# A Theoretical Overview of Consumers' Temporal Perception: Prospective versus Retrospective Estimates

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## Abstract

The subjective experience of time has important implications for marketers. Modern day consumers are in constant scarcity of time and, therefore, regard it as a very valuable asset. Given that consumers often sacrifice their time in the form of experiencing delays, waiting for service, spending time to search for product information and to shop, it is possible to conceptualize time as a significant component of the total cost of these transactions (Kellaris & Kent, 1992). Existing researches have recommended musical characteristics responsible for various effects on consumers. Music, used as an important marketing stimulus, has the power to influence consumers' temporal perceptions. The current study reviews theories on temporal perception and brings forward research questions that would enable further insight on the effects of music modality from two different temporal perception research paradigms.


## Theoretical Background on Temporal Perception

The notion of time (temporal) perception refers to an individual's time-related experiences, behaviors, and judgments (Block & Zakay, 2001). It includes such temporal experiences as (1) duration (interval length) estimates, and (2) subjective speed of time passage (Sucala, 2011). Subjective speed of time passage refers to the perceived pace with which time passes (Wearden, 2005). Duration estimate is defined as an estimation of a temporal interval length (Sucala, et al., 2010). Although literature on time perception has generated research on both subjective speed of time passage, and duration estimates, much of the research effort is centralized around the latter topic (Block, 1990).

The subjective experience of time has important implications for marketers. Modern day consumers are in constant scarcity of time and, therefore, regard it as a very valuable asset. Given that consumers often sacrifice their time in the form of experiencing delays, waiting for service, spending time to search for product information and to shop, it is possible to conceptualize time as a significant component of the total cost of these transactions (Kellaris & Kent, 1992). Thus, a possible way to minimize the cost of time for consumers is to manipulate their perceptions of it by controlling the properties of external stimuli that surround and influence them.

Research on time perception has produced a number of contradictory findings as to how duration estimates are formed. Research suggests that perceived time is a function of changes in external stimuli and internal states experienced during a particular time interval (Zakay & Block, 1994). More specifically, physical time interval of a stimulus event can be perceived differently under different physical, cognitive and psychological states.

For instance, a body of empirical evidence suggests that estimates on the duration of an event become longer when the event is filled with an information processing task than when it is empty (Ornstein, 1969; Thomas & Brown, 1974; Boltz, 1991). However, the literature has witnessed other studies (Zakay, Nitzan & Glicksohn, 1983) that report just the opposite. Furthermore, a group of investigations (Ornstein, 1969; Thomas & Brown, 1974; Boltz, 1991) suggests a positive relationship between the amount of information to be processed from an event, and the magnitude of duration estimates about it. Conversely, some research (Curton & Lordahl, 1974; Grondin & Macar, 1992; McClain, 1983; Zakay, 1989) suggests a negative relationship between the same two variables (Zakay & Block, 1994).

The reason for this obvious contrast in findings is that time perception research is governed by two distinct experimental paradigms. Based on the researcher's point of view, human time perception can be investigated from either a prospective paradigm or a

retrospective paradigm (Zakay, 1990). Research suggests that different cognitive mechanisms characterize prospective and retrospective duration estimates (Sucala, Scheckner, and David, 2011). In the prospective paradigm, subjects are made aware that the experimental task involves estimating the duration of a stimulus. In contrast to prospective time perception, the retrospective paradigm involves collecting subjects' duration estimates after the completion of a stimulus task (Zakay & Block, 1997). In this case, subjects are not aware that they will have to make a duration judgment at the end of the task.

***Prospective Temporal Perception***

Cognitive research on prospective time perception has traditionally explained the phenomenon with attentional models (Zakay & Block, 1994). These models rely on the premise that time perception is a function of temporal and non-temporal information processing (Thomas & Weaver, 1975; Zakay, 1989; Zakay & Block, 1996). According to this framework, when required to make a prospective duration estimate, individuals divide their attentional resources between processing temporal (time-related) information, and non-temporal (task-related) information (Sucala, 2011).

