that are not from the domain of his or her expertise. According to the Honing theory, the essence of an idea may exist in a domain-independent form and has the potential to be actualized within the constraints of different specific domains. The self-mending nature of the worldview leads to emotional and cognitive restructuring during the creative process. Since the core idea remains same, the artist who creates a painting inspired by the musical piece will have a similar cognitive restructuring of the worldview as the person who created the musical piece. The viewers could possibly perceive this structural resemblance in the related works.

The experimental task of matching musical pieces to the paintings that were inspired by the musical pieces was novel and complex. The participants had no artistic training and this could explain why they performed only moderately well on the identification task. Although participants in Designs 1 and 2 displayed above-chance levels of correct identifications, the differences between the real hit rates and the randomized hit rates were small. The statistical effect sizes were nevertheless high for reasons explained in section 3.2 of this chapter. Overall, the results were statistically significant in the identification task for Designs 1 and 2. The study might show more accuracy in the identification task and better overall results if we had experts as participants of the study.

In Design 5, the identification task was altered by showing all the twelve paintings together on one screen and by providing an extra option to the participants for selecting ‘none’ when they were not sure which given piece of music had inspired the painting. The presentation of all the paintings together provided an opportunity to simultaneously compare the paintings, hence making the task more challenging for the participants. Unlike the other designs, Design 5 did not have a forced choice task with the four pieces of music as options. The option ‘none’ provided an easy way out to participants when they were not sure of their response. The display of the paintings on one screen made each painting appear in small sizes and participants had to scroll down the screen to see the paintings. There is a possibility that unlike other designs, participants might have found it difficult to notice the details of each painting. The complexity of Design 5, and the option of ‘none’, might be the reason that naïve participants had difficulty accurately identifying the musical inspirations of the paintings.

The results also provide evidence for individual differences in the form of creative style effect of the artists (i.e., some artists have stronger creative style than others). This study also shows how the individual difference in creative style can influence the ability to interpret the musical pieces into paintings. The identification task was found to be more accurate for some artists than others. Based on the individual analysis of the paintings, it was revealed that all the paintings by Artist 2 and three paintings by Artist 3 were identified at above-chance levels (see Tables 3.7 and 3.8). This could be due to differences in the ability of an individual artist to create a work of art inspired by a musical piece. Even though the artists come from similar professional backgrounds, they may have personality variances leading to differences in their creative styles.

Overall, the results of Design 1 were significant for both the analyses for individual artists and as well as for individual paintings. Design 2 showed mixed results. In case of analyses for individual artists the results were non-significant for both Artist 1 and Artist 2. In the other analyses for individual paintings, it was found that only the Hu values were found to significant. The Design 5 had non-significant results in both the analyses for individual artists and for individual paintings. This indicates that overall participants were modestly successful in identifying which paintings were inspired by which musical pieces in Design 1 and Design 2.

The identification task discussed above helped to establish which of the paintings closely resembled the sources of inspiration. In order to further understand how people perceived the resemblances, similarity ratings and experiential ratings tasks were designed to investigate whether the paintings of the same artist were rated similar to each other and whether they produced similar psychological experiences. Another purpose was to

investigate whether the paintings were rated as being similar to the pieces of music that inspired them and whether the paintings and musical inspirations also produced similar psychological experiences.

3.4.2 Similarity Ratings Task

In the similarity task the paintings of Artist 2 were rated similar to each other and similar proximity was observed for the paintings of Artist 3. The paintings of Artist 1 were farther apart in the MDS plot, indicating greater dissimilarity (see Fig 3.2). The paintings of the same artist being rated close to each other indicate a strong creative style of the artist. These findings are in line with the identification task. In other words, this result suggests that since the creative styles of Artist 2 and Artist 3 were recognizable in the paintings they created, the participants rated paintings created by Artist 2 and Artist 3 as very similarly to each other. The closeness in the similarity ratings between the paintings and pieces of music that inspired them are evidence for a cross-domain interpretation effect. Paintings a3p1, a3p2, and a3p3 which were created by Artist 3, were rated similar to the pieces of music that inspired them. Only one painting a2p3, created by Artist 2, did to some extent, reflect the essence of the musical piece (m3) that inspired the painting despite the strong influence of the creative style. Out of the four paintings created by Artist 1, two paintings were rated as relatively similar to the musical pieces that inspired them (a1p2 and a1p3). These results show that the cross-domain aspect of creativity entails an interplay between the personal creative style and the cross-domain transfer of the essence of an idea. While the four paintings of one artist were perceived to be sharing a similar style due to the personal signature of the artist, there was also similarities perceived between some of the paintings

and the musical pieces that inspired them, to the extent that participants were able to identify the musical pieces that inspired the paintings.

In conclusion, the participants recognized reinterpreted content, emotion, and stylistic features, even when an artist's paintings reflected a strong personal signature. Previous studies have indicated that the paintings by artist Paul Klee that were supposedly inspired by a few pieces of music were perceived to be similar to the pieces of music due to the shared emotional value (Peretti, 1966). My study indicates that the effectiveness of the interpretation process and the dominance of the personal creative style of the artist determine the extent to which people are able to perceive similarities between the source of inspiration and the final product. In some cases, the creative style of the artist overshadowed the cross-domain interpretation process (e.g., Artist 2).

3.4.3 Experiential Ratings Task

The purpose of the third task of experiential ratings was to see if the paintings and the pieces of music that inspired them produced similar psychological experiences. The variables used in this task were not just limited to the cross-modal emotion transfer variables (arousal and valence), as described in the circumflex model of affect by Russell (1980). In addition, the list included collative variables (Berlyne, 1970), and other adjectives used in the aesthetic appreciation of art (unpublished honors thesis, Carbett 2012). The purpose of obtaining this list of variables was to have a comprehensive way of measuring the psychological experience of perceiving art and music.

