

Musical Factors Influencing the Perceptual and Cognitive Reality of Schenkerian Hierarchic Structure in Music: A Qualitative Case Study

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Abstract: The Schenkerian hierarchical structure, a fundamental concept in Schenkerian theory, offers a systematic approach to analyzing the underlying organization of tonal music. However, the extent to which listeners perceive and cognitively process these hierarchical structures remains an area of inquiry. This study investigates the influence of various musical factors on the perception and cognition of Schenkerian hierarchical structures. Through a qualitative research approach involving undergraduate music students, the research explores how elements such as harmony, structural position, linear progression, rhythm, meter, and intensified tones shape listeners' understanding of musical hierarchy. The findings highlight the predominant role of harmony, aligning with Schenkerian theory's emphasis on harmonic progression. Additionally, the study underscores the subjective nature of linear progression interpretation, influenced by individual musical backgrounds and training. The results suggest the need for a more comprehensive Schenkerian analysis framework that incorporates rhythm and intensified tones, as these factors were generally ranked lower in importance by participants. Despite limitations in sample size and experimental scope, this study provides a nuanced understanding of how listeners process and comprehend hierarchical structures in music.

Keywords: Schenkerian Theory; Hierarchical Structure; Music Perception; Music Cognition; Musical Factors; Qualitative Analysis; Case Study.

1. Introduction

Unraveling the perceptual and cognitive realities of hierarchical structures in music is the central focus of this study, with a particular emphasis on the framework proposed by Schenkerian theory. Schenkerian theory provides a systematic approach to analyzing tonal music's underlying organization and plays a pivotal role in understanding the perceptual and cognitive reality of these hierarchical structures. Previous research has revealed intrinsic correlations between Schenkerian theory and both perception and cognition (Serafine et al., 1989; Temperley, 2011; Carrabr , 2015), forming the theoretical foundation for this field. However, the specific musical factors that enable the perception and recognition of the Schenkerian hierarchical structure remain unclear, necessitating further investigation. To address this gap, this research aims to elucidate the musical factors potentially influencing listeners' perception and cognition of Schenkerian hierarchical structures by examining elements such as harmony, structural position, linear progression, rhythm, meter, and intensified tones. The findings of this study are expected to enrich our understanding of how hierarchical structures in music are processed and comprehended by listeners, shedding light on the perceptual and cognitive underpinnings of the Schenkerian hierarchical structure. This endeavor contributes not only to scholarly discourse on music perception and cognition but also offers insights for music theorists seeking to deepen their understanding of this intricate musical framework[1-3].

2. Schenkerian Theory in Music Perception and Cognition Research

Several pioneering studies have shed light on the perceptual and cognitive reality of hierarchical structures in music, revealing intrinsic correlations between Schenkerian theory, perception, and cognition. For instance, Serafine et al. (1989) conducted experiments to verify the cognitive reality of Schenker's hierarchical theory. They examined whether individuals can discern the correlation and distinction between the underlying structure and surface manifestations of musical compositions. Similarly, Nicola Dibben (1994) employed a comparable approach. Their experiments adopting a reductionist perspective demonstrated that listeners can perceive melodies and harmonic progressions through structural skeletons. To some degree, the reductions can function as representations of how listeners hear and understand musical structure.

David Temperley (2011) discussed evaluating Schenkerian theory not only as a theory of composition describing composers' mental representations but also as a predictive model for listeners' cognitive representations of tonal music. Jason Yust (2012) proposed an experimental approach to investigate the perceptibility of structural reductions in tonal melodies, reporting how hypotheses derived from Schenker's theories explain features of listeners' perception of key relationships. Instead of presenting musical reductions directly, Yust manipulated melodies at individual tones in a same-different task. This methodology examined the effects of within-harmony deviations at different time-span reduction levels on listeners' recognition, hypothesizing that deviations in deeper reductions would alter the fundamental mental representation of the melody. Furthermore, experimental support for the perceptual and cognitive possibilities of

Schenkerian theory, especially the melodic aspect, has been documented in studies by Martínez (2001, 2008), Larson & McAdams (2004), and Larson & VanHandel (2005).