Due to capacity limitation (Kahneman, 1973), as a task demands more non-temporal information processing, less attentional resources are allocated for the processing of temporal information, which, in turn, results in experiencing a shorter duration (Zakay & Block, 1994). More specifically, as the difficulty of processing a task increases, experienced duration becomes shorter (Macar, Grondin, and Casini, 1994) because attention is focused more on processing non-temporal stimuli than temporal stimuli. Therefore, attentional models of time perception predict a negative relationship between the amount of information to be processed from an event and the length of duration estimates (Zakay & Block, 1994).

***Retrospective Temporal Perception***

Hence, factors such as temporal time processing or task difficulty are not relevant in making retrospective duration estimates. Alternatively, this experimental paradigm mainly concerns subjects' remembrance of event durations (Kellaris & Mantel, 1996). Research suggests that, in the retrospective scenario, duration estimates about a stimulus event are based on the amount of information encoded and retrieved from the event (Ornstein, 1969, Block, 1990, Zakay and Block, 1996). Therefore, retrospective models predict a positive relationship between the amount of memory processed from a stimulus, and the magnitude of duration estimates about it. A classic model of retrospective time perception is Ornstein's (1969) storage-size model. The model posits that as individuals allocate larger memory space to a complex information processing load, their duration estimates expand.

Individuals generally do not pay close attention to the passage of time. When required to remember the duration of a stimulus, they rely on availability heuristic, which means that they perceive the duration as being longer if they can retrieve more memory about the stimulus (Block, 1990; Zakay and Block, 2004). Research also sugests that duration estimates are amplified when stimuli are novel (Tse, et al., 2004; Pariyadath and Eageman, 2007), bigger (Ono and Kawahara, 2007; Xuan, et al., 2007), faster (Brown, 1931), and brighter (Fraisse, 1963; Brigner, 1986; Xuan, et al., 2007). Furthermore, stimuli containing larger numerosity (Xuan, et al., 2007), more complex patterns (Roelofs and Zeeman, 1951; Schiffman and Bobko, 1974), and higher number of events (Poytner, 1989; Brown, 1995) are also perceived as occupying more temporal space.

Another key approach to retrospective duration estimate is the contextual-change model of time perception (Block and Reed, 1978; Block, 1990). This model contends that remembered duration of an event expands as a function of the amount of contextual changes encoded in memory (Zakay and Block, 1997). These contextual changes are characterized by

both (1) external changes related to the stimulus event, and (2) internal changes related to the individual. Internal changes may stem from changes in meanings, cognitive strategies, or states of mood (Zakay and Block, 1994). In general complex stimuli involve more contextual changes because they demand more varied kinds of processing (Zakay and Block, 1997). As Poytner (1983) points out, each of these contextual changes creates a meaningful segment in a given time period. As the processing load of an event becomes heavier, the level of time segmentation increases. As a result, individuals remember a multi-segment time period as being longer than an augmented time period (Zakay and Block, 1997). The same argument holds also for filled versus empty time intervals (Zakay and Block, 1994), where a filled interval means a heavier information processing load due to the occurrence of more changes (segments).

**Music-related Consumer Research on Temporal Perception**

Music-related consumer research on time perception has accumulated a significant amount of scholarly work since the 1980s. The literature mainly deals with musical influences on various time-related dependent variables, such as consumer attitudes and perception. However, the vast majority of these investigations share a simplistic conceptualization of music where musical sound is seen as a generic sonic mass. Music theory, on the contrary, suggests that musical sound is not a sonic chunk. Rather, music consists of a number of structural elements, which can basically be grouped as time, pitch, and texture (Bruner 1990). In other words, musical sound can be thought of as being a complex combination of individual elements, where each element interacts with another.