The results were consistent with the results of the identification task and the similarity ratings task. In line with the previous tasks the paintings by Artist 2 produced a similar psychological experience for the viewers and appeared clustered together in the MDS plot.

The paintings a2p2 and a2p1 were close; a2p3 and a2p4 were found to overlap (see Fig 3.3). Hence, the paintings of Artist 2 created similar psychological experiences indicating that the paintings reflected the strong creative style of the artist. On the other hand, the two paintings a2p2 and a2p4 by Artist 2 appear close to the musical pieces that inspired them.

In other cases, paintings inspired by the same musical pieces and created by different artists were closely rated on the experiential ratings, e.g., a3p2 and a2p2 were close; a2p4 and a3p4 overlapped on the MDS scatterplot. The three paintings a3p2, a3p3, and a3p4 by Artist 3 are in proximity to the musical pieces that inspired the paintings. Also, the two paintings a1p2 and a1p3 by Artist 1 and the musical pieces that inspired them produced similar psychological experiences; the paintings produced very dissimilar psychological experiences when compared to each other. Overall, consistently the results show a strong creative style for Artist 2 and a strong cross domain interpretation happening for Artist 3. In order to better understand the interplay of the creative style of the artists and cross-domain interpretation effects, a set of ratios was computed based on the ratings obtained from the similarity and experiential rating tasks.

3.4.4 Ratios

The ratios more precisely describe the two aspects that have been discussed earlier: 1) the creative styles of the artists, 2) evidence for cross-domain interpretations (i.e., interpretation of a musical piece into a painting). The ratios reported in Tables 3.20 and 3.25 provide a way to look at the effects of creative style and the effects of cross-domain interpretation for each of the artists. It was observed that Artist 2 had a strong creative style. The paintings of Artist 2 were rated similar to each other and also produced similar psychological experiences. Interestingly, the cross-domain interpretation effect was found to

be small. This means that even though each of the paintings was inspired by a particular musical piece, participants did not rate those two items as similar, nor did the paintings and musical pieces produce similar psychological experiences. Nevertheless, participants were able to identify the musical pieces that inspired the paintings of Artist 2 at above chance levels. This indicates that despite the dominant creative style of the artist, the cross-domain interpretation effect remained evident enough for people to identify the resemblance between the paintings of Artist 2 and musical pieces that inspired them.

The paintings of Artist 1 reflected a small creative style effect. Also, it was observed in the MDS plots for both similarity ratings and experiential ratings that the paintings of Artist 1 were farther apart (See Fig 3.1, 3.2, and 3.3). However, the cross-domain interpretation effect was found to be large in the case of experiential ratings and moderate in the case of similarity ratings. This denotes that the paintings of Artist 1 produced similar psychological experiences as the pieces of music that inspired those paintings. The paintings were rated moderately similar to the pieces of music that inspired them in the similarity ratings task. The paintings of Artist 1 were accurately matched with the musical pieces that inspired them, at above chance levels.

For Artist 3, it was observed that the creative style effect was moderate for similarity ratings and small for the experiential ratings. These results suggest the possibility that the participants might perceive an overall similarity between the paintings of Artist 3; however, when asked to provide ratings on the description of psychological variables, there were no similarities found in the psychological experiences. Overall, the cross-domain interpretation effect was found to be moderate for Artist 3, for both the similarity ratings task and the experiential ratings task. Hence, the paintings of Artist 3 led to moderately similar

psychological experiences. Also, participants had moderately similar psychological experiences while viewing the paintings of Artist 3 and listening to the musical pieces that inspired the paintings.

These ratios are consistent with previously discussed results. They show the pattern of effects of creative style and cross-domain interpretation observed for all three artists in this study. Overall, the ratios indicate that a strong creative style may overshadow the cross-domain interpretation effect, as for Artist 2, but when the creative style effect was low, the cross-domain interpretation of ideas was more recognizable.

3.4.5 Summary of the Findings

Overall the findings showed that the paintings of all the artists were identified with the music pieces that inspired them at above chance levels. However, when analyzed for similarity, all the paintings were not consistently rated similar to the pieces of music that inspired them. In case of the experiential ratings, it was observed that the sources of inspiration and the inspired products were rated closer to each other i.e., they created a similar psychological experiences. These findings can be explained based on the interplay between the effects of cross-domain interpretation and the creative style of the three artists. The strong creative style of the artist appears to overshadow the closeness perceived between the musical pieces and the paintings inspired by those musical pieces. Also, it might be more difficult for participants to identify similarities between items from different domains (e.g., paintings and musical pieces) than to identify similarities between items from the same domain (e.g., different paintings). There could be a disparity in the participants' experiences when they were asked to provide experiential ratings while experiencing works in the visual

and auditory domains. The results suggest that cross-domain interpretation is a complex phenomenon that requires further investigation.

The current study implies that when the viewers rate a painting and a musical piece similar to each other, they might not perceive similarity based on the psychological experiences but rather based on the way the paintings perceptually appear, mapping the cross-modal features (i.e., brightness to pitch). It seems possible that when participants are trying to identify which musical piece inspired which painting, they are focusing more on the overall similarities between the two items. This is consistent with studies that show that when people make aesthetic preference decisions for which colors should be associated to which musical pieces, they show a systematic associative pattern. These decisions are strongly determined by the emotions common to music and color (Palmer, Schloss, Xu, and Prado-Leon, 2013). The similarity decisions in my study can be related to such cross-modal mapping. However, in the current study, overall the similarities between paintings and the pieces of music that inspired them were not observed to be high.

