DESIGNING WEBSITES AND COMPOSING MUSIC: IDENTIFYING USABILITY CONSTRUCTS AND THEIR NOMOLOGICAL NETWORKS

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ABSTRACT

Website usability is reported to have crucial effects on online purchases, but few theoretical models thoroughly examine these effects. In this article, music composition theory is adopted to propose a theoretical model of website usability, based on the belief that composing good music is similar to designing a usable website. Nomological networks between three constructs of music (melody, harmony, and rhythm), cognitive and affective appraisals, and online purchase intention were examined. A field study was conducted to validate the psychometric properties of measurement items and the nomological networks for the proposed model. The study results demonstrate that the proposed model successfully explains a large amount of variance of the effects of website usability on online purchases and thus can be considered as an alternative theoretical model of website usability.

Keywords: website usability, music composition theory, online purchasing

1. Introduction

> *Many empirical studies of website usability had no theoretical orientations. Data are collected, but no underlying model or theory of the process exists to be confirmed or refuted. Such a theory would be very useful because there are too many alternative proposals to test by trial and error. A strong theoretical model could reduce the set of plausible alternatives to a manageable number for testing.*
>
> -[Zhang & von Dran 2002, p. 11]

Researchers and practitioners [Green & Pearson 2011; Karimov et al. 2011; Wells et al. 2011] have expended a considerable amount of time and money to develop usable websites where customers search, navigate, indirectly touch, feel or experience products or services before actual purchases. However, it has been reported that current websites still contain numerous usability problems including difficulty in navigation, disorientation, lack of interaction and reliability, lack of professionalism (e.g. low-quality images), irrelevant content, difficulty in reading text (e.g. different fonts, typefaces) and learning functionality (e.g. inconsistent design structures) [Lee & Kozar 2012; Treiblmaier & Pinterits 2010; Tan et al. 2009; Tung et al. 2009]. Customers have not overwhelmingly gravitated to online purchases [Casalo et al. 2008] and thus online sales still represent only seven percent of all retail sales in the U.S. [Forrester Research 2009].

There are many reasons for poorly designed websites, but this study focuses on the lack of theoretical models to guide website usability. Although such models could explain and predict the effects of web design factors on online customer perceptions and behaviors, very few theoretical frameworks exist in the electronic commerce literature [Lee & Kozar 2009]. A researcher lamented on this lack of attention, noting that "many design principles have been proposed in the cause of development and evaluation of websites. However, these principles generally lack a strong theoretical background, suggesting several principles based on existing practices with no explicit theoretical constructs" [Lee & Kim 2002 p. 130].

Given this background, the primary goal of this study is to propose a theoretical model of website usability based on music composition theory. Music composition theory [Slonimsky & Kassel 1998], defined as the study of how music is put together, provides a means of composing ear-pleasing music by appropriately combining the three major musical components of *melody*, *harmony* and *rhythm*. These three components are building blocks of music and how they are arranged determines the color, texture, and form of every musical composition [Wright 2000]. Music composition theory has successfully explained humans' attitude formation and behaviors toward and caused by music [Albert & Bell 2002; Bruner 1990]. The theory is appropriate as a theoretical framework of website usability in that (1) like a website designer, a music composer creates music that can influence both a consumer's feeling and perception;(2) like online consumers, music listeners develop their preference to music by integrating an evaluation developed while listening to each piece (i.e., bar or measure) of a song to an evaluation that is developed while listening and creating an impression of the entire song; and (3) like a usable website, well-composed music is a powerful stimulus which develops both cognitive and affective appraisals that then motivates human behaviors [Dowling 1999].

In summary, this study proposes and tests a theoretical model of website usability based on music composition theory, assuming that a website designed by mingling a relevant amount of melodious, harmonious, and rhythmical website design components can invoke a positive attitude in online customers toward a website that would trigger online purchases.

2. Research Background and Hypotheses Development

2.1. Previous Studies Proposing Theoretical Models of Website Usability

As e-business sites explosively have grown and the web has become a dominant interface, usability researchers have applied basic usability principles to the web environment and developed web-specific usability metrics, guidelines, tools, and techniques [Kim et al. 2002; Loiacono et al. 2007; Palmer 2002; Tung et al. 2009; Venkatesh & Agarwal 2006]. Web usability refers to the extent to which web sites can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of website use [Agarwal & Venkatesh 2002, p. 170]. A number of studies on website usability have been conducted to assess its influence on online customer perceptions and behaviors, classified into two categories: (1) identification and measurement of website usability factors and (2) development and testing theoretical models of website usability.

Both researchers and practitioners have first attempted to identify and develop website usability constructs. For example, researchers in the human-computer interaction field [e.g., Gehrke & Turban 1999; Schubert & Selz 1999] have proposed multiple usability factors to conduct an objective assessment of website design quality including page loading, navigation efficiency, download time, successful search rate, error rates, task completion time, and frequency of cursor movement. Meanwhile, arguing that website usability is not intrinsically objective in nature, but rather is closely related with an online consumers' subjective perception of a website through interaction with the site, IS researchers [e.g., Loiacono et al. 2007] proposed subjective measures of website usability including consistency, interactivity, relevance, ease of understanding, learnability, trust, and readability. Several website design experts [e.g., Nielsen 2000; Spool 1999] and companies (e.g., Microsoft, Webby awards) also proposed website usability constructs based on their intuition and web design experiences. For example, Microsoft suggested a usability guideline (called Microsoft Usability Guidelines) with five usability factors including content, ease-of-use, promotion, made-for-the-medium, and emotion.

Recently, researchers have proposed theoretical models of website usability [Kim et al. 2002; Singh et al. 2005; Venkatesh & Agarwal 2006]. The models proposed usability constructs based on their theoretical postulations and nomological networks between them and online customer perceptions and behaviors. For example, Venkatesh and Agarwal [2006] adopted the Microsoft Usability Guidelines (MUG) and proposed a website usability model measuring website design quality. They examined the relationship between those factors and website use. Based on the analogy of websites as buildings, Kim et al. [2002] adopted a theory of architectural quality to measure the architectural quality of a website utilizing firmness, convenience, and delight. They found how these factors affect online customer satisfaction and loyalty. Finally, Singh et al. [2005] developed a theoretical model of website usability based on Kaplan's landscape preference model with factors including coherence, legibility, mystery, and variety that affect preference toward a particular landscape. Although these theoretical models provide valuable insights to understand the effect of website usability on online customers' perceptions and behaviors, more efforts are needed to develop a theoretical model that provides richer understanding related to website usability in that (1) they narrowly defined and measured the website usability primary focusing on design effectiveness, not examining broader aspects of website usability including efficiency and satisfaction; (2) they have as their primary purpose to specify metrics, but do not identify the nomological networks between endogenous and exogenous variables of website usability. In particular, there was lack of investigation on the relationship between website usability

constructs and cognitive and affective appraisals. (3) Despite that online consumers evaluate website design quality by incorporating both molar-level ('a high-level, abstract usability perception toward a website') and molecular-level usability ('a low-level, concrete, and tangible usability perception toward a website') [Singh et al. 2005], previous studies put limited attention on molar-level usability factors as well as the relationship between molecular and molar-level usability factors. Given these limitations, this study attempts to propose and test a theoretical alternative of website usability that examines the nomological networks associated with three molar-level music composition variables and seven usability constructs as well as investigates their influence on both cognitive and affective appraisals.

2.2. Relation between Usable Website Development and Music Composition

Music is commonly defined as "the art of organized sound, the purpose of which is to elicit an aesthetic and cognitive response in listeners" [Kellaris & Kent 1994]. Building a usable website is similar to composing good music in that both intend to provide a satisfying experience for the target audience [Kim et al. 2002]. That is, just as a usable website creates a favorable attitude and increases stickiness, revisit rates, and online purchases [Becker & Mottay 2011], well-composed music is an effective means for triggering emotions, brain processing, nonverbal communication, and behaviors [e.g., Gagnon & Peretz 2003]. From an affective perspective, music may stimulate emotions of pleasure, arousal, sadness, surprise or happiness [Kellaris & Kent 1994] and from a cognitive perspective, music affects learning, memory, information processing, and association [Bruner 1990]. The effects of music have been attested to throughout history by marketers [Kellaris & Kent 1994], composers, poets, and researchers in organizational behavior [Albert & Bell 2002].

As Gargarian [1993] indicated, composing is seen as a form of designing. Music composition is similar to web design in that music composers create different kinds of objects (i.e. different songs) using a set of design components. That is, by using different combinations of pitches, durations, meter, tempo, musical instruments and then assembling them in different combinations, composers can create different types of music. Similarly, web designers develop websites by using different combinations of website design components and contents. As composers can develop a unique theme, color, message, and recognizable units of music by integrating music composition components, web designers likewise develop websites uniquely to meet business goals by integrating web design components. Not all music or every website will please its customers. Music and websites only can make their customers satisfied when they were designed to meet needs and goals. Therefore, composition of music that meets listeners' desires can be achieved only when the composer and listeners share a common objective. Similarly, a website that meets customers' goals can be designed only when designers and customers share common understanding. Otherwise, what a composer thinks is pleasant music, listeners can hear as a noise, and what a designer thinks is an attractive website, customers can see as clutter. Web designers make continuous improvements to a website by examining the shape, location, arrangement of web design components, and revising them.

Music theorists [Dowling 1999] and cognitive psychologists [Kellaris & Kent 1994] have argued that audio feelings (i.e. music) are highly connected with visual feelings (i.e., websites). People develop perceptions of music not just by listening to it, but by connecting it to associated visual images such as places, people, time, and objects that the music depicts. For example, while listening to a pop song by the Beach Boys, people experience their emotions toward the particular song by both listening to it, associating it with past experiences, and imagining a beach that they previously visited. Another example of auditory and visual links is that it is common to see gunfights, bar room brawls, and thundering hooves while watching a Western musical which helps an audience arouse more salient cognitive and affective emotions by connecting audio with visual images. People use imagery created by the music by remembering and replaying it, creating vivid images.