This multi-dimensional (versus uni-dimensional) character of music should be carefully considered when using musical variables in a consumer research design. If not, interactions among structural musical elements may produce confounding effects, which in

turn may cast doubt on the internal validity of the research. For instance, a common trait of the music-related consumer research that documented no tempo effects on time perception (Bickel, 1984; Caldwell and Hibbert, 2002; Chebat, et al., 1993; North et al., 1998) is that they simply manipulated musical tempo by using some form of music (e.g.,, classical compositions - popular songs, liked – disliked music), thereby ignoring the multidimensional nature of musical sound. More specifically, although musical tempo was the independent variable in these investigations, its effect was not isolated from the effects of other musical elements. The internal validity of these investigations are questionable because it is quite possible that their findings were confounded by the main or interaction effects of other musical variables (e.g., rhythm, phrasing, pitch, texture, etc.) (Oakes, 2003).

Since Bruner's (1990) seminal work, the music-related consumer research has produced a number of investigations that acknowledged the multidimensionality of musical sound (Kellaris & Kent 1991, 1992, 1994; Kellaris & Rice 1993; Kellaris, et al., 1993; Kellaris & Mantel 1994, 1996; Oakes 1999, 2003; Oakes & North, 2006). In a seminal review article on music and mood, Bruner (1990) borrowed insights from music theory, and proposed a taxonomy of structural musical elements. The taxonomy defined musical sound in terms of three basic musical elements, namely *time* (characterized as tempo, rhythm, and phrasing), *pitch* (characterized as mode, melody, and harmony), and *texture* (characterized as volume, timbre, and orchestration). Bruner suggested that music should be seen as a chemistry of these compounds, and that emotional responses to music depend largely on their main and interactive effects.

In another seminal work, Kellaris and Kent (1994) proposed a similar taxonomy in which music was characterized in terms of tempo, tonality, and texture. Different from Bruner (1990), however, Kellaris and Kent (1994) also designed an experimental study to document

the main and interaction effects of musical elements on a number of emotional responses. Findings of this seminal work are discussed in the following sections.

For instance, Milliman (1982) manipulated tempo in a supermarket setting, and found the speed of in-store traffic to be significantly slower with slower music than with faster music. The author also observed a significant negative relationship between tempo and sales volume, such that sales volume was higher under slow music than fast music. In a consecutive study, Milliman (1986) used a restaurant setting to observe the behaviors of customers. The study reported that customers who listened to slow music while eating spend a longer time to finish their meal. In two consecutive field studies, Chebat, et al. (1993) investigated the effects of positively versus negatively valenced music on perceived waiting durations. Findings suggested that positively valenced music increased perceived duration of the wait, but this effect did not influence approach behaviors negatively. A related study by Hui, Dube and Chebat (1997) suggested that subjects listening to liked-music perceived the wait time as being longer than those listening to disliked-music. However, similar to Chebat, et al. (1993) they posited that the perceived wait time did not have a negative effect on subjects' attitude toward the service. Similarly, Cameron, et al. (2003) reported that although liked music caused wait time to be perceived as being longer, it also evoked positive mood, which in turn positively affected subjects' evaluations of their service experience. Finally, Yalch and Spangenberg (2000) found that although subjects listening to familiar music shopped faster than those listening to unfamiliar music, they perceived the duration of shopping interval as being longer.

***Music Modality***

According to music theory, musical sound can be characterized in terms of three main elements: pitch, time, and texture (Bruner, 1990). These musical elements have main and

interaction psychoacoustic effects on the listener. Modality is an important musical variable since it provides the basic framework within which pitches are organized to form melodies and harmonies (Kellaris and Kent, 1991).Study by Stout and Leckenby (1988) found mode to have the greatest impact among other musical components.

Modality refers to the configuration of intervals between notes in a scale, the most common examples being the "major" and "minor" modes (Apel 1973). Modality is a well-established antecedent of affective response to music. Each mode has a distinct sound and creates a specific mood on the listeners. In general, major tones tend to be-associated with positive thoughts and feelings, whereas minor tones with negative thoughts and feelings (Bruner, 1990).

There are also many "atonal" modalities which are neither major nor minor, each with its own aesthetic character. Music in neither major nor minor mode (atonal music) is found to be associated with feelings of surprise, sadness, and ominousness. Atonality in its broadest sense describes music that lacks a tonal center.  Atonality usually describes music compositions where a hierarchy of pitches focusing on a single, central tone is not used, and the notes function independently of one another.