The results suggest that there is a distinction between the similarity ratings and experiential ratings. The similarity decisions do not seem to be based on the deeper collative, cognitive and emotionally based descriptive variables and other cross-media stylistic features (Berlyne, 1974, Hasenpus, 1975; Russel, 1980; Watson & Tellegen, 1985). It was found that in some cases the strong creative style of the artist overshadowed the reflected essence of the idea from inspiration to the final product. Even though artists with a stronger creative style (i.e., personal signature) may use a source of inspiration to create something new, the essence of the idea linked to the source of inspiration is not strongly reflected in the new creation. This might be due to the urge of the artist to reflect his or her own voice in the creation, and

the fact that they put less emphasis on the source of inspiration and perhaps interpret it in a more personal way.

My study sheds light on two important aspects of artistic creativity: the creative style of the creator and the cross-domain interpretation of ideas. Earlier, Willmann (1944) showed that when abstract designs were used as inspirations for musical compositions, the essence of the abstract designs was carried forward in a recognizable way. Even though the music composed by different composers was quite different, the participants were able to successfully associate the musical pieces with the abstract designs that inspired them. It should be noted that in Willmann's study, abstract line drawing that was not emotionally or aesthetically stimulating was purposefully chosen in order to limit the scope for creative interpretation. This could have limited the scope for the artists to express their personal creative styles in their creations.

On the whole, the present results highlight the significance of cross-domain interactions occurring during the creative process. It suggests a novel way of addressing the domain-specific and domain-general debate on creativity. The creative process can be domain-general at the level of the interpretation of ideas coming from the source of inspiration in another domain. The final creative product might appear very domain specific, but this domain-general process of inspirations, interpretation, and translation of ideas from other domains enriches creativity.

Further research is needed to clarify the extent to which these results can be generalized to domains other than painting and music. Also, there is a general need to better understand what contributes to the psychological experience of art, and the mechanisms underlying cross-domain interpretation of ideas. Suggestions for addressing the limitations of

this study, and for further research, can be found in the concluding chapter of this dissertation. (The reason they are located there is to allow better integration of the discussion of the studies described in Chapter Two and in Chapter Three.)

4 Conclusions

This dissertation makes a contribution to the psychology of creativity by providing a novel and relatively detailed set of studies on how stylistic elements of the creator's worldview and the inspirational stimulus affect creative outcomes. The purpose of this dissertation was to explore two important aspects of the creative process: personal creative style and the cross-domain interpretation of an idea. These were investigated in the domains of music, painting, and creative writing.

The dissertation developed out of the observation that creative individuals wrestle with issues or ideas that are, for them, ill-defined, and these individuals appear to use whatever means available to explore, unravel, and restructure their networks of understandings. Creative expressions develop from the individual seeking to resolve conflicts, fill gaps, and attain consistency within the self-organizing structure of his or her worldview. Individuals go about this in various ways that leave different stylistic traces on the creative outcomes. This transformative process of honing the idea leads to restructuring of the creator's worldview by interpretation, abstraction, and translation of ideas across domains. Ideas may be initiated through contact with various inspirational sources or through life experiences, and be manifested in domains that are distant from the original sources of the ideas. In this way, the creative output may go beyond the domain of the original inspirational source; the individual may capture the essence of the expression and re-express in another domain and this original essence is recognizable by others. Also, the personal style of the artist, who is creating the new piece of work, may get reflected in the work of art.

As discussed in Chapter One, several previous theories of creativity cannot account for both the recognizability of personal creative styles and the translatability of creative ideas

across domains. In these theories, creativity is typically portrayed as a process of generating, exploring, and selecting amongst candidate ideas that are assumed to already exist in discrete, well-defined states (e.g. Darwinian theory). Most theories of creativity do not explicitly incorporate the vagueness or ill-defined nature of recently born ideas, or the complementary notion of the potentiality of an idea to manifest in different ways. This potentiality of an idea actualizes given different media or different means the creator might have at his or her disposal. This notion of ideas evolving through a process of context driven “actualization of potentiality” is central to the Honing theory of creativity. Creative ideas are viewed as manifestations of the self-mending and self-organizing nature of the worldview. Creative individuals are more comfortable with ambiguity (Zenasni, F., Besançon, M., & Lubart, T., 2008), and therefore they tend to allow ideas to remain in an ambiguous state until a consistent and satisfying way of expressing them is found. In this ambiguous state, an idea may shed its domain-specific attributes while retaining its domain-independent core. The uniqueness of the worldview is reflected in the personal signature or creative style of the individual and it may be seen in all that he or she creates.

The creative style of the creator is reflected not just within their domain of expertise but also across domains, hence, there is a possibility that ideas may also cross domains. The creator may take inspiration from one domain and manifest it into a final product in another domain. The ideas may be constantly evolving as these cross-domain interpretations occur but the final creative product typically emerges within the constraints of a specific domain. Hence, creative ideas are to some extent domain-independent. An ill-defined idea may, for instance, arise out of the attempt to, for instance, solve a problem, reconcile seemingly incompatible views, or improve an existing design to make it more functional or aesthetically

pleasing. During this process of working on the original crude idea, which might be later actualized appropriately in completely different domains from the original source of the idea, the individual's worldview gets restructured in a unique way. This might lead to the personal creative style being reflected in the creation, as it is the manifestation of a unique worldview. Also, not just personal style but the inspiration of the work suggests some association of the new product to the source of inspiration, even though the source of inspiration and the new product were from different domains. Both the personal creative style of the individual and the association of the new product with the source of inspiration are recognizable.