2.3. Music Composition Theory and Its Three Major Components

Music is not a simple sonic mass, but a complex chemistry of controlled elements [Bispham 2006]. That is, musical sound is multidimensional in nature. Music theoreticians point out that there are objective properties of music, and generally agree that melody, harmony, and rhythm are three major dimensions of musical sound [Pearce & Wiggins 2006; Wright 2000]. These factors constitute the raw materials composers use to organize sound and are thought of as the objective design features of musical products.

Melody denotes a series of individual pitches, one occurring after another, so that the composite order of pitches constitutes a recognizable entity [Yudkin 1999]. Recognizable entity means that a well-written melody does not wander aimlessly, but seems to stand by itself as an abstract idea and can be easily remembered. As shown in Figure 1, there is a recognizable entity that is repeated several times until the end of the music, which characterizes easy-to-learn-and-memorize music [Berz 1995]. Melody gives music a sense of movement up and down through space as it moves forward in time. It consists of two inseparable, interacting elements: a succession of pitches and a succession of time values (or durations). The highs and lows of pitch and the longs and shorts of duration combine to give a

melody its particular shape and form. Using pitch and duration, melody develops a specific theme of the music and builds a memorizable unit [Kaminska & Woolf 2000].

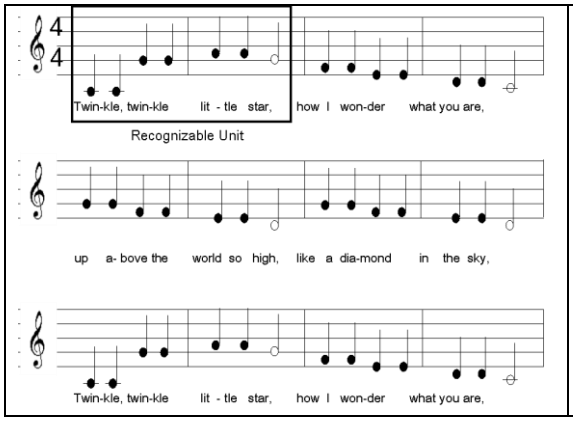

Figure 1：An Example of Melody

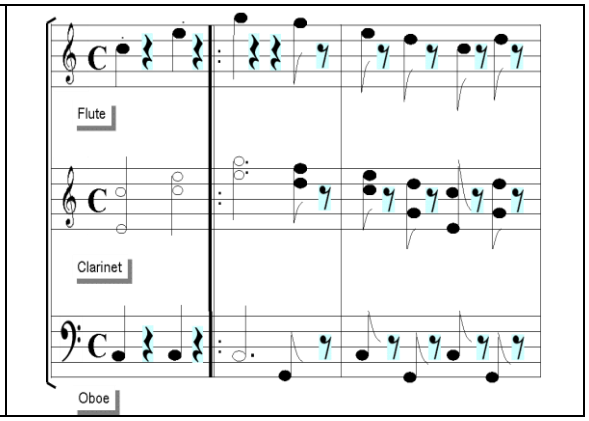

Figure 2：An Example of Harmony

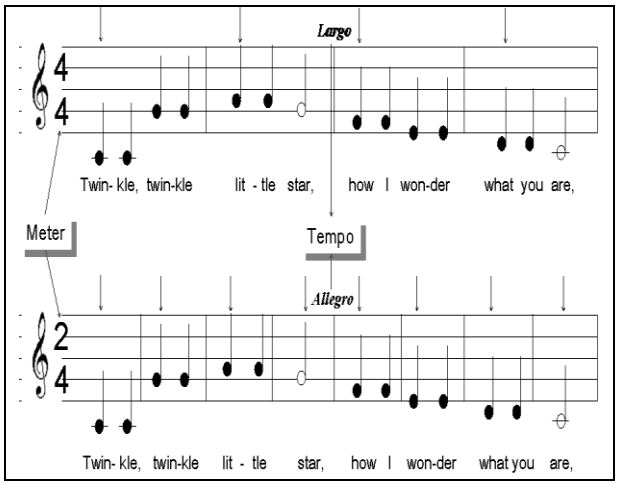

Figure 3：An Example of Rhythm

Harmony refers to a composite made up of two or more tones or instruments of different pitch that sound simultaneously [Albert & Bell 2002]. More than two tones blend together into a composite and make their own distinctive quality of sound [Smirnov 1999]. Compared to melody which develops a horizontal aspect of music by consisting of pitches sounding one after another in a linear fashion, harmony is viewed as vertical aspect of music because it concerns the building of chord tones played together derived from the scale on which the music is based [Marjorie 1997]. Figure 2 shows an example of harmony. When sounds from several instruments are well blended, music becomes richer in expressing a variety of meanings and emotions [Costa et al. 2000]. Harmony also provides the structure of music and enhances its expressiveness. Harmonious music is known to develop the feelings of playfulness, happiness, and serenity and effectively delivers the theme of the music to listeners [Bruner 1990].

Finally, *rhythm* is defined as the organization of time in music which divides up long spans of time into smaller, more easily comprehended units [Wright 2000]. As meter regulates and pulsates a poem, rhythm organizes music in much the same way. Rhythm is determined by tempo, the rate of speed at which music moves, and meter, the organization of beats into groups [Marjorie 1997]. The examples of tempo are largo and allegro, while those of meter are duple (2/4, 4/4) or triple (3/4). Figure 3 shows an example of rhythm. Using tempo, rhythm embodies timely flow (or movement) in music [Clarke 1999]. Using meter, rhythm helps create coherence out of chaos and offers predictability through repetitive patterns. Rhythm is a timekeeper controlling a flow of time, which provides regularities helping build expectations for the timing of future events [Bispham 2006].

Previous studies have found significant influence of melody, harmony, and rhythm on listeners' cognitive and affective appraisals while listening to music. For the relationship between music composition constructs and affective appraisals, Gagnon and Peretz [2003] found that melodies in the major mode evoked positive affect

including factors such as happy, cheerful and joyous. Zenatti [1985] revealed that harmonic intervals provided listeners high pleasantness. Makris and Mullet [2003] showed rhythm characterized by tones of different durations was perceived to be happy and pleasant. Meanwhile, for the relationships between music composition constructs and cognitive appraisals, Dewitt and Crowder [Dewitt & Crowder 1984] found significant influence of melody on both short-term and long-term memory. Zenatti [1985] found strong influence of harmony on recall, and Keller and Burnham [2005] found an influence of rhythm on attention. Pitch, glides, scales, tones, onset and offset asynchrony, timbre, and number of repetitions are music composition elements often used for manipulating melody. Chords are used for manipulating harmony. Tempo, meter, and intervals (or duration) are used for manipulating rhythm.

In summary, the quality of music is directly related to the conglomeration of melodious, harmonious, and rhythmic components that fit into the theme of particular music. Music composers develop different music by placing different emphasis on each of the three constructs to please the listeners. These three components of music now will be considered as constructs affecting website usability.

The *melody perception* in website design can be defined as the extent to which a website has a series of distinct recognizable units that help online customers easily learn and memorize, distinctively recognize, and not be disoriented while navigating. Melody is an important construct in developing a positive attitude toward a website since online customers will prefer a website providing distinct design patterns that establish a theme and help to easily remember and learn the structure and content of the website and predict what they will encounter next.

The *harmony perception* in website design can be defined as the extent to which the design components (or features) of a website are well organized and fit together. Web designers use many different types of web design components for constructing a website. However, depending on how well the design components are blended with each other, online customers can develop totally different perceptions of the websites developed using the same kind of design components. If each design component is disconnected and looks incoherently placed in a website, online customers would perceive it as a nonprofessional, buggy, and visually unattractive, leaving them with a negative attitude and motivating them to hop to another website. That is, people like to visit websites constructed using diverse design components that are well mingled with each other.

The *rhythm perception* in website design can be defined as the extent to which the design components (or features) are evenly assigned across web pages, allowing patterned movement through a website. One of the common mistakes made by e-business companies is to put too much content and too many design components on the home page. To do this, web designers either use very small fonts, narrow line space, and little white space, or they create a long vertical page, making users continuously scroll down [Briem 2002]. Online customers can feel a psychological burden and perceive high cognitive loads from such a crowded website, resulting in abandonment and unpleasant feelings [Morkes & Nielsen 1997]. Therefore, web usability experts [e.g., Cooper 1999; Nielsen 2000] have requested allocating web design components evenly across web pages, assuring an even distribution of material.

Melody, harmony, and rhythm of music positively affect individuals' cognitive and affective appraisals. We propose the same is true for a website. That is, when online customers observe a series of web pages, one occurring after another, so that the composite order of web pages constitutes a recognizable entity, the website is seen as a variety of web design components that work harmoniously, the website divides up its space into consistent and more easily comprehended web pages, and the website is able to develop both affective appraisals (fun, interesting, pleasant) and cognitive appraisals (usefulness, effectiveness, convenience). Thus, we hypothesize that

- H1: Web customers' melody perception has a positive effect on their cognitive appraisals (H1a) and affective appraisals (H1b).
- H2: Web customers' harmony perception has a positive effect on their cognitive appraisals (H2a) and affective appraisals (H2b).
- H3: Web customers' rhythm perception has a positive effect on their cognitive appraisals (H3a) and affective appraisals (H3b).

2.4. Relationship between Music Composition Constructs and Website Usability Constructs

Melody, harmony, and rhythm of websites can be considered as molar-level constructs because they can be developed not by listening to each single piece of the music, but by listening to the whole accumulation of music. Although there are usability factors that contribute to develop the melody, harmony, and rhythm perceptions, there were no previous studies that examined this.