Despite the progress made by these studies, questions remain unanswered regarding how listeners perceive and recognize the Schenkerian hierarchical structure and the specific factors contributing to its perceptibility and recognizability. This study aims to fill this gap by identifying and delineating the musical factors potentially influencing the perceptive and cognitive reality of the Schenkerian

hierarchical structure, enriching our understanding of Schenkerian theory's impact on musical perception and cognition.

3. Theoretical Discussion

Before delving into the empirical investigation, this section discusses the potential factors that may influence the perception and cognition of Schenkerian hierarchical structures, as shown in Table 1.

Table 1. Proposed Musical Factors Influencing the Perception and Cognition of Schenkerian Hierarchical Structures

Musical Factors			
The first factor	Structural position		The primary tones at the beginning (e.g., beginning tone)
			The closing tones at the end (e.g., ending tone)
			The midpoint of a linear progression (e.g., melodic transitions)
			The peak tones (e.g., the highest and lowest tones or close to them)
The second factor	Harmony		Harmonic function (e.g., tonic and dominant)
			Harmonic progression (e.g., I-V-I)
			Harmonic cadence
			Consonant tones (e.g., harmonic tones)
			Dissonant tones (e.g., nonharmonic tones)
The third factor	Rhythm and meter		Rhythmic and metric accents (e.g., accented beat, syncopation)
			Long held tones
The fourth factor	Linear progression (Linear motion)		Descending stepwise motion
			Ascending stepwise motion
			Arpeggiated and disjunct motion
The fifth factor	Intensified tones	Embellished tones	Tones with ornaments (e.g., trills, acciaccatura, appoggiatura, arpeggio)
			Tones with articulation (e.g., staccato, sforzato)
	Recurring tones		Repeated tones (e.g., the tones played continuously)
			Frequently occurring tones (e.g., the tones that occur frequently but not continuously)

1) Structural Position: According to Fred Lerdahl (1989), a tonal hierarchy is crucial for maintaining the distinction between salience and structural importance in tonal music. Without such a hierarchy, the structural integrity of tonal music could collapse. Consequently, this study categorizes tonal hierarchy as highly relevant, considering its significance at both surface and deep structural levels. Hjortkjær et al. (2009) suggest that tones at or near the beginning or end of a melody play a crucial role in structural organization, akin to the beginning or end of a narrative. However, in Schenkerian theory, the initial or final position of notes may not be inherently crucial. Techniques such as prolongation can delay the arrival at the primary note of the *Urlinie*, affecting the perceived structural significance of individual notes. Therefore, the structural position of tones within the tonal hierarchy, such as the central tone at the beginning, the closing tone at the end, turning points, and peak tones (highest and lowest pitches), warrants further investigation. By examining these elements, we can better understand their contribution to the overall structural integrity and perception of hierarchical structures in music.

2) Harmony: Harmonic function (especially tonic and dominant), harmonic progression, and cadences are considered essential in shaping listeners' perception of musical structure. The role of harmonic factors in Schenkerian analysis has been widely acknowledged, and their influence on listeners' understanding of hierarchical structure merits further investigation.

3) Rhythm and Meter: Rhythmic and metric accents, as well as long-held tones, may influence listeners' perception and cognition of the Schenkerian hierarchical structure. Serafine et al. (1989) suggest that metric accent is a major

factor in determining what listeners regard as structurally important. Tones on strong or accented beats, tones of longer rhythmic duration, and tonic tones are more easily recognized as focal points. However, their experimental results showed that participants struggled to identify hierarchical structures based solely on metric accent. Previous studies have often focused on linear aspects of pitch and melody, potentially neglecting the importance of rhythmic and metrical components. The omission of distinctive rhythm and meter in Schenker's *Ursatz* raises questions about the relative importance of harmonic factors compared to rhythmic and metrical aspects.