More specifically this dissertation investigated two cross-domain aspects of the creative process. The first set of studies, discussed in Chapter Two, investigated whether personal creative styles or personal signatures are recognizable within and across-domains. Art students were shown two sets of paintings, the first by five famous artists, and the second by their art student peers. For both sets, they guessed the creators of the works at above-chance levels. Similarly, creative writing students guessed at above-chance levels which passages were written by which of five famous writers, and which passages were written by which of their writing student peers. When creative writing students were asked to produce works of art, they guessed at above-chance levels which of their peers produced which artwork. Finally, art students who were familiar with each other's paintings were asked to produce non-painting artworks. They guessed at above-chance levels which of their peers produced which non-painting artwork. These findings support the hypothesis that creative styles are recognizable not just within but also across domains.

This implies that creative style reflects something deeply intrinsic to the individual as opposed to reflecting solely the constraints and affordances of the particular domain he or she

happens to have chosen. The findings are consistent with the Honing theory of creativity according to which the creative process arises from the creator's drive to mend or elaborate his or her worldview in the face of new perspectives or challenges. The theory suggests that an individual's creative outputs are expressions of a unique internal model of the world (i.e., a uniquely structured and self-organizing worldview); hence, the creative style or personal signature of the creator can cross domains and is not limited to the primary area of expertise.

The next study, reported in Chapter Three, investigated the interpretation of ideas from the domains of music to painting and examined the factors that might lead some artists to have a stronger sense of personal creative style than others. The impact of the source domain on the final product was compared and contrasted with the impact of the personal creative style of the artist on the final product. I found that, generally, the extent to which a connection is perceived between the inspirational source and the final product is inversely proportional to the extent to which the personal signature of the artist is recognizable. This suggests that while some individuals are more inclined to act as a conduit for the faithful cross-domain expression of the creative ideas they encounter, other individuals pay less attention to external stimuli and instead aim to express elements of their internal worldviews, including their own stylistic inclinations, in their creative works.

I investigated how well people were able to recognize which works of art were inspired by which pieces of music. Three expert painters created four paintings, each of which was the artist's interpretation of one of four different pieces of instrumental music. Participants were able to identify which paintings were inspired by which pieces of music at statistically significant, above-chance levels. The findings support the hypothesis that the impetus for a creative act can come from a source that is not specific to, and that is deeper

than, knowledge of the tools and techniques of a specific domain. The findings are consistent with the notion that creative ideas can exist in an at least somewhat domain independent state of potentiality and become more well defined as they are actualized in accordance with the constraints of a particular domain. Even though the paintings of all the artists were identified at above chance levels, it should be noted that real effect sizes were small, indicating rather modest performance on the identification task.

I also investigated whether participants were able to assign similar experiential ratings and similarity ratings to paintings and the pieces of music that inspired them. I also explored the similarity ratings and experiential ratings between paintings and pieces of music. The study showed that the extent to which people are able to perceive similarities between the paintings and the pieces of music that inspired them was determined by the effectiveness of the interpretation process and the dominance of the personal creative style of the artist. The results indicate that when the paintings by some artists were rated as similar to each other, there was less reflection of the musical inspirations in the artworks (i.e., the paintings were rated less similar to the music that inspired them). There were cases where the creative style of the artist overshadowed the cross-domain interpretation process (e.g., Artist 2).

Similar findings emerged for the experiential ratings, indicating that paintings by artists with strong creative style produced similar psychological experiences to each other. In the paintings influenced by cross-domain interpretation effects, i.e. when the musical pieces that inspired the paintings were easily identifiable, the paintings produced similar psychological experiences to the musical pieces that inspired them. The results of similarity ratings and experiential ratings for the paintings were consistent.

These findings suggest that creative expression is a manifestation of the creator's worldview and, hence, the reflection of personal style. However, the creator interacts with the outer world from where he or she might get inspiring ideas. Such cross-domain interactions may initiate a restructuring of the worldview in a unique way. This restructuring occurs while working on the idea; for instance, the process of composing a musical piece restructures the worldview of the composer. Later, an artist may be inspired by the same musical piece and create a painting. Since the painting is inspired by the musical piece, this encounter may restructure the worldview of the painter in a way that is similar to that of the composer. When a viewer looks at that painting and listens to that musical piece he or she can perceive some connection between the two due to the structural resemblance of the worldviews that manifested the two products in completely different domains. Simultaneously, the influence of the creator's personal creative style is reflected in the final products. There may be differences in the degrees to which personal creative styles are reflected in the artworks of different artists. Creative individuals may be inspired by a creative product in one domain and attempt to express it within the constraints of another domain. The core ideas remain domain-independent and recognizable, at least to some extent. There might be instances where the effect of personal creative style overshadows the effect of a cross-domain interpretation or vice versa. The studies presented in this dissertation provide evidence of cross-domain interactions. The studies are consistent with the view that creative inspirations or interests can arise from multiple and varied external and internal interactions and are not just dependent on a particular set of domain-specific tools.

4.1 Limitations

The results of studies discussed in Chapter Two support the hypothesis that the creative process to some extent involves the cross-domain interpretation of ideas. In the process of carrying out these studies, ideas arose for how to improve studies of this kind. I believe that the hypotheses would be even more strongly supported if the procedures were slightly modified in a number of respects. If I were to carry out a study like this again, I would use participants who were experts in both music and painting, since that would make viewers more aware of the cross-modal mappings and subtle translations from one domain to another due to domain specific training. It may be that, although the capacity to meaningfully express oneself and reflect a personal signature is not just restricted to a domain in which one has expertise, it is nevertheless enhanced through the acquisition of domain-specific skills.

The generalizability of the results is subject to certain limitations. First, the current studies involved only a few artistic domains. It is possible that we would find variation in the results if analogous procedures were carried out in other domains. For example, the cross-domain interpretations might be less evident if they occurred between domains such as technological invention and music, as there might be less scope for cross-modal mapping. In a less extreme example, such as the interpretation of ideas from music to writing, there might be more gist-based processing than item-based processing (e.g., the mood of music is more likely to be represented in the form of writing and individual words are less likely to match features such as tempo). Hence, naïve viewers might less readily detect cross-domain interactions. However, it is possible that there would still be cross-domain interactions in terms of the mood-based, social, and cognitive variables.