Consumer research involving the objective properties of music suggests that modality produces main and interaction effects on a wide variety of consumer responses. For instance, in their seminal work, Kellaris and Kent (1994) operationalized mode (along with tempo and texture) in three levels as major, minor, and atonal. The authors documented that while music in major mode was evaluated as being more appealing than music in minor mode, atonal music was found to be less appealing than either major or minor tones. Moreover, feelings of surprise were greater when the music was played in atonal (than tonal major or tonal minor) keys.

In another experimental study, Kellaris and Kent (1991) investigated the main and interaction effects of mode and tempo on a number of evaluative and behavioral intention measures. The authors reported that evaluations of, and behavioral intention toward music were greater under faster tempo and more tonal music. Furthermore, tempo and mode were also found to have a positive influence on felt arousal from the music. Kellaris and Rice (1993) explored the influence of tempo, volume, and gender on a number of listener responses to music.

Kellaris and Kent (1992) reported a significant effect of mode on retrospective duration estimates. According to the findings, music in major mode (versus minor and atonal modes) positively influenced duration estimates, such that subjects who listened to this type of music reported longer estimates. Using insights from the cognitive models of psychological time, the authors proposed that higher duration estimates were a result of felt pleasantness from major modes, which motivated listeners to devote more cognitive resources on processing the music, rather than time. Their finding showed that time moves fastest during the least liked mode, the atonal mode. They explained their finding with a cognitive capacity model that assumes that familiar music causes the allocation of greater cognitive resources." (p.373). But other evidence suggests instead that the atonal music uses more resources and that increased cognitive activity makes time fly.

Cognitive models of retrospective time perception (Ornstein, 1969, Block, 1990, Zakay & Block, 1996), postulate a positive relationship between duration judgments and the amount of information processing. Furthermore, time perception research also suggests a positive relationship between duration estimates and complex stimulus characteristics (Brown, 1931; Xuan, et al., 2007; Roelofos & Zeeman, 1951; Schiffman & Bobko, 1974).

The review of the theoretical grounds of both temporal perception mechanisms and findings from music modality research imply a direct effect modality on temporal perception. Human time perception depends on whether the duration judgment is made prospectively or retrospectively. In the prospective paradigm, individuals estimate the duration of a complex task as being shorter because less attentional resources are devoted to the processing of temporal information. Alternatively, in the retrospective paradigm, individuals report longer duration estimates for complex tasks because their duration judgments are based on the amount of task-related information encoded in memory (Zakay and Block, 1997).

***RQ1****: How do prospective time estimates differ among tonal (minor and major tones) and atonal music expositions?*

***RQ2****: How do retrospective time estimates differ among tonal (minor and major tones) and atonal music expositions?*

**Discussion and Directions for Future Research**

Music plays a pervasive role in consumers' lives and is often used in marketing communication. The scarcity of time in the lives of modern consumers makes it a valuable asset. Although physical time is an objective property and can be measured universally, psychological time is relative, and its perception may change depending on individual and situational characteristics. Therefore, an effective method of reducing the cost of time for consumers may be to alter the way how it is perceived.

Music related consumer research demonstrates that music can play an effective role in changing consumers' temporal perceptions. In addition to its effectiveness as a psychological tool, its presence in almost all contexts of consumers' lives makes music a highly convenient

and powerful agent for this purpose. Consumer research on time perception suggests that music can alter temporal perception through the individual or interactive effects of structural elements, such as tempo, modality, and texture. Dissecting music down to its structural elements is, in fact, crucial in order to conduct internally valid research on time perception. Advances in digital music technology facilitate such research.

The current study reviewed the literature on temporal perception mechanisms and explored possible effects of music modality on the perception of prospective and retrospective time. In light of the prior theoretical explanations two research questions were brought forward for future exploration. It is proposed that relative simplicity of tonal (versus atonal) music with different mechanisms underling time perception research paradigms would lead individuals to report duration estimates that differ in length. Findings from music related consumer research would serve valuable insights on such mechanisms which would expand our current understanding on the effects of specific properties of music on consumer behavior.

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