4) Linear progression: The presence of a downward melodic line, a key feature of Schenkerian theory, may contribute to listeners' perception of hierarchical structure. At local levels, salience at the musical surface determines structural significance, whereas at global levels, more abstract qualities such as linear progression may play a greater role. The coherence between discrete pitches relies on abstract factors beyond concrete techniques. This study posits that melodic fluency serves as a crucial abstract element in maintaining coherence within tonal melodies. Schenker's concept of the *Urlinie* underscores this notion, emphasizing a simple stepwise line underlying even the most complex melodies. This inherent fluidity and coherence in tonal melodies can be understood as a form of prolongation, contributing to the overarching structural integrity of the music. The significance of linear progression in Schenkerian analysis suggests that it may also play a vital role in listeners' cognitive processing of music.

5) Intensified tones: Events that are relatively loud, registrally prominent, texturally prominent, dense, or of long

duration may be structurally salient and influence listeners' perception of hierarchical structures. However, it should be noted that strong metrical accents may not always align with structural elements in Schenkerian reductions, further complicating the role of intensified tones in perceiving hierarchical structures. The importance of ornamented tones in perceiving structure is likely to be controversial, with some listeners arguing for their significance while others do not.

While these factors are discussed as potentially significant, it is important to note the interplay between them. For instance, the closing tone of a melody may also serve as a cadential tone, highlighting the interplay between structural position and harmonic factors. Further empirical investigation is needed to clarify these relationships and their impact on listeners' perception and cognition of Schenkerian hierarchical structures [4-7].

4. Methodology

This study employed a qualitative research approach to explore the influence of various musical factors on the perception and cognition of Schenkerian hierarchical structures. Qualitative methods were chosen due to their ability to provide rich, in-depth insights into participants' experiences and thought processes (Creswell, 2013). The exploratory nature of this study, focusing on participants' subjective perceptions and interpretations, aligns well with the strengths of qualitative research. However, the small sample size and the specific context of this study (undergraduate music students at a single university) may limit the transferability of the findings to other populations or settings. Additionally, the researchers' own musical backgrounds and experiences may have influenced their interpretations of the data. To address this, the researchers engaged in reflexivity by acknowledging their potential biases and actively seeking alternative explanations during the analysis process.

A multifaceted approach was utilized, comprising listening experiments and semi-structured in-depth interviews. The listening experiments involved presenting selected musical excerpts to participants and assessing their ability to discern structurally significant measures and fundamental tones contributing to the hierarchical structure. Participants were instructed to distinguish between surface-level elements and deeper structural components, drawing upon their intuitive perceptions and musical understanding.

Following the listening experiments, interviews were conducted to delve into the participants' rationales and the factors they perceived as influential in their structural recognition. These interviews, which allowed participants to articulate their individual experiences and perspectives, aimed to uncover the reasoning behind their choices and identify which musical elements they found most significant (such as harmony, etc.).

This combination of controlled listening tasks and open-ended interviews facilitated a comprehensive exploration of the interplay between theoretical constructs and cognitive realities, providing insights into the perceptual and cognitive processes underlying the comprehension of the Schenkerian hierarchical structure.

(1) Experimental Design

Experiments were conducted in a controlled setting, designed to elicit participants' awareness of the structural layers in music. Participants engaged in a series of tasks assessing their understanding of musical structure. By

differentiating between 'surface structure' and 'fundamental structure,' the tasks aimed to link participants' sensory experiences and musical understanding to Schenkerian structural theory. To be specific, the first task involved identifying structurally significant measures within selected pieces based on intuitive responses. The second task required participants to identify tones contributing to the fundamental structure, considering various musical elements. These tasks were tailored to evaluate the impact of factors such as structural position, harmony, rhythm and meter, linear progression, and ornamentation on the perception and cognition of the hierarchical structure.

(2) Participants

Six undergraduate music students from Kyushu University were recruited using purposive sampling. This sampling method allowed for the selection of participants who met specific criteria, such as having basic performance abilities and music theory knowledge, while also having prior exposure to Schenkerian theory. Ensuring overall consistency among participants in these aspects minimized the influence of existing familiarity with the conceptual framework on their perceptions. The overall consistency of the participants in these aspects as much as possible, ensured that their perceptions were not influenced by their existing familiarity with the conceptual framework. Although the sample size is relatively small, it is considered appropriate for qualitative studies that aim to provide detailed, context-specific insights rather than broad generalizations (Patton, 2015).