By conducting a thorough review of previous studies [Lee & Kozar 2012; Loiacono et al. 2007; Tung et al. 2009] on website usability, we attempted to identify the potential relationships between music composition constructs and website usability constructs which are believed to be closely linked to each other. Then, to specify potential relationships, a focus group session with five usability experts was conducted to select website usability factors which are relevant as antecedents of music composition constructs. Previous studies [Lee & Kozar 2012; Moore & Benbasat 1991; Tung et al. 2009] used expert judgment to identify constructs and their nomological

networks while conducting a theory-developing exploratory study. The focus group included two IS faculty and three usability experts each with more than 5 years' experience in web design[1]. Research background information was presented to the group and a description of music composition theory and definition of music composition constructs were distributed before starting the selection. We provided definitions of 10 usability constructs identified through extensive literature review on website usability [e.g. Lee et al. 2012]. Then each expert was requested to identify and rate the relationships between music composition constructs and website usability constructs. Each of the possible relationships was rated with a 5-point Likert scale. When a very strong relationship was perceived, the experts assigned 5 points and assigned 1 point when they believed there was a very weak relationship. The relationships having an average of 4 or more points were selected for this study. In addition, based on feedback from the experts, we also identified uniqueness as a construct affecting melody. Out of the ten candidate constructs, security, tele-presence, and simplicity did not match with the music composition constructs and were not included in this study. The influence of the seven website usability constructs on online customer perceptions has been found in previous studies[2]. The identified relationships are:

- Learnability, uniqueness, navigability, and interactivity positively influence melody perception.
- Interactivity and content relevance positively influence harmony perception.
- Consistency and readability positively influence rhythm perception.

Melody**:** This study expects that online customers will perceive melody when the website provides a high level of learnability, uniqueness and convenient navigation. As Ferre et al. [2001] indicated, *learnability* represents "ease to learn the main website functionality and gain proficiency to complete the job (p. 23)." Online consumers want to spend less effort when they revisit websites and perform similar tasks [Zhang & von Dran 2000]. Liu and Arnett [2000] indicated that increased ability to browse and find relevant information is directly related to customers' online satisfaction. Vaughan and Dillon [2006] also argued that if a user interacts with a website repeatedly, he or she can learn the order and structure of that space and create a mental representation with special emphasis on a block of repeated distinctive elements. To increase learnability through this repeatability, web designers can use a repeated building block to implement a uniform structure, use a common top-down or orderly contents, or use assistants and wizards across web pages, allowing users to perceive melody.

Uniqueness refers to how much the website is distinct from other websites [Tian et al. 2001] and is derived from the theory of uniqueness [Synder & Fromkin 1977]. Researchers in psychology and marketing have recognized that uniqueness is a guiding force in defining and motivating Western people [e.g., Markus & Kitayama 1991] and becomes a stronger force in e-commerce or m-commerce [e.g., Hong et al. 2006]. Studies found that the lack of uniqueness is one of the reasons for low-level website stickiness [e.g., Nemzow 1999]. The recognizable unit such as "twin-kle twin-kle lit-tle star" in Figure 1, helps people uniquely perceive and memorize the music. The recognizable unit consists of a series of individual pitches, which is a common composition tool to incite a listener's melody perception. Melody has been used by composers as a building block to develop a unique theme and message of the music. This stimulates melody perception, helping people easily remember the music. Similarly, people perceive melody from a website which includes recognizable units created by the use of different types of web design components. By using several web structuring tools (e.g. cascading style sheet), web designers have developed recognizable units. The recognizable units help visitors uniquely identify a website. Therefore, in a web usability context, we posit that uniqueness positively affects melody since it helps people distinctively identify the website.

Computer-based navigation, defined as "the decisions and actions that contribute to a person's ability to find and examine data organized in the computer medium" [Watts-Perotti & Woods 1999, p.270], has been considered the most critical factor affecting the design quality of computer systems. Likewise, the crucial effect of navigability in the web environment has been emphasized by both researchers [Palmer 2002; Webster & Ajuja 2006] and practitioners [Nielsen 2000]. *Navigability* in a web context refers to the website's capability to provide alternative interaction and navigating techniques. People also navigate in music. By using a succession of pitches and a succession of durations, listeners perceive melody, the sense of moving up and down in music, which helps listeners to figure out "where I am". That is, the succession of pitches and durations assist people to easily find their location

[1] During the focus group study, we attempted capturing not only the designers' perspective, but also the online customers' perspective with respect to identifying the constructs and nomological networks. In particular, the two faculty members served as representatives of online customers, while the three industry experts served as website designers.

[2] Studies to examine the influence of website usability constructs on online customer perceptions have been conducted. Examples are Roy et al. [2001] for Consistency, Palmer [2002] for Navigability, McKinney et al. [2002] for Learnability, Loiacono et al [2007] for Uniqueness, Liang and Lai [2000] for Interactivity, and Zhang and von Dran [2002] for Content Relevance.

in music and helps them to predict where it will go next. For instance, Figure 1 showed that a succession of pitches and durations compose the A-B-A melody, which helps a listener predict the flow of music. While listening to the B melody, people may expect to listen to the A melody next. Therefore, the pitches and durations can be considered as a navigator system in music. It has been known that web users want to have a sense of their place, and navigation support tools can provide this support [Webster & Ajuja 2006]. Navigable websites allow users to easily find and acquire the information they are seeking. By using multiple navigation tools such as search facilities, online indices, site maps, intelligent agents, and landmarks, navigable websites provide online users more control in navigation and help reach the target web page with less disorientation [Fang & Holsapple 2007; Palmer 2002]. We expect that easy navigation positively affects melody by providing online customers with the sense of movement up and down through a website.

Finally, interactivity, defined as a website's ability to create vivid interaction and communication with users, is expected to affect melody in that it helps customers learn and memorize the website. The site visitor becomes involved with the website. Interactivity can be implemented by use of a variety of communication features (e-mail, BBS, online community, chat), help features (short cuts, wizards, online FAQ), and multimedia (pop-up, images, dynamic pictures, videos, music, flash). [Campbell & Wright, 2009] Web designers stimulate melody perception by using these design elements which provide vivid interaction, attention to the site visitor, and communication between the website and visitors. Thus, we hypothesize that:

H4: Website's navigability (H4a), uniqueness (H4b), learnability (H4c), and interactivity (H4d) have a positive effect on web customers' melody perception.

Harmony**:** We propose that online customers perceive harmony when a website provides a satisfactory amount of *interactivity* and *relevant contents.* The visitor is blended with the site through interactivity [Chou 2003; Fiore et al. 2005]. The site combines elements to create a harmonious oneness. That is, web designers use a variety of design components to customize the site's look, feel, and content which enhances online customers' communicability with the website. If online customers perceive these components as well-mingled together to match their personal value and preference for design and content or can relate to and communicate with the site, they perceive harmony with the website.

Content Relevance refers to the pertinence of the website contents to online users for achieving their goals. Content relevance is achieved when a website contains accurate, up-to-date content with relevant depth and scope. The importance of content relevance on customer perceptions has been widely recognized [Agarwal & Venkatesh 2002]. A trade-off exists between the vast amount of web content and limited web space [Morkes & Nielsen 1997]. Web designers have to carefully select the content included in a website by considering the trade-off between scope and depth, and accuracy and timeliness. That is, web contents should be well mingled together and blended with different depth, scope and currency in a limited web space to successfully create harmony perception. When the relevance is achieved by successfully balancing the characteristics of web content, online customers can develop harmony perception. Thus, we hypothesize that:

H5: Website's interactivity (H5a) and content relevance (H5b) have a positive effect on web customers' harmony perception.

Rhythm**:** We expect that online customers will perceive rhythm and be able to utilize a common cadence on a website when its design patterns (or features) are consistent and in a readable format. *Consistency* refers to "the consistent location of page components within and across pages" [Becker & Mottay 2011, p.55]. Consistency promotes usability perception by providing a common look and feel to each page. That is, the consistent use of design elements facilitates the development of web users' shared understanding of order and structure for a website [Vaughan & Dillon 2006]. As mentioned earlier, one of the critical mistakes made by e-business companies is to put too many web design components and too much content on a homepage. Visitors are overwhelmed, do not know where to start, and cannot establish a pattern to move through the material. Visitors left the websites without further navigation as they could not establish a cadence or pattern of movement through the site. Empirical studies have found that consistent distribution of website design components and contents across a web page can decrease error rates and increase performance and user satisfaction [Everard & Galletta 2006; Ozak 2001]. Consistency positively affects rhythm in that using the same font, color, size, or location across a web page helps allow a flow through a website. That is, by evenly allocating web design components across web pages in a consistent manner, online customers can achieve a patterned movement.

Readability refers to the extent to which a website is well organized to assist visitors' ease of reading and understanding. A readable website will exhibit a flow allowing rhythmic movement. Better readability is acquired using a small amount of displayed text, relative contrast between text characters and page background, larger white

space, and page-by-page presentation compared to a page-scrolling presentation [Nielsen 2000]. These factors all affect the speed at which customers navigate in the web space (tempo) and the organization of contents and space into web pages (meter) which determines rhythm. Therefore, we hypothesize that:

H6: Website's consistency (H6a) and readability (H6b) have a positive effect on web customers' rhythm perception.

2.5. Cognitive and Affective Appraisals and Purchase Intention

Based on previous findings of several human decision making theories (e.g. Theory of Reasoned Action/Theory of Planned Behavior) [Madden et al. 1992], we hypothesize that a positive attitude is directly related to online purchase intention. This study divides attitude into cognitive appraisals based on beliefs and knowledge structures [Segalowitz et al. 2001] and affective appraisals based on emotions, feelings and reactions [Chen & Wells 1999; Hughes & Lowis 2002] and separately measures the influence of each appraisal following suggestions of previous researchers [van der Heijden 2002].. Te'eni [2001] indicated that "the (technology adoption) models should capture both aspects (cognitive and affective appraisals), so as to build a more accurate representation of actual behavior" (p.253). Customers compare their affective and utilitarian value separately before purchases, and thus successful web designers should carefully develop the site to promote both values [Lu et al. 2012]. On this basis, this study hypothesizes that cognitive and affective appraisals significantly influence online customers' purchase intention. Studies [e.g., Lee & Kozar 2009] have found significant effects of attitude on purchase intention. This leads to:

H7: Web customers' cognitive appraisals (H7a) and affective appraisals (H7b) have a positive effect on their purchase intention.

We also test the generalizability of the hypothesized relationships under different gender and age by performing a multi-group analysis.