Another limitation of this work is that the participants of the studies, described in Chapter Three were undergraduate psychology students with no artistic training. It is possible that the results of the experiential ratings task would have been more strongly correlated with the similarity task and the guessing task if the participants had some expertise in the areas of painting and music. These naïve participants could have been guessing the connection between the paintings and musical pieces based on overall similarity, and not explicitly thinking of experiential variables as they rated the paintings and musical pieces.

4.2 Suggestions for Future Research

Previous studies have shown that the aesthetic judgments of experts are different from those of naïve participants while viewing buildings (Purcell, 1984), drawings (Getzels & Csikszentmihalyi, 1976) and paintings (Schmidt, Mclaughlin & Leighton, 1989). The current studies could be replicated with three groups of participants: 1) those with visual arts training, 2) those with musical training, and 3) those with both musical and visual arts training. This would help determine whether expert viewers are better than naïve viewers at recognizing the source of inspiration of an artwork. This would also help determine whether there are significant differences in the similarity ratings and experiential ratings, when the viewer's expertise is in the source domain versus the target domain.

An interesting direction for further research into the cross-domain recognition of personal creative style would be to investigate the underlying cognitive mechanisms. The common-coding theory of action-perception suggests a possible explanation based on action simulation. The theory proposes that there is common symbolic representation of an action, its perception, and its imagination, such that any one of these movement representations can automatically trigger the other two (Prinz, 1997). Research has shown that people are able to

recognize their own dynamic trace in situations, such as clapping (Falch, Knoblich & Prinz, 2004), and characteristic hand movements while playing a piano (Repp & Knoblich, 2004). Taking this line of research a step further, these findings suggest that, when others who are highly familiar with the work of a particular individual recognize their personal creative style, there is a domain-independent pattern or symbolic representation that underlies the individual's work.

The common coding hypothesis could at least partially account for the ability to re-interpret ideas across domains, and to recognize the essence of an idea after it has been re-interpreted. Moreover, it could also provide an explanation for how it is possible to recognize dynamic inspirational sources (such as music) from static traces (such as paintings). This hypothesis could be tested by designing a study with two conditions, one showing a time-compressed video of the artist drawing, and the second showing the final product of the drawing. If common-coding theory suggests the mechanism underlying the recognizability of creative style, then in the time-compressed video condition the participants would have more opportunity to mentally simulate the action of the artist. Therefore, the participants would be expected to show better recognition of personal signatures.

The studies reported in Chapter Three demonstrated cross-domain interpretation across just two domains and with a limited number of artists. Replicating the current study with other domains (e.g., writing, sculpture, and dance) would help determine whether there are domain-specific differences arising from the source. This would help us obtain a richer understanding of the psychological phenomenon of cross-domain abstraction across different artistic domains. Also, using a larger pool of artists for the initial creation of the stimuli

might help us better understand the role of individual differences and distinct personal signatures in cross-domain interactions.

To determine the extent to which color-sound association plays a role in recognizing which musical pieces inspired which paintings, the original study reported in Chapter Three could be replicated with two sets of stimuli: (1) normal pencil sketches without color, and (2) sketches made with colored pencils. If lack of color does not hinder performance (i.e., identifying the source of inspiration), then this would suggest that it is other variables, such as lines, forms, and shadings that facilitate the interpretation process.

In conclusion, the claims that creativity is domain-specific may be an artifact of looking primarily at rare examples of highly accomplished creative individuals. In fact, creativity is a manifestation of our internal worldview and the creative style of the artists can be recognizable across domains. Creative ideas may remain to some extent domain independent. This dissertation sheds light on two important domain-general aspects of the creative process: personal style and cross-domain interpretation of ideas. The findings of this dissertation have a number of important implications for future practice. This research has implications for understanding the creative development of an individual. The findings reveal that personal signature can be recognizable across domains and creative expression might not be confined to one domain. The fact that the source of inspiration can come from a distant and independent domain has implications for viewing creativity not solely or even primarily as a talent-dependent domain-specific construct or an avenue to the generation of products of immediate tangible value. Instead, individuals might creatively express themselves in several areas that might therapeutically restructure the worldview of the individual to resolve

conflicts. This process of cognitive restructuring of the worldview might contribute to the creative development and wellbeing of the individual.

The cross-domain aspect of creativity has a potential therapeutic value as a form of self-expression and an exploration of one's interests and personal style. Art therapy has been considered useful for regulating mood and managing anxiety (DePetrillo & Winner, 2005, Kimport & Robbins, 2012, van der Venet & Serice, 2012). Similarly, expressing through music and writing has both mental and physical health benefits (Gadberry, 2011, Ghetti, 2013, Fernandez & Paez, 2008, Baikie & Wilhelm, 2005). By better understanding that creative ideas in one domain can constitute sources of inspiration in other domains, we can more fully tap into the wellspring of creative possibilities that exists around and within us.

These findings about the inspiration and cross-domain translation of ideas have implications for education. The evidence for the domain-general interactions in the creative process suggests that creation in a particular domain can be enriched with inspiration, abstraction, and interpretation of ideas from other domains. This can be applied in the field of education to explore the potentiality of the students. The more opportunities students have to draw inspiration from diverse environments, the greater the extent to which they gain an understanding of the learning task at hand. There is research that supports the effectiveness of cross-domain learning; for instance, multicultural exposure has been correlated with better creative performance (Leung, Maddux, Galinsky, & Chiu, 2008). It is possible that exposure to diverse situations, or encounters with different domains, may cause individuals to experience initial discomfort, anxiety and/or conflict due to the absence of familiarity. However, this initial discomfort may lead to the honing of ideas and restructuring of the

worldview to resolve the conflicts and attain stability. This transformative process could facilitate creative expressions.