(3) Materials

The following musical pieces were selected for analysis:

- a) Beethoven, Piano Sonata, Op. 10 No. 3 III, mm. 1-16.
- b) Haydn, St. Anthony Chorale, mm. 1-29.
- c) Chopin, Prelude in G Major, Op. 28 No. 3, mm. 1-33.

The first two pieces were chosen for their relative simplicity, featuring clear themes, slower tempos, and distinct harmonies. In contrast, Chopin's piece presented different characteristics, increasing the complexity of structural recognition.

(4) Procedure

The experiments were conducted on a one-to-one basis to minimize external influences and provide a clear view of each participant's cognitive processes in relation to the experimental stimuli. Before commencing the experiment, participants received a brief introduction to the study's objectives and procedures. The experiment consisted of two listening sessions:

- First Listening: Participants identified measures within the pieces they perceived as structurally significant based on their listening experience. They were instructed to circle at least three measures they considered crucial.
- Second Listening: This task focused on identifying tones believed to contribute to the fundamental structure. Participants considered the relationship between the melody in the upper staff and the harmony in the lower staff, selecting tones they perceived as structurally foundational. They were to choose at least three such tones, distinguishing the most important ones with solid lines and the relatively important ones with dashed lines.

After the listening sessions, participants compared their identified fundamental structures to those outlined in Schenkerian analyses. The Schenkerian analysis results and graphs for these pieces were derived from Beach (2012: 55;

73-74; 111). The researcher explained Beach's Schenkerian analysis process for these materials in detail. This was followed by an interview where participants discussed the factors they felt influenced their perceived structures and those deemed influential, referencing several factors discussed and presented in section 3

(5) Data Collection and Analysis

Participants' reasons for their choices were discussed, focusing on musical aspects such as harmonic content, rhythm and meter, structural position, and linear progression. This allowed for an exploration of which musical factors participants believe significantly impact the hierarchic structure. Qualitative analysis techniques were employed to interpret the data collected during the experiment. Themes and patterns emerging from participants' responses were identified and analyzed.

During the interviews, participants' reasons for their choices were discussed, focusing on the several possible factors proposed in this study. This discussion allowed for an exploration of which musical factors participants believe

significantly impact the hierarchical structure. Qualitative analysis techniques, especially thematic analysis, were employed to interpret the data collected during the experiment and interviews. Themes and patterns emerging from participants' responses were identified and analyzed to understand the factors influencing their perception and cognition of Schenkerian hierarchical structures[8-11].

5. Results and Discussion

The results from the interviews provide valuable insights into the factors that participants (denoted A-F) identified as influential in shaping their perception and cognition of Schenkerian hierarchical structures in music. The data, detailed in Figure 1, shows both individual preferences and collective trends that highlight the most influential factors. Individual rankings are expressed in Arabic numerals, and overall group rankings are summarized through Roman numerals, providing a visual representation of how each factor is valued by participants.

	Musical Factors		Participants themselves		Ranking	Schenkerian hierarchic structure	Ranking	
A-F: 6 participants	The first factor	Structural position	5persons (A, B, C, D, F)	3persons (A①, B①, D②)	II	3persons (A, D, F)	2persons (A①, D①)	IV
					III		2persons (A②, F④)	IV
Arabic numerals: Individual ranking of the importance	The second factor	Harmony	6persons (A, B, C, D, E, F)	3persons (A①, C①, E①)	II	5persons (A, B, C, D, E)	5persons (A①, B①, C①, D⑤, E①)	I
					I		4persons (A⑤, B②, E②, F①)	II
Roman numerals: Collective preferences	The third factor	Rhythm and meter	3persons (C, D, F)	2persons (C②, F⑥)	III	1person (D)		
					II		1person (D⑦)	V
	The fourth factor	Linear progression (Linear motion)	4persons (B, C, E, F)	1person (B③)	IV	5persons (A, C, D, E, F)	5persons (A⑧, C③, D②, E④, F②)	I
					IV		2persons (A⑨, F①)	IV
	The fifth factor	Intensified tones	Embellished tones	2persons (A, D)		3persons (A, D, F)		
							III	1person (D⑩)
	Free text	F: timbre, instrument		2persons (A⑦, D④)	IV		2persons (A⑪, D⑨)	IV
					IV	2persons (D⑧, F③) ²⁴	IV	