3. Research Method

To validate measurement instruments for the proposed theoretical model and investigate nomological networks between endogenous and exogenous variables, a field study was conducted. We developed measurement instruments following the suggestions of Bearden et al. [1989] and Straub [1989] as described below.

3.1. Instrument Development

Two separate instrument development processes were applied. First, the instrument items for melody, harmony, and rhythm were developed following the new item development procedure of Bearden et al. [1989]. An initial pool of 24 items was generated to reflect melody, harmony, and rhythm. Item generation relied on reviewing published, popular, and theoretical concepts of music composition [Bruner 1990; Wright 2000]. The items were developed by examining qualitative data gathered in an exploratory investigation and converting frequently mentioned descriptions of the three constructs into items. The content validity of the items was examined in two stages. First, seven judges were given the definition of each construct, a related explanation, and an example item[3]. The judges then were asked to allocate the statements to one of the three constructs or to a 'not applicable' category. After completion of two-round instrument purification processes by two separate groups of experts, a total of 13 items were generated. They include 4 items for melody, 4 items for harmony, and 5 items for rhythm. Second, the instrument items of seven website usability constructs were developed based on a review of the literature to ensure content validity. The items have good psychometric properties and apply well to the e-business environment.

The content validity of all instrument items was tested by nine experts familiar with music, scale development, and e-commerce. The wording, item order, content, and format of the questionnaire were examined and modified by the suggestions of the experts. Each item was formatted into a 7-point Likert-type scale (strongly disagree to strongly agree). A total of fifty-three undergraduate students taking an e-business class in a large Western university having at least one online purchase experience in the past year were recruited to pretest the instrument. Without informing participants of the goal of the study, participants were requested to navigate two websites, Amazon.com and Travelocity.com, before completing the questionnaire. An online purchase scenario for each website was provided to guide their navigation[4]. Participants were motivated by an opportunity to win a sweepstakes. An exploratory factor analysis (EFA) was conducted and three items that did not group well were removed. Table 1 showed the final instrument items employed in the main survey.

[3] The judges consisted of 2 IS faculty members, 2 IS doctoral students, 2 marketing doctoral students, and 1 marketing faculty member familiar with the instrument development process.

[4] After navigating one website, participants were requested to fill out the questionnaire. Then, they repeated the same action for the other website. Participants were randomly assigned to each website to prevent a potential order effect.

Table 1: Measurement Items

Construct	References	Instrument Items
Purchase Intention	[Palmer 2002]	I intend to purchase products or services from the website. I predict I would purchase products or services from the website
Attitude Toward a Website	[Ajzen 1985]	Affective Appraisals
		Visiting the website is (1) Dull…Exciting, (2) Pleasant…Unpleasant (3) Interesting…Boring
	[Venkatesh et al. 2003]	Cognitive Appraisals
		The website is effective to achieve my goals to visit. The website is convenient to achieve my goals to visit. The website is comfortable to achieve my goals to visit. The website is helpful to achieve my goals to visit.
Melody	[Bruner 1990; Wright 2000]	The website contains special design patterns (or features) that help me remember the website. The website has particular design patterns (or features) that distinguish it from others. A sense of systematic movement is perceived while moving forward through the website. There are particular design patterns that characterize the website.
Harmony	[Bruner 1990; Wright 2000]	All the components of the website are well organized. Each component of the website helps other features provide better functions to visitors. The components of the website are cohesive. Each component of the website is well synchronized.
Rhythm	[Bruner 1990; Wright 2000]	I perceive consistent passage of time while navigating the website. There are constant patterns of contents and design components across web pages. It takes the same amount of time (or effort) to navigate each web page. I can move around the website at a steady pace. The website divides up its space into small and constant units.
Consistency	[Ozak 2001]	The website repeats the same structure, components, and overall looks across web pages. The website contains similar components across web pages. Web pages in the website are consistently designed. Each web page on the website is of similar design.
Navigability	[Lee & Kozar 2009]	The website provides multiple search features (e.g. search engine, menu bar, go-back-and-forward button, etc.) to obtain the target information. The web page that I am looking for can be reached through multiple pathways. There are multiple ways to access the web pages that I am looking for and/or return to shopping menus. The website keeps the user oriented as they shop.
Learnability	[Zhang & von Dran 2000]	Less amount of time and mental effort is required to do similar tasks as I navigate the website. I can easily remember how to reach the same page when I visit next time. The contents provided by the website are easily learnable. As time passes, I am more accustomed to the website with less effort.
Interactivity	[Jiang et al. 2010; Palmer 2002]	The website contains components to help the interaction between website and customers. Interactive features of the website are vivid and evoke responses. The website provides features for interactive communication between customers, or between customers and online company.
Content relevance	[McKinney et al. 2002]	The website contains in-depth information. The website provides up-to-date information. The scope of information provided by the website is relevant. The information provided by the website is accurate.

Readability	[Nielsen 2000]	The website's wording is clear and easy to read. The website has enough white space (or margins) to make it readable. Every page contains the appropriate amount of components to fit into a page. The website uses colors and structures that are easy on the eyes.
Uniqueness	[Tian et al. 2001]	I feel a distinct image from the website. The website has something different than other websites. The website contains a style that is all its own. The website has lots of similarity with other websites [R].

3.2. Main Survey

As in the pretest, we selected Amazon.com and Travelocity.com as target websites. We selected these websites since they are top-ranked websites in the Alaxa Global 500 rankings with respect to average customer visits and are well recognized by the subjects. Other information systems research also used these websites for their studies [e.g., Agarwal & Venkatesh 2002], allowing the direct and indirect comparison of our research findings. The target population of the validation study was online purchasers-individuals who have experienced online purchases at both websites. Through an invitation letter, advertisement through online communities, and offline newspapers, a total of 1,600 subjects were recruited for the survey. Both online and offline surveys were developed, and participants could choose a survey based on their preference.

After discarding unusable responses, 628 usable questionnaires were gathered for Amazon.com (response rate: 0.79 = 628/787), while 652 (response rate: 0.80 = 652/813) usable questionnaires were gathered for Travelocity.com. For Amazon.com, the average age of participants was 28.46 years; online purchases per year were an average of 3.01 times. Participants had an average of 3.52 years online experience and have excellent Internet capability. 50.3% of the subjects were male, and the rest were female. The similar demographic information was found from the participants of a Travelocity.com survey (see Table 2). Participants navigated each website following an online purchase scenario given by the researchers and completed a questionnaire after finishing the navigation. Participants were motivated by an opportunity to win a sweepstakes. Student subjects in specific classes additionally received class participation points. Participation was voluntary and required approximately 45 minutes[5].

Table 2: Demographic Information

Characteristics	Amazon.com (n = 628)		Travelocity.com (n = 652)	
Average Age	28.46 years		28.52 years	
Gender	Male Female	50.3% 49.7%	Male Female	52.2% 47.8%
Avg. Online Experience	3.52 years		3.58 years	
Internet Capability	3.95, 1 (poor)…. 5(excellent)		3.78	
Avg. Online Purchases	3.01 times		3.25 times	

3.3. Results

Structural equation modeling was used to simultaneously perform both measurement and structural model analysis. The measurement model analysis was used to validate psychometric properties of the measures, while structural model analysis was used to investigate nomological networks between the constructs. To conduct the analyses using structural equation modeling techniques, the model consisting of a collection of scales, each defined according to a weighted linear combination of the items, is first specified. During the analysis, the fit of the hypothesized model to the sample data is assessed with a sample covariance matrix (S). Next, a covariance matrix implied by the specified model (Σ) is computed. Finally, through iteratively changing estimates of the model parameters, a specific maximum likelihood (ML) function with the minimum differences between S and ∑, is identified. The model fit indexes and significance of estimated factor loadings confirmed the validity of the model. Data were analyzed using LISREL [Joreskog & Sorbom 2006]. Researchers recommend 200 or a number five times

[5] Participants were motivated by an opportunity to win a sweepstake. We provided Barnes and Noble's gift cards with a total worth of $2,500 dollars. The odds of winning a sweepstakes were approximately 25%.

larger than the total number of unknown parameters [Bentler & Chou 1988] as the minimum sample size for running LISREL. The sample size of this study was large enough to meet both criteria. We adopted a two-step approach to cross-validate the proposed model [Anderson & Gerbing 1988]. We used Amazon.com data as a calibration sample and Travelocity.com data as a validation sample.

3.4. Measurement Model Analysis: (Amazon.com: Calibration Sample)

A confirmatory factor analysis was conducted for validating psychometric properties of the instrument. Psychometric properties were measured by (1) examining whether the measurement model has an acceptable goodness-of-fit and (2) investigating its convergent and discriminant validity and reliability [Anderson & Gerbing 1988]. As shown in Table 3, we examined overall goodness-of-fit for the model separately for the music composition theory only model and the proposed theoretical model. We found the overall goodness-of-fit statistics for both models were met following the cut-off value guidelines [Hair et al. 2005]. For the former model, the $\chi 2/df$ was 1.807, which is below the desired threshold of 3.0. RMSEA was 0.036, which is below the 0.08 cut-off. All GFI (0.950), AGFI (0.935), NFI (0.963), and CFI (0.983) are above the cut-off value of 0.90. The same goodness-of-fit statistics were found for the latter model. These results suggested that the measurement model adequately fit the data.

Table 3: Goodness of Fit of Measurement Model and Structural Equation Model

Fit Index	Recommended Value	Music Composition Only		Proposed Theoretical Model	
		Measurement Model	Structural Model	Measurement Model	Structural Model
$\chi 2/df$	< 3.0	1.807	1.879	1.508	1.899
GFI	> 0.90	0.950	0.949	0.907	0.882
AGFI	> 0.80	0.935	0.935	0.891	0.867
NFI	> 0.90	0.963	0.962	0.925	0.902
CFI	> 0.90	0.983	0.982	0.973	0.951
RMSEA	< 0.08	0.036	0.037	0.028	0.038

Unidimensionality refers to the extent to which indicators are strongly associated with each other and represent a single concept. This is a necessary condition for reliability analysis and construct validation [Anderson & Gerbing 1988]. Unidimensionality is confirmed when all factor loading scores are statistically significant. All factor loadings were significant at p=0.001 (minimum t-value = 17.274), confirming that unidimensionality is satisfied.