The present research provides a way of empirically testing these cross-domain aspects of creativity, giving evidence for the creative inspiration and unique personal style underlying the creative works, aspects that are recognizable in different forms, both within and across creative domains.

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Appendices

Appendix A: Examples of non-painting artworks used in study three, Chapter

Two

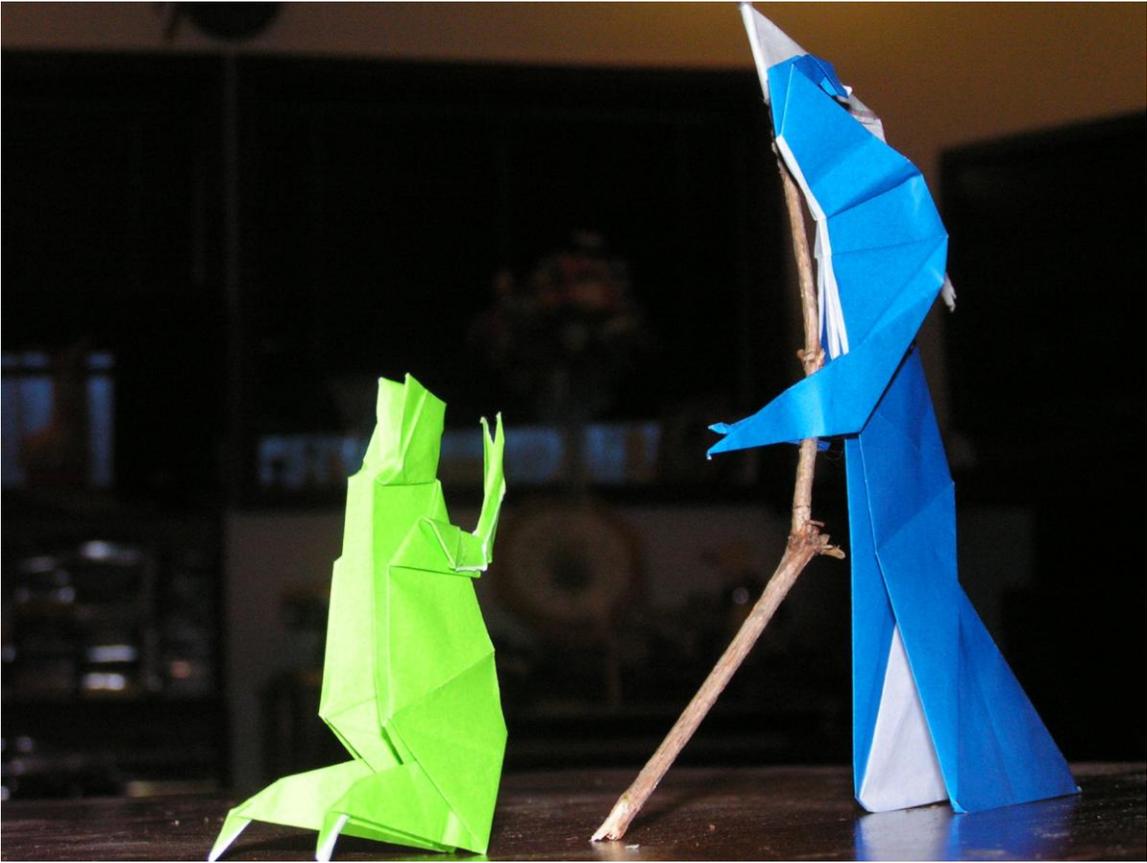
1. Jewelry



2. Wall hanging



3. Paper art



4. Pottery



Appendix B: Consent form, demographics, used in phase two, Chapter Three



Informed Consent Request

The purpose of this study is to understand how the creative process works. It will take approximately 30 minutes to complete.

You will see paintings and listen to four pieces of music. You will then guess which piece of music inspired which painting, and rate the similarity between the painting and music.

Taking part in this research study is completely voluntary. You are free to withdraw at any point and you must be 18 to participate. There are no potential risks to participating in this study. The potential benefit is enhanced knowledge about creativity.

All information that you provide will be kept strictly confidential. This research study has been approved by the Behavioural Research Ethics Board at the University of British Columbia, Canada. Results of this project may potentially be presented at a conference or included in an article that is submitted for publication in an academic journal. Your name will not appear anywhere in the article, and it will be impossible for anyone to identify you as a participant. The only people who will have access to the data and computer files will be the principle investigator of the project and her research assistant. If you have any questions or desire further information about this procedure, you can contact one of the principal investigators of this project: Aparajita Ranjan (apara.ranjan@ubc.ca) or Dr. Liane Gabora (liane.gabora@ubc.ca). If you have any concerns about your treatment or rights as a research subject, you may contact the Research Subject Information Line in the UBC Office of Research Services at 604-822-8598 or send an e-mail to RSL@ors.ubc.ca.

By clicking on the button below you are agreeing to participate in this study.

Click 'I agree' to indicate your consent and start the experiment.

I AGREE 



Demographics

Please complete the demographics below.

Your gender :

Your Age :

What is your academic/professional training in the Visual Arts?

What is your academic/professional training in Music?

[NEXT](#)

Appendix C: Design 1- Identification Task (Instruction and sample pages)



Welcome to our Study

Cross-Domain Translations of Ideas

Instructions

One painting and a piece of music will appear on the screen at the same time. Please look at the painting and listen to the piece of music. You will be asked to rate how similar the painting is to the piece of music on a five point Likert scale.

In total, you will see 12 paintings and listen to 4 pieces of music. Each piece of music is 3 minutes long.