Figure 1. Individual and Group Rankings of Musical Factors Influencing the Perceptual and Cognitive Reality of Schenkerian Hierarchical Structure

Factors Influencing Perception and Cognition of Schenkerian Hierarchic Structure

- **Harmony:** Universally recognized by all participants as a key factor, harmony (including harmonic function and progression) was consistently ranked high in importance for its role in shaping hierarchic structure.
- **Structural Position and Linear Progression:** Close behind, these elements were also highly rated. Five participants identified linear progression as significant, with distinct interpretations of its influence; descending motions were often associated with signaling the end of phrases or transitions, while ascending motions were linked to climactic or developmental parts of the composition.
- **Rhythm and Meter, Intensified Tones:** Less frequently chosen and generally ranked lower in importance. Only one participant considered it

crucial, indicating a potential undervaluation of these elements in the cognitive processing of structural recognition in music.

The predominant recognition of harmony and its functions highlights its central role, consistent with Schenkerian theory's emphasis on harmonic progression. The importance of a tone's structural position often aligns closely with its harmonic function, further emphasizing the central role of harmony in the perception and cognition of Schenkerian hierarchical structures.

On the other hand, even when participants chose the same factor, such as linear progression, their reasons for selecting it varied. For example, some participants considered descending stepwise motion important for foreshadowing the end of a musical expression or the beginning of a new passage, while others viewed ascending stepwise motion as crucial for signaling the melody's climax and further developmental changes. The varied interpretations of linear progression

suggest that individuals might apply personal musical experiences and expectations to their analytical listening, which can diversely influence their perception of structure. This diversity in interpretations warrants further exploration in future research.

Rhythm and meter, along with intensified tones, were less frequently chosen and generally ranked lower in importance. Serafine et al. (1989: 43) also mentioned in their research: "The previous experiments, although suggesting that subjects are sensitive to metric accent as a determiner of structure, nevertheless do not show an especially strong ability on the part of the subjects to identify an excerpt's hierarchic structure." As such, these factors, while influential, are not considered critical determinants of the perception and cognition of hierarchic structures. This is consistent with Schenkerian theory, and these tend not to be important elements in analyzing hierarchies.

Furthermore, participants were asked to rate how well they thought the hierarchical structure proposed by Schenkerian theory could be perceived and recognized through the musical factors discussed. The participants' choices varied widely, ranging from high recognition (80-100%) by one participant to no correspondence (1-20%) by another. This variation underscores the subjective nature of musical perception and the complexity of applying Schenkerian analysis in practical listening contexts.

6. Conclusion and Future Directions

This study reveals the interplay between various musical factors and their influence on the perception and cognition of the Schenkerian hierarchical structure. The findings contribute to a more nuanced understanding of how listeners process and make sense of hierarchical structures in music. The predominant recognition of harmony and its functions aligns with Schenkerian theory's emphasis on harmonic progression, while the varied interpretations of linear progression underscore the subjective dimension of musical perception influenced by individual backgrounds and musical training. The results also highlight the need for a more comprehensive understanding of how different musical elements are perceived and the potential for expanding Schenkerian analysis to more fully incorporate elements like rhythm, meter, and intensified tones, which were generally ranked lower in importance by participants. Moreover, examining the interaction between different musical factors and their cumulative effect on the perception of musical structure could yield deeper insights into the cognitive processes involved in music analysis. Future research could build upon these findings by exploring the impact of the potential factors presented in this study on structural perception in more detail.

While this study provides insights into the factors

influencing the perception and cognition of the Schenkerian hierarchical structure, it is not without limitations. The small sample size and the specific pieces chosen for the experiments may limit the generalizability of the findings. The lack of a control group could have introduced potential biases as well. Expanding the study to include a larger, more diverse sample and a broader range of musical pieces would help strengthen the validity and generalizability of the results. Additionally, given the subjective nature of musical perception highlighted by the study, future research could benefit from a mixed-methods approach that combines quantitative measures with the qualitative insights provided here. This could provide a more comprehensive understanding of the cognitive processes underlying the perception and recognition of the Schenkerian hierarchical structure.

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