Convergent validity was evaluated using three criteria suggested by Fornell and Larcker [1981]: (1) all indicator factor loadings (λ) should be significant at $p<0.05$ and exceed 0.7, (2) composite reliabilities should exceed 0.7, and (3) average variance extracted (AVE) by each construct should exceed the variance due to measurement error for that construct. As shown in Table 4, all factor loadings in the CFA model exceeded 0.7 and were significant at $p = 0.001$. Composite reliabilities ranged between 0.805 and 0.916, and AVE values were well above the cut-off value of 0.50, greater than variance due to measurement error. Thus, all three conditions for convergent validity were met.

Discriminant validity was assessed by constraining the estimated correlation parameters (φij) between constructs to 1.0 and then performing a chi square difference test on the values obtained for the constrained and unconstrained [Anderson & Gerbing 1988]. As shown in Table 5, the chi-square differences between constrained and unconstrained were significant at $p<0.05$, showing clear discriminant validity among these constructs. Inter-construct correlations were also examined for confirming discriminant validity. As shown in Table 6, all of the correlations between the constructs were less than 0.7, all the diagonal values in the table were greater than 0.707 and greater than other values in the same column and row, representing appropriate discriminant validity. Finally, *reliability* was examined using Cronbach α and all constructs also showed over 0.830, indicating high reliability of items used for each construct (See Table 4).

Table 4: Confirmatory Factor Analysis: Measurement Model

Construct	Items	Loading	CFR	AVE	Cronbach α	Construct	Items	Loading	CFR	AVE	Cronbach α
Purchase Intention(PI)	PI1	0.863	0.846	0.733	0.845	Uniqueness (UNIQ)	UNIQ1	0.729	0.854	0.595	0.851
	PI2	0.849					UNIQ2	0.826			
Affective Appraisals (AFF)	AFF1	0.811	0.841	0.638	0.838		UNIQ3	0.750			
	AFF2	0.761					UNIQ4	0.777			
	AFF3	0.822				Navigability (NAV)	NAV1	0.748	0.860	0.605	0.859
Cognitive Appraisals (COG)	COG1	0.828	0.916	0.733	0.916		NAV2	0.804			
	COG2	0.841					NAV3	0.762			
	COG3	0.884					NAV4	0.796			
	COG4	0.870				Interactivity (INT)	INT1	0.779	0.805	0.579	0.830
Melody (MEL)	MEL1	0.807	0.886	0.660	0.885		INT2	0.755			
	MEL2	0.814					INT3	0.749			
	MEL3	0.838				Content Relevance (CONT)	CONT1	0.783	0.844	0.576	0.844
	MEL4	0.789					CONT2	0.795			
Harmony (HAR)	HAR1	0.753	0.854	0.594	0.854		CONT3	0.724			
	HAR2	0.752					CONT4	0.730			
	HAR3	0.774				Consistency (CONS)	CONS1	0.839	0.913	0.725	0.913
	HAR4	0.802					CONS2	0.858			
Rhythm (RHM)	RHY1	0.746	0.899	0.641	0.897		CONS3	0.843			
	RHY2	0.823					CONS4	0.866			
	RHY3	0.828				Readability (REA)	REA1	0.791	0.882	0.651	0.880
	RHY4	0.836					REA2	0.849			
	RHY5	0.767					REA3	0.807			
Learnability (LEA)	LEA1	0.763	0.844	0.574	0.844		REA4	0.779			
	LEA2	0.765									
	LEA3	0.763									
	LEA4	0.740									

CFR: Composite factor reliability, AVE: Average variance extracted

Table 5: Pairwise Discriminant Analysis

Model	χ^2	d.f	Model	χ^2	d.f	Model	χ^2	d.f
Original	1582.2	1049	COG with LEA	2693.5	1061	RHY with NAV	2338.9	1061
PI with COG	1963.8	1061	COG with UNIQ	2656.7	1061	RHY with INT	2018.0	1061
PI with AFF	1905.2	1061	COG with NAV	2756.5	1061	RHY with CONT	2151.2	1061
PI with MEL	1981.5	1061	COG with INT	2290.8	1061	RHY with CONS	2579.7	1061
PI with HAR	1821.4	1061	COG with CONT	2510.3	1061	RHY with REA	22103.9	1061
PI with RHY	1887.7	1061	COG with CONS	3050.8	1061	LEA with UNIQ	2620.0	1061
PI with LEA	2329.5	1061	COG with REA	2734.7	1061	LEA with NAV	2191.9	1061
PI with UNIQ	2189.1	1061	MEL with HAR	2119.1	1061	LEA with INT	2173.0	1061
PI with NAV	2191.7	1061	MEL with RHY	2135.3	1061	LEA with CONT	2087.7	1061
PI with INT	2005.3	1061	MEL with LEA	2402.2	1061	LEA with CONS	2711.8	1061
PI with CONT	2075.0	1061	MEL with UNIQ	2327.5	1061	LEA with REA	2339.7	1061
PI with CONS	2304.0	1061	MEL with NAV	2356.4	1061	UNIQ with NAV	2485.8	1061
PI with REA	2132.4	1061	MEL with INT	2019.9	1061	UNIQ with INT	1992.0	1061
AFF with COG	2422.0	1061	MEL with CONT	2051.6	1061	UNIQ with CONT	2371.8	1061
AFF with MEL	1971.2	1061	MEL with CONS	2824.1	1061	UNIQ with CONS	2640.8	1061
AFF with HAR	1845.7	1061	MEL with REA	2462.7	1061	UNIQ with REA	2508.0	1061
AFF with RHY	1880.6	1061	HAR with RHY	1936.5	1061	NAV with INT	2024.7	1061
AFF with LEA	2268.6	1061	HAR with LEA	2415.9	1061	NAV with CONT	2186.8	1061
AFF with UNIQ	2310.7	1061	HAR with UNIQ	2391.0	1061	NAV with CONS	2750.7	1061
AFF with NAV	2151.4	1061	HAR with NAV	2325.9	1061	NAV with REA	2277.1	1061
AFF with INT	1961.2	1061	HAR with INT	2008.5	1061	INT with CONT	1956.9	1061
AFF with CONT	1998.9	1061	HAR with CONT	2086.2	1061	INT with CONS	2331.8	1061
AFF with CONS	2563.0	1061	HAR with CONS	2767.7	1061	INT with REA	2055.3	1061
AFF with REA	2162.6	1061	HAR with REA	2229.5	1061	CONT with CONS	2675.9	1061
COG with MEL	2459.1	1061	RHY with LEA	2398.0	1061	CONT with REA	2248.1	1061
COG with HAR	2176.2	1061	RHY with UNIQ	2402.7	1061	CONS with REA	2819.6	1061
COG with RHY	2467.7	1061						

Table 6: Inter-Construct Correlation Matrix[6]

	PI	AFF	COG	MEL	HAR	RHY	LEA	UNIQ	NAV	INT	CONT	CONS	REA
PI	**0.856**												
AFF	0.565	**0.798**											
COG	0.598	0.483	**0.856**										
MELO	0.552	0.655	0.606	**0.812**									
HAR	0.584	0.683	0.647	0.569	**0.771**								
RHYM	0.628	0.686	0.646	0.663	0.685	**0.801**							
LEA	0.301	0.438	0.243	0.398	0.363	0.421	**0.758**						
UNIQ	0.436	0.414	0.300	0.470	0.414	0.445	0.240	**0.771**					
NAV	0.415	0.516	0.311	0.483	0.467	0.503	0.464	0.336	**0.778**				
INT	0.442	0.486	0.369	0.498	0.491	0.514	0.371	0.503	0.476	**0.761**			
CONT	0.449	0.552	0.445	0.596	0.562	0.571	0.514	0.377	0.475	0.495	**0.759**		
CONS	0.370	0.436	0.402	0.456	0.431	0.588	0.220	0.326	0.322	0.336	0.368	**0.852**	
REA	0.470	0.545	0.446	0.485	0.550	0.662	0.423	0.357	0.497	0.473	0.496	0.406	**0.807**

3.5. Structural Model Analysis (Amazon.com: Calibration Sample)

The analysis of the structural equation model provides two results: the goodness-of-fit of the comprehensive model and all relationships among constructs based on the hypotheses. The fit statistics indicated that the model provided a good fit to the data. Except for GFI (0.882), all other goodness-of-fit statistics for both the music composition theory only model and the proposed theoretical model were well above their cutoff values (see Table 3). Figure 4 shows the R^2 and path loadings for all hypothesized relationships.[7]

Melody (H1a: $\gamma = 0.237$, $p < 0.001$; H1b: $\gamma = 0.322$, $p < 0.001$), harmony (H2a: $\gamma = 0.373$, $p < 0.001$; H2b: $\gamma = 0.404$, $p < 0.001$) and rhythm (H3a: $\gamma = 0.296$, $p < 0.001$; H3b: $\gamma = 0.344$, $p < 0.001$) all showed significant influence on cognitive and affective appraisals. The results indicated that navigability (H4a: $\gamma = 0.182$, $p < 0.001$) uniqueness (H4b: $\gamma = 0.198$, $p < 0.001$), learnability (H4c: $\gamma = 0.155$, $p < 0.001$), and interactivity (H4d: $\gamma = 0.362$, $p < 0.001$) were important determinants for melody, interactivity (H5a: $\gamma = 0.400$, $p < 0.001$) and content relevance (H5b: $\gamma = 0.418$, $p < 0.001$) were determinants for harmony, and finally consistency (H6a: $\gamma = 0.383$, $p < 0.001$) and readability (H6b: $\gamma = 0.589$, $p < 0.001$) were determinants for rhythm. The amount of variance explained by endogenous variables ranged from 0.528 to 0.732. Online customers' purchase intention was significantly determined by both cognitive (H7a: $\gamma = 0.399$, $p < 0.001$) and affective appraisals (H7b: $\gamma = 0.448$, $p < 0.001$). Interestingly, affective appraisals showed more influence on the intention than cognitive appraisals. The reverse results have been reported in previous research [Venkatesh & Davis 2000].