[NEXT](#) 



Question 1 of 12

Question 1

Listen to each piece of music and then select which piece of music you feel was used as the inspiration for the painting on the left



Click on the button to select the music

Music 1 :

Music 2 :

Music 3 :

Music 4 :

NEXT



Question 6 of 12

Question 6

Please listen to the music and look at the painting given below. Rate how similar the painting is to the piece of music on a five point Likert scale.



(Music 1)

completely similar

somewhat similar

neutral

somewhat dissimilar

completely dissimilar

NEXT

Appendix D: Design 2 - Identification Task (Instruction and sample pages)

Similar instruction page was provided for each of the three parts of this design.



Welcome to our Study

Cross-Domain Translations of Ideas

Part 1 Instructions

One painting and a piece of music will appear on the screen at the same time. Please look at the painting and listen to the piece of music. You will be asked to rate how similar the painting is to the piece of music on a five point Likert scale.

In total, you will see 12 paintings and listen to 4 pieces of music. Each piece of music is 3 minutes long.

*Note: This survey works best with Internet Explorer, Firefox, and Chrome. If you encounter any problems listening to the music please check if you need to upgrade your flash plug-in

[NEXT ▶](#)

Similar pages were provided for each of the three parts of this design.

Question 13 of 16

Question 13

Please listen to the music and look at the painting given below. Rate how similar the painting is to the piece of music on a five point Likert scale.



(Music 2)

completely similar

somewhat similar

neutral

somewhat dissimilar

completely dissimilar

NEXT 



Question 16 of 16

Question 16

Please look at the painting and listen to the music given below. Rate how similar the painting is to the piece of music on a five point Likert scale.



(Music 2)

completely similar

somewhat similar

neutral

somewhat dissimilar

completely dissimilar

NEXT

Appendix E: Design 3 - Similarity Ratings Task (Instruction and sample pages)



Welcome to our Study

Similarity Ratings

Part 1 Instructions

Two paintings will appear on the screen at the same time. Please look at the paintings and rate how similar the paintings are to each other on a five point Likert scale.

*Note: This survey works best with Internet Explorer, Firefox, and Chrome. If you encounter any problems listening to the music please check if you need to upgrade your flash plug-in.

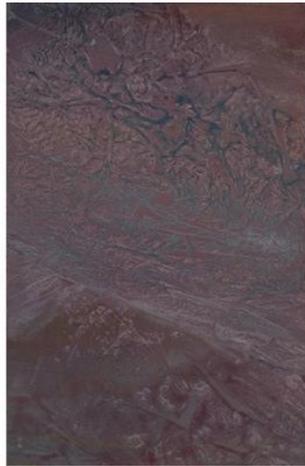
[NEXT](#) 

(Painting-painting pair rated for similarity)

Question 15 of 66

Question 15

Please look at the two paintings given below. Rate how similar the two paintings are on a five point Likert scale.



completely similar

somewhat similar

neutral

somewhat dissimilar

completely dissimilar

NEXT 



Question 65 of 66

Question 65

Please look at the two paintings given below. Rate how similar the two paintings are on a five point Likert scale.



completely similar

somewhat similar

neutral

somewhat dissimilar

completely dissimilar

NEXT

(Music-music pair rated for similarity)



Part 1 is Complete!

Instructions for Part 2:

Two audio files of music will appear on the screen at the same time. Please press the play button to listen to the two pieces of music and then rate how similar the pieces of music are to each other on a five point Likert scale

Please click "next" to begin the part 2 of the study.

NEXT 

(Music-music pair rated for similarity)



Question 6 of 6

Question 6

Please listen to the two pieces of music given below. Please press the play button in order to listen to the music one at a time. After listening to the two pieces please rate how similar the two pieces of music are to each other on a five point Likert scale.

Music 2 :

completely similar

somewhat similar

neutral

Music 3 :

somewhat dissimilar

completely dissimilar

NEXT

Appendix F: Design 4 - Similarity Ratings Task (Instruction and sample pages)



Welcome to our Study

Similarity Study

Instructions

One painting and a piece of music will appear on the screen at the same time. Please look at the painting and listen to the piece of music. You will be asked to rate how similar the painting is to the piece of music on a five point Likert scale.

In total, you will see 12 paintings and listen to 4 pieces of music. Each piece of music is 3 minutes long.

*Note: This survey works best with Internet Explorer, Firefox, and Chrome. If you encounter any problems listening to the music please check if you need to upgrade your flash plug-in

[NEXT ▶](#)



Question 3 of 48

Question 3

Please listen to the music and look at the painting given below. Rate how similar the painting is to the piece of music on a five point Likert scale.



(Music 1)

completely similar

somewhat similar

neutral

somewhat dissimilar

completely dissimilar

NEXT



Question 1 of 48

Question 1

Please listen to the music and look at the painting given below. Rate how similar the painting is to the piece of music on a five point Likert scale.



(Music 3)

completely similar

somewhat similar

neutral

somewhat dissimilar

completely dissimilar

NEXT

Appendix G: Design 5 - Identification Task (Instruction and sample pages)



Welcome to our Study

Paintings and Music

Part 1 Instructions

You will see twelve paintings and listen to four pieces of music. You will be asked to identify which painting is inspired by which piece of music.

*Note: This survey works best with Internet Explorer, Firefox, and Chrome. If you encounter any problems listening to the music please check if you need to upgrade your flash plug-in.

[NEXT](#) 



a place of mind

THE UNIVERSITY OF BRITISH COLUMBIA

Okanagan Campus

Please listen to each piece of music and identify which piece of music (if any) inspired each of the paintings displayed below. You can make your selection by selecting the option in the drop-down box provided under each painting. You may click on an image to view a larger version of it.

Music 1 :

Music 2 :

Music 3 :

Music 4 :



Select Music

Select Music

Select Music

Select Music



Select Music

Select Music

Select Music

Select Music



Select Music

Select Music

Select Music

Select Music

Appendix H: Design 6 - Experiential Ratings Task (Instruction and sample pages)



Welcome to the Study

Art Appreciation: Experiential Variable Ratings

Instructions

A painting or piece of music will appear on the screen. Below the painting or piece of music you will see some statements about the painting or the piece of music respectively. Please look at the painting or listen to the music and rate how much you agree with the statements about the painting/music.

*Note: This survey works best with Internet Explorer, Firefox, and Chrome. If you encounter any problems listening to the music please check if you need to upgrade your flash plug-in.

[NEXT ▶](#)



Question 1 of 8

Question 1

Please look at the painting given below. Please rate how much you agree with the following statements about this painting. Please select one of 5 options to rate your agreement (1- strongly agree, 2- somewhat agree, 3- not sure, 4- somewhat disagree, 5- strongly disagree)



	strongly agree	somewhat agree	not sure	somewhat disagree	strongly disagree
1. The painting is annoying.	<input type="radio"/>				
2. The painting is distressing.	<input type="radio"/>				
3. The painting makes me fearful.	<input type="radio"/>				
4. The painting makes me nervous.	<input type="radio"/>				
5. The painting makes me jittery.	<input type="radio"/>				
6. The painting makes me anxious.	<input type="radio"/>				
7. The painting makes me feel enthusiastic.	<input type="radio"/>				
8. The painting makes me elated.	<input type="radio"/>				
9. The painting makes me excited.	<input type="radio"/>				
10. The painting is euphoric.	<input type="radio"/>				

- | | | | | | |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 11. The painting is lively. | <input type="radio"/> |
| 12. The painting is peppy. | <input type="radio"/> |
| 13. The painting is abstract. | <input type="radio"/> |
| 14. The painting is complex. | <input type="radio"/> |
| 15. The painting is thought-provoking. | <input type="radio"/> |
| 16. The painting is mind-blowing. | <input type="radio"/> |
| 17. The painting is absurd. | <input type="radio"/> |
| 18. The painting is beautiful. | <input type="radio"/> |
| 19. The painting is captivating. | <input type="radio"/> |
| 20. The painting is delightful. | <input type="radio"/> |
| 21. The painting is intolerable. | <input type="radio"/> |
| 22. The painting is disturbing. | <input type="radio"/> |
| 23. The painting is strong. | <input type="radio"/> |
| 24. The painting is dominating. | <input type="radio"/> |
| 25. The painting is powerful. | <input type="radio"/> |
| 26. The painting is deep. | <input type="radio"/> |
| 27. The painting is profound. | <input type="radio"/> |
| 28. The painting is unique. | <input type="radio"/> |
| 29. The painting is creative. | <input type="radio"/> |
| 30. The painting is bold. | <input type="radio"/> |
| 31. The painting is rough. | <input type="radio"/> |
| 32. The painting is raw. | <input type="radio"/> |
| 33. The painting is orderly. | <input type="radio"/> |
| 34. The painting is polished. | <input type="radio"/> |
| 35. The painting is predictable. | <input type="radio"/> |

[NEXT](#) 



Question 7 of 8

Question 7

Please listen to the music given below. Please rate how much you agree with the following statements about this piece of music. Please select one of 5 options to rate your agreement (1- strongly agree, 2- somewhat agree, 3- not sure, 4- somewhat disagree, 5- strongly disagree)

(Music 4)

	strongly agree	somewhat agree	not sure	somewhat disagree	strongly disagree
1. The music is annoying.	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. The music is distressing.	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. The music makes me fearful.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. The music makes me nervous.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. The music makes me jittery.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. The music makes me anxious.	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. The music makes me feel enthusiastic.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. The music makes me elated.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. The music makes me excited.	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. The music is euphoric.	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. The music is lively.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. The music is peppy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
13. The music is abstract.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
14. The music is complex.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
15. The music is thought-provoking.	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. The music is mind-blowing.	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. The music is absurd.	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. The music is beautiful.	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. The music is captivating.	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. The music is delightful.	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. The music is intolerable.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. The music is disturbing.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
23. The music is strong.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
24. The music is dominating.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
25. The music is powerful.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
26. The music is deep.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
27. The music is profound.	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
28. The music is unique.	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
29. The music is creative.	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
30. The music is bold.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
31. The music is rough.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
32. The music is raw.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

- 33. The music is orderly.
- 34. The music is polished.
- 35. The music is predictable.

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

NEXT 

Appendix G: List of terms used

Terms	Definitions
Ekphrasis	Artistic expression in which one medium of art tries to relate to another medium by defining and describing its essence and form.
Cross-media Style	An artistic style that can be demonstrated by works of art in more than one medium. For example, the term <i>rococo</i> is applied to the painting, sculpture, literature, and music of that period.
Collative variables	A set of stimulus properties in the objects of perception such as complexity, novelty, surprisingness, and incongruity.
Worldview	An individual's internal model of the world, as well as one's values, attitudes, predispositions, and habitual patterns of response..
MDS	Multidimensional scaling (MDS) is a set of methods that allows to visualize how near points are to each other for many kinds of distance or dissimilarity metrics and can produce a representation of the data in a small number of dimensions.
H	A simple hit rate (H) is the proportion of correct guesses. Although intuitively meaningful, simple hit rates should be corrected for chance guessing and for response bias, such as the tendency to use particular response categories more or less than other response categories.
Hu	An unbiased hit rate (Hu), that corrects for chance guessing and for response bias.
ICC	The intraclass correlation coefficient (ICC) is a measure of the reliability of measurements or ratings. It was used to assess the inter-rater reliability.