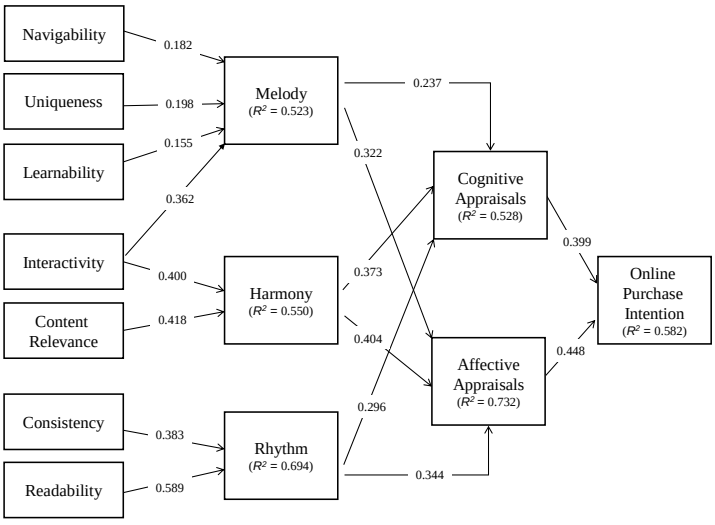

Figure 4: Results of Structural Model Analysis (Amazon.com)

[6] The diagonal value in the table represents the square root of the average variance extracted. For confirming convergent validity, it is generally recommended to greater than 0.707 and greater than correlation values in the same column and row.

[7] Music composition theory only model also confirmed all hypothesized relationships. See Appendix C.

3.6. Validation Sample Analysis (Travelocity.com)

The proposed model was cross-validated using the data from Travelocity.com. The psychometric properties of the measurement instruments were measured based on a confirmatory factor analysis and found to have good psychometric properties[8]. Convergent and discriminant validity also met the recommended criteria (see [Anderson & Gerbing 1988]), respectively. All the constructs showed over 0.80 Cronbach α, indicating that high reliability is achieved.

The analysis of the structural equation model was conducted and found to have a good fit to the data as shown in Table 7. Hypothesized relationships except harmony-cognitive appraisals ($\gamma = 0.050$, $p > 0.05$), interactivity-melody ($\gamma = 0.053$, $p > 0.05$) and uniqueness-melody ($\gamma = 0.049$, $p > 0.05$) were significant at $p < 0.05$ and thus were supported. The insignificant relationships between harmony-cognitive appraisals and uniqueness-melody may be caused by the goal-oriented and straight forward online search and purchases of Travelocity.com users in purchasing flight tickets, limited web space to implement vivid communication and interaction mechanisms, and the highly standardized website design features of online travel websites.

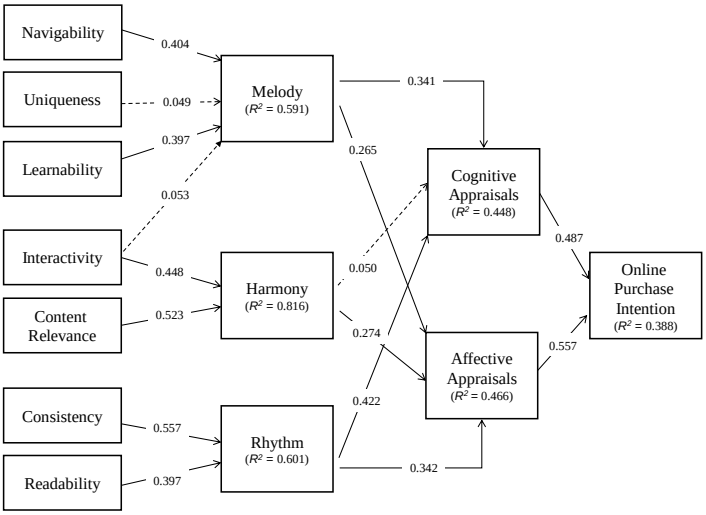

Figure 5: Results of Structural Model Analysis (Travelocity.com)

Table7: Goodness of Fit of Measurement Model and Structural Equation Model

Fit Index	Recommended Value	Music Composition Only Model		Proposed Theoretical Model	
		Measurement Model	Structural Model	Measurement Model	Structural Model
$\chi 2$/df	< 3.0	1.609	2.145	1.601	1.913
GFI	> 0.90	0.956	0.945	0.904	0.886
AGFI	> 0.80	0.942	0.930	0.888	0.871
NFI	> 0.90	0.964	0.954	0.920	0.902
CFI	> 0.90	0.984	0.975	0.968	0.951
RMSEA	< 0.08	0.033	0.042	0.030	0.037

3.7. Multi-group Analysis

Further analysis was performed to investigate whether the proposed model and measures are invariant across different subgroups. This study utilized a multi-group analysis for different gender, age, and purchase experience for Amazon.com. The multi-group analysis has two main advantages: (1) it allows testing of the generalizability of measurement items by comparing item-factor loadings across different groups, and (2) the structural weights are directly comparable by using equivalent measurement where observed scores from different groups are in the same scales [Drasgow & Kanfer 1985]. Multi-group analysis recently has been adopted by IS researchers to validate the generalizability of well-known constructs including end-user computing satisfaction [Doll et al. 2004] and models

[8] See Appendix A (Confirmatory Factor Analysis) and Appendix B (Inter-construct Correlation Matrix).

including the technology acceptance model [Deng et al. 2005]. Multi-group analysis consists of two sequential processes: (1) a comprehensive assessment of item-factor loadings and model-data fit for each subgroup, and (2) structural weights invariance test.

First, item-factor loadings and model-fit analysis were conducted across gender, age and purchase experience. The item-factor loadings remained high across different groups (from 0.691 to 0.885) and significant, as evidenced by their t-values (ranged from 25.125 to 37.660). All items had reliability scores above 0.50, indicating good item reliability. Therefore, measurement items were validated as reliable measures with good psychometric properties. Adequate model-fit was also found across different groups as shown in Table 8. Although the NFI score was below 0.90 across groups, they had other model-fit indices that could be considered adequate and excellent item-factor loadings. Based on these findings, we could conclude that the data for each group fit the model sufficiently well to further process the multi-group analysis of structural invariance.

Table 8: Goodness-of-Fit Indices for Each Group

Fit Index	Male	Female	Older	Younger	Less	More
X2/d.f	1.617	1.379	1.552	1.463	1.522	1.467
CFI	0.925	0.963	0.935	0.954	0.944	0.949
NFI	0.827	0.878	0.837	0.869	0.854	0.857
RMSEA	0.044	0.035	0.046	0.036	0.040	0.039

The first step of a multi-group analysis of structural invariance is to develop an equal pattern baseline model. As shown in Model 1 in Table 9, this equal pattern model had good model fit indicating that the same patterns of parameters could fit the data for all different groups. The second step is to investigate measurement equivalence by forcing each item-factor loading to be equal across the different groups resulting in Model 2. Model 2 also had adequate model-fit. The chi-square difference test between Model 1 (Amazon: $\chi 2$/d.f = 10308.849/6877) and Model 2 (Amazon: $\chi 2$/d.f = 10432.987/7057) was conducted and found that it is insignificant (124.138 with 180 d.f). This implied that the measurement model was invariant across subgroups.

Table 9: Measurement Equivalence

Model	Model	$\chi 2$	d.f.	RMSEA	NFI	CFI	$\triangle\chi 2$	$\triangle$d.f.	Sig.
Model 1	Equal Patterns	10308.85	6877	0.016	0.847	0.943			
Model 2	Factor Loadings Invariant	10432.99	7057	0.016	0.845	0.944	124.14	180	p>0.05

The standardized structural weights for the endogenous and exogenous variables were shown in Table 10 for all different groups. The weights represented the best estimates of the true structural weights since they were estimated with the item-factor loadings held equal across different groups. They were not affected by differences in item-factor loadings across the groups.

Table 10: Standardized Structural Weights

DV	IV	Older	Younger	Male	Female	Less	More	DV	IV	Older	Younger	Male	Female	Less	More
PI (R^2)		0.604	0.498	0.552	0.587	0.557	0.564	MEL(R^2)		0.569	0.471	0.473	0.525	0.490	0.507
	AFF	0.434	0.419	0.388	0.499	0.427	0.438		LEA	0.125	0.154	0.191	**0.034**	0.208	**0.065**
	COG	0.476	0.412	0.480	0.384	0.468	0.418		UNIQ	0.241	0.183	0.138	0.445	0.136	**0.057**
AFF (R^2)		0.743	0.730	0.712	0.812	0.729	0.774		NAV	0.132	0.173	0.125	0.251	0.194	0.237
	MEL	0.173	0.476	0.490	0.157	0.408	0.299		INT	0.355	0.327	0.385	0.159	0.313	0.463
	HAR	0.420	0.451	0.355	0.526	0.279	0.639	HAR (R^2)		0.467	0.475	0.436	0.554	0.440	0.576
	RHY	0.456	0.117	0.210	0.358	0.350	**0.093**		CONT	0.356	0.483	0.451	0.519	0.260	0.626
COG (R^2)		0.530	0.539	0.531	0.584	0.531	0.570		INT	0.397	0.272	0.270	0.332	0.461	0.182
	MEL	0.225	0.238	0.175	0.316	0.245	0.114	RHY (R^2)		0.629	0.610	0.591	0.738	0.622	0.644
	HAR	0.248	0.460	0.446	0.323	0.358	0.490		CONS	0.387	0.307	0.278	0.411	0.334	0.311
	RHY	0.417	0.198	0.270	0.277	0.282	0.278		REA	0.561	0.611	0.62	0.534	0.592	0.625

*Older: 30 and above 30, Younger: below 30, More: Online purchase experience is greater than 3, Less: Online purchase experience is less than 3

As shown in Table 10, all the structural weights were found to be significant, although their weights were varied across different groups. For example, cognitive appraisals had a stronger effect on purchase intention than affective appraisals for males, while it is the reverse for females. The same reverse relationships were found for the older (i.e.

30 and above 30 years old) and younger age group (i.e. below 30 years old). The details will be discussed later.

3.8. Common Method Variance Test

One of the main challenges in behavioral research is called common method variance. This is the "variance that is attributable to the measurement method rather than to the construct of interest" [Podsakoff et al. 2003]. Common method variance is a major source of measurement error, which can deteriorate the conclusion validity of the relationships between variables. The sources of common method variance include common rater effects, item characteristic effects, item context effects, and measurement context effects. In the IS field, self-reported usage has been recognized as a main source of common method variance, which can be produced when respondents respond to both independent and dependent measures at the same time. Since this study includes self-reported purchase intention measures, we tested the significance of the common method effect by adopting the correlated uniqueness model [Makris & Mullet 2003]. The correlated uniqueness model examines method effects by allowing the error terms of variables measured by the same method to be correlated. Then, by comparing the chi-square difference (χ^2/d.f.) and model fit between the uncorrelated model and the correlated model, the significance of the method effect is determined. A significant effect does not exist if there is no chi-square difference and no significant model fit improvement. Table 11 exhibits the comparison result. As shown in the table, no significant method effect was found. First, there was no significant chi-square difference (χ^2/d.f. = 2096.1/1091 – 2020.7/1065 = 0.02, p >0.05). Second, the model fit was not considerably improved. Therefore, we can conclude that there was no significant common method variance, indicating that the identified relationships between constructs were not strongly affected by the method effect.

Table 11: Common Method Variance Test

	Uncorrelated Model	Correlated Model
χ^2/d.f.	1.897	1.913
GFI	0.886	0.882
AGFI	0.868	0.867
NFI	0.904	0.902
CFI	0.952	0.951
RMSEA	0.038	0.038

4. Discussion

The design of a usable website is critical to successful e-business. However, very little is known about the factors of website usability, their effects that make using the web a compelling consumer experience, and the key consumer behavior outcomes of this compelling experience. The absence of a theoretical model of website usability is one of the main reasons for this lack of understanding. This study adopts music composition theory and proposes a theoretical model of website usability to explain or predict the effects of website usability on online customer perceptions. While there is a challenge to the proposed model's generalizability across different types of websites and users, the findings of the research demonstrated that the model had strong psychometric properties and explained a large amount of the variance of attitudes and purchase intention of online customers. This indicates that the model could be considered an alternative theoretical model of website usability. Several interesting results were found through this study.

First, we found that both the music composition theory only model and the proposed theoretical model had good psychometric properties for their measurement and addressed a large amount of variance of cognitive and affective appraisals and purchase intention by confirming most of the hypothesized relationships. The generalizability of the models also was confirmed through a multi-group analysis. It implies that both models can successfully be used as a theoretical model for addressing the effect of website usability. However, researchers should carefully select the most appropriate model by considering the trade-off between parsimony (the music composition only model) and richer understanding (the proposed theoretical model) and the trade-off between research interest and constraints (e.g. small sample size).

Second, this study found that both cognitive and affective appraisals significantly influenced online purchase intention. This is consistent with the recent findings of psychology and marketing researchers [Albert & Bell 2002; Fiore et al. 2005; Kellaris & Kent 1994; Kempf 1999] noting that the human mind and behavior is influenced not only through affective attitude development but also through the development of cognitive attitude, both of which are derived from music composition constructs such as melody, harmony, and rhythm. That is, it confirmed the beliefs of musicians and marketers in a website design context arguing that music is a potent stimulus for expressing

and evoking affect and an effective means for evaluative judgment. The significant effect of cognitive appraisals indicated that consumers' beliefs about the usefulness and effectiveness of a website significantly influenced their purchase intention. This is in accordance with research that has demonstrated the utilitarian nature of online consumers [Jarvenpaa & Todd 1997]. Meanwhile, the significant impact of affective appraisals suggested that websites are challenged to incorporate hedonic features to meet users' needs for perceived enjoyment, fun, and arousal while using them. Recently, the importance of affective appraisals in website design has been found by many researchers [Kim & Eastina, 2011; Zhang & Na 2005]. This result showed that online consumers not only valued effectiveness but also valued enjoyment in their online shopping. However, in spite of its importance, affective appraisals still have received little attention by IS researchers. It is recommended that researchers put more effort to broaden the boundary of website usability by developing constructs that represent affective aspects and incorporating them into the theoretical model of website usability.

Third, a strong influence of melody, harmony, and rhythm on cognitive and affective appraisals was found, indicating that music constructs were appropriate determinants of positive attitude toward a website. By blending a pertinent amount of melodious, harmonious, and rhythmical website design components and content, website designers can successfully communicate with online customers and invoke their emotional and cognitive appraisals. However, the insignificant effect of harmony on cognitive appraisals in Travelocity.com indicated that online consumers evaluated 'how well each design feature is mingled with' as an entirely affective appraisal rather than a cognitive one. It suggested that online consumers at Travelocity.com had greater enjoyment when multimedia and content were harmonized in a website.

Fourth, all website usability constructs showed significant relationships with the three music constructs, confirming that music composition constructs are variables that successfully mediate the relationships between website usability constructs and attitudes toward the website. Navigability and learnability were found to be significant factors affecting melody, whereas that of uniqueness and interactivity was mixed. The result indicated that online consumers perceive melody when websites contain repeated design features across web pages (e.g. logos, search engine, background color, frames, and cascading style sheets) that help them easily remember, distinctively recognize, and maneuver without getting disoriented. The insignificant finding of uniqueness and interactivity at Travelocity.com was not surprising because travel websites generally sell standardized products through a standardized process. It may make travel websites relatively difficult to design uniquely by using a variety of interactive design elements. This is recognized by designers who create a functional website. Harmony was found to be significantly influenced by both interactivity and content relevance. This indicated that website designers should make an effort to align relevant depth and scope of information with multimedia features. Lastly, it was found that consistency and readability had a strong influence on rhythm. It asserted that website designers should arrange website design features (e.g., white space, language, color, frame, and font) to provide a readable web page that would be perceived as rhythmical in a virtual environment.

Finally, this study found that the theoretical model was successfully validated across consumers of different age, gender and previous purchase experience. Most of the hypothesized relationships were confirmed and website usability constructs explained a large amount of the variance of purchase intention. Several interesting dissimilarities across groups with respect to the strength of the relationships between website usability constructs, attitude, and purchase intention were discovered. From an age perspective, first, for the younger-age group, affective appraisals showed stronger influence on purchase intention than cognitive appraisals, but it was reversed for the older-age group. This shows that as people become older, they make more conservative purchase decisions by relying more on usefulness, ease of use, and effectiveness of a website. The result is consistent with that of previous studies. For example, Burke [2002] suggested that younger shoppers respond more favorably than older shoppers to features which are designed to make shopping more entertaining. Meanwhile, older consumers were more pragmatic, placing greater emphasis on having detailed information on the product, quality of service, and a fast and secure shopping environment. For the younger age-group, melody had the highest influence on affective appraisals, while rhythm had the same strongest impact for the older age-group. The findings indicated that older consumers felt fun, excitement, and enjoyment when design components of a website are evenly assigned across web pages in a consistent and readable format. This is coincident with the findings of previous technology adoption studies pointing out that older people perceive enjoyment when they find a new technology easy to use and read [Morris & Venkatesh 2000]. Meanwhile, younger consumers perceived enjoyment from distinct design patterns of a website which help distinguish it from other websites. They are more sensitive to the interface for their online shopping and hence leave quickly from websites designed only based on standardized design templates and components [Hawthorne 2000]. Rhythm was also the strongest factor affecting cognitive appraisals for older customers, while harmony was strongest for younger customers. Supporting the important role of rhythm for improving the efficiency and effectiveness perception of older customers, several website usability gurus [Ellis & Kurniawan 2000; Nielsen

2000] have proposed guidelines for designing a website for older adults which is easy to read and consistent. Finally, the relationships between website usability constructs and the three music composition constructs were confirmed for both age groups.

From a gender perspective, for males, cognitive appraisals showed stronger influence on purchase intention than affective appraisals, while for females, it was reversed. The result suggested that men tended to be directed more towards task-oriented behavior, while women tended to be directed more towards process-oriented and emotional behavior [van Slyke et al. 2002]. Moreover, for males, melody was the strongest factor impacting affective appraisals while for females, harmony was the most significant factor influencing affective appraisals. This indicated that females feel enjoyment and fun when website design components are well mingled with each other. Women have been known to perceive affect from the objects blending well in a variety of their design components [Norman 2002]. Harmony was the strongest factor affecting cognitive appraisals for males, suggesting that men perceived a website useful and effective when a variety of website design components are well mingled together to deliver a relevant amount of interactivity and information. Except for the learnability-melody relationship for females, all the relationships between the seven website usability constructs and three music composition constructs were found to be significant across different genders. The insignificance can be interpreted by the factor that several design features assisting learnability (hierarchical content order, wizards, or assistants) did not strongly influence female customers' perception of distinctive design patterns.

Finally, from a past purchase experience perspective, for the less experienced group (i.e., having less than 3 online purchase experiences), cognitive appraisals were found to have a stronger effect on purchase intention than affective appraisals, while for the more experienced group (i.e. three or more purchase experiences), it was reversed. This implies that the less experienced persons focused more on usefulness, effectiveness, or convenience of the website rather than on fun, interest, or pleasantry of it. The insignificant effect of rhythm on affective appraisals of the more experienced group is interesting, indicating that evenly distributed website design components with patterned movement contributed more to stimulating website users' cognitive perception rather than to positive affect. Further, the insignificant relationships between learnability-melody and uniqueness-melody may be due to the extensive experience of the subjects. Experienced online customers who have repeatedly purchased products or services by visiting a variety of web stores likely have tried many different types of design features. Thus they are less likely to perceive uniqueness and learnability while visiting websites they are familiar with than with websites they never visited.

In summary, although the proposed theoretical model was successfully validated across different ages and genders, this study found that different user groups are affected by different types of design factors. This finding will provide useful insights to e-business designers on how to develop a customized website that could be highly attractive to the target consumers.

5. Limitations

This study has several limitations which should be revisited in future studies. First, the two target websites used in the study might not represent all e-business domains. Second, endogenous and exogenous variables were collected through a self-reported survey, which could cause a self-selection bias. Although a common method variance test showed no significant self-selection bias, controlled lab experiments or replication studies measuring actual purchase in addition to purchase intention are recommended to deliver more practical guidelines and implications to e-business managers. Third, because the theoretical model was the focus of the study, other important website usability constructs (e.g. security) were overlooked. Fourth, other variables affecting online purchasing decisions including price, reputation, time, location constraints, and social influence on website usability and music composition perceptions were not investigated. Fifth, target websites of this study are websites rated as top-quality ones. Target subjects are familiar with them through their repeated visits and purchases. It is recommended to replicate studies with websites having moderate-quality and sites that visitors are less familiar with to test the generalizability of the findings of this study. Sixth, the proposed model was not compared with other related theoretical models of website usability. Future studies could address these issues. Finally, although it is conducive to utilize a focus group study to identify unknown nomological networks between website usability constructs and music composition constructs, it is recommended that future studies reconfirm the networks by adopting more rigorous methods such as a cognitive mapping approach.

6. Implications and Conclusions

Despite these limitations, this study could aid researchers and practitioners by providing useful knowledge about usable website design. From a theoretical perspective, the study has at least three implications. First, it proposes a new theoretical model of website usability. A good alternative theory provides a richer understanding of

website usability. In the absence of such theory-based effort, website designers would have to continually rely on developers' intuition, and more often than not, could not successfully capture the needs of end-users. By adopting an established theoretical model of music composition, and testing it in a website usability context, it was found that the model explained a significant amount of variance in online purchases. While more validation needs to be done, the proposed model can be used as an alternative theoretical model for conducting future research in website usability.

Second, this study develops and validates instruments for the proposed model using scientific instrument development procedures, something lacking in previous research. Previous website usability studies were lacking in instrument development because their instruments were developed based on industry usability professionals' intuition and experience. The validated instrument items, therefore, can be utilized in future usability studies and accumulated study findings can be directly compared.

Finally, this study found that different demographics were influenced by different usability factors. Although previous studies in information systems [Morris et al. 2005; Venkatesh et al. 2000] and marketing [Garbarino & Strahilevitz 2004; Kim et al. 2008] have found significant moderating effects of demographic variables such as age, gender, and past purchase experience on adoption of information systems and selection of products, stores, or services, only a few studies have empirically validated the effects of those moderating variables in a website usability context. This study can help researchers reach a clearer understanding of the preference of different groups of consumers towards different website usability factors. Ideal future e-business environments might include mass customization. This study can be a stepping stone for investigating micro-segmentation for customized e-commerce environments.

This study also has practical implications. First, the study finding of significant influence of both cognitive and affective appraisals on purchase intention provides useful insights to website designers and e-business managers and emphasizes that they should put balanced efforts to design websites that render online consumers both effectiveness and enjoyment. As indicated earlier, despite growing demands for designing a hedonic website that satisfies users' needs for fun, excitement, and enjoyment and the advancement of web technologies that enable diverse hedonic design components into web pages, website designers still follow industry guidelines emphasizing primarily the effective and efficient aspects of websites. The results of this study can be used to challenge practitioners to change their utilitarian-centered design perspective to a more balanced design perspective to weight utilitarian and hedonic design perspectives more equally. Second, this study identifying that websites with melodious, harmonious, and rhythmical design components stimulate a great deal of affective and cognitive appraisals of online consumers and that website usability constructs have significant relationships with music constructs confirms that our research model based on music composition theory can be successfully used by website designers as an alternative design guideline to develop usable websites that meet with consumers' hedonic and utilitarian needs. Finally, the dissimilarities of nomological networks of the research model across ages and gender, however, provide valuable knowledge for website designers to customize websites by wisely allocating the limited resources for website development. For example, for younger or female shoppers whose purchase decision is more heavily influenced by affective appraisals, website designers should assign more resources to increase melody perception (e.g. unique webpage structures by using cascading style sheets), while for older or male consumers, more efforts should be made to enhance rhythm perceptions (e.g. using larger white space, or assigning displayed text and images evenly across web pages), resulting in increased cognitive appraisals.

In summary, this study proposes and validates an alternative theoretical lens to understand the effect of website usability on online purchases. Future research in examining the boundaries and extending this theoretical model are expected to better explain the relationship between website design and online customer perception and behavior.

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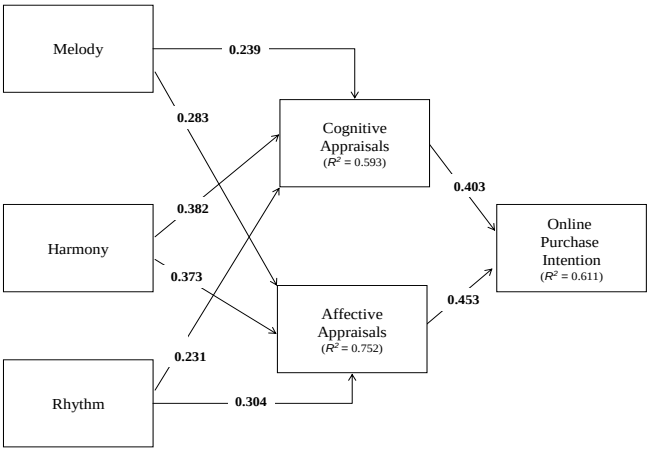
Appendix A: Confirmatory Factor Analysis (Travelocity.com)

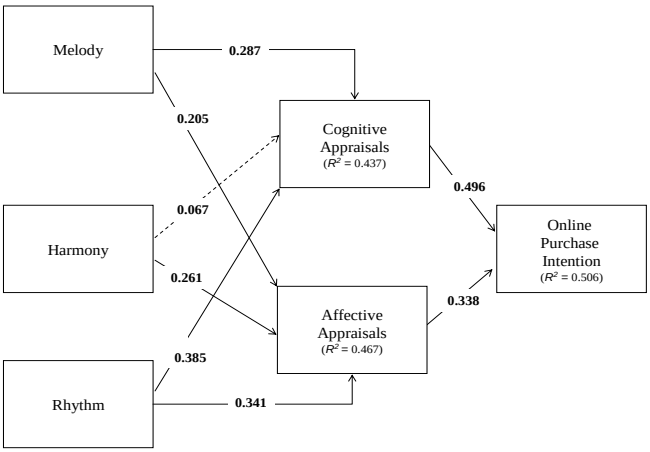
Construct	Items	Loading	CFR	AVE	α	Construct	Items	Loading	CFR	AVE	α
Purchase Intention (PI)	PI1	0.828	0.831	0.711	0.83	Uniqueness (UNIQ)	UNIQ1	0.714	0.846	0.579	0.843
	PI2	0.858					UNIQ2	0.828			
Affective Appraisals (AFF)	AFF1	0.781	0.819	0.603	0.817		UNIQ3	0.723			
	AFF2	0.736					UNIQ4	0.774			
	AFF3	0.810				Navigability (NAV)	NAV1	0.776	0.873	0.631	0.872
Cognitive Appraisals (COG)	COG1	0.835	0.922	0.747	0.922		NAV2	0.811			
	COG2	0.857					NAV3	0.790			
	COG3	0.889					NAV4	0.801			
	COG4	0.875				Interactivity (INT)	INT1	0.772	0.815	0.594	0.844
Melody (MEL)	MEL1	0.821	0.883	0.653	0.882		INT2	0.772			
	MEL2	0.824					INT3	0.769			
	MEL3	0.827				Content Relevance (CONT)	CONT1	0.787	0.861	0.608	0.861
	MEL4	0.758					CONT2	0.794			
Harmony (HAR)	HAR1	0.776	0.870	0.626	0.87		CONT3	0.758			
	HAR2	0.785					CONT4	0.779			
	HAR3	0.779				Consistency (CONS)	CONS1	0.827	0.902	0.698	0.902
	HAR4	0.825					CONS2	0.840			
Rhythm (RHM)	RHY1	0.715	0.886	0.610	0.882		CONS3	0.826			
	RHY2	0.816					CONS4	0.849			
	RHY3	0.826				Readability (REA)	REA1	0.736	0.849	0.587	0.848
	RHY4	0.811					REA2	0.824			
	RHY5	0.730					REA3	0.782			
Learnability (LEA)	LEA1	0.764	0.844	0.575	0.844		REA4	0.717			
	LEA2	0.762									
	LEA3	0.757									
	LEA4	0.751									

Appendix B: Inter-factor Correlation Matrix (Travelocity.com)

	PI	AFF	COG	MEL	HAR	RHY	LEA	UNIQ	NAV	INT	CONT	CONS	REA
PI	**0.843**												
AFF	0.383	**0.776**											
COG	0.528	0.262	**0.864**										
MELO	0.536	0.466	0.530	**0.808**									
HAR	0.387	0.442	0.354	0.344	**0.791**								
RHYM	0.593	0.543	0.568	0.649	0.489	**0.781**							
LEA	0.448	0.585	0.316	0.586	0.382	0.602	**0.759**						
UNIQ	0.292	0.222	0.221	0.346	0.189	0.368	0.355	**0.761**					
NAV	0.380	0.483	0.304	0.601	0.290	0.488	0.532	0.267	**0.795**				
INT	0.377	0.437	0.308	0.345	0.698	0.436	0.394	0.274	0.352	**0.771**			
CONT	0.377	0.482	0.274	0.400	0.731	0.450	0.406	0.151	0.370	0.608	**0.780**		
CONS	0.384	0.314	0.335	0.405	0.287	0.608	0.384	0.316	0.294	0.299	0.258	**0.836**	
REA	0.377	0.423	0.219	0.441	0.336	0.457	0.563	0.214	0.480	0.401	0.350	0.270	**0.766**



Appendix C a) Amazon: The Music Composition Only Model



Appendix C b) Travelocity: The Music Composition Only Model