Closure: a mind/brain perspective

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Compulsory Declaration

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

Signature: Signed by candidate Date: 28/12/2023

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Abstract

The topic of closure – that sense of logical completion and conclusion – is often given much weight in the discussion of Western Classical music. However, this discussion enters uncertain territory when dealing with works which eschew the tonal-syntactic structure of the common practice period; a challenge common to music of the Twentieth Century. This dissertation concerns itself with the question of how closure can be achieved under these conditions. Most of the literature approaches this issue by analysing musical devices or procedures which composers employ at non-tonal musical endings, but this is usually done without first establishing criteria for distinguishing between endings that articulate closure and those that do not. To address this, I begin by proposing a definition of closure as a concept and then explore the cognitive underpinnings of this sensation through a review of Event Segmentation Theory. This allows me to construct a lens through which to revisit the existing work on non-tonal endings and discuss their potential closural effect. My discussion concludes that, in the absence of a well-developed or commonly understood grammatical-semantic system, music requires a linear or directed process with a limiting element (either a process which is self-limiting, one that proceeds toward a previously stated limit, or one that is interrupted by a significant modification) for it to stimulate a sense of closure. A notable exception to this was the possibility of closure as a result of high processing effort when locating an ending. I believe that these conclusions are valuable to the formal analysis or composition of non-tonal works within the Western Classical tradition.

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List of Abbreviations and Acronyms

b.	beat or pulse
DAT	Dementia of the Alzheimer Type
EST	Event Segmentation Theory
GEBD	Generic Event Boundary Detection
m.	measure
mm.	multi-measure; a range of measures
OED	Oxford English Dictionary

1. Introduction

1.1 Research Question

This study is concerned with the psychological mechanisms that underpin musical closure – the compound sense of temporal or segmentary ending and narrative completion. More specifically, it seeks to provide a possible answer to the following question:

How can closure be brought about in a goal-orientated[1] musical work, within the context of the Western classical tradition, when the means afforded by tonal harmonic syntax are eschewed? This question is addressed within the context of the music of the Twentieth Century.

1.2 Chapter Summary

Section 1: Introduction begins by stating the topic of my work and in later subsections it addresses the limitations of the present study, provides a brief overview of the types of relevant literature, and considers why revisiting the topic of closure is beneficial. Section 2: The Production of Closure outlines a conceptual description of closure, followed by a proposal of how closure might come to be perceived in terms of Event Segmentation Theory (EST). Section 3: Examples of Closural Devices reviews the techniques discussed in a cross-section of the existing musicological[2] literature on musical endings and considers their closural potential in light of the previous discussion in Section 2. This section (Section 3) concludes with an analysis of an excerpt from the second movement of Bartók's sixth string quartet, as a means of demonstrating and explaining my position on the topic of musical closure.

Here, I find it necessary to discuss my selection of music to be analysed. I am aware of a wide array of positions which regard Bartók as a tonal composer, as summarised by Waldbauer

[1] "Goal-orientated" is understood here as indicating that the formation of expectations is a central part of the listening experience, and that the frustration or realisation of these expectations provides the sense of musical form and narrative.

[2] By musicology, I mean to refer to all fields encompassed by the academic study of music, though many of the authors to whom I refer could be more specifically categorised as music theorists.

(1996). This allows for the case to be made that my argument could be better supported by the consideration of a composer whose work is further displaced from the tonal tradition. However, my consideration of the term "tonal" is in rather a limited sense, which includes the use of functional harmony and diatonic pitch-collections as basic elements. While Bartók frequently composes with the materials of tonality – in either their standard or extended forms – these materials are frequently employed in ways outside of common practice functional harmony. As an example from my analysed excerpt, the use of the diminished fourth (and its inversion) in the upper melody as a characteristic and prominent interval suggests that the melody was based on the type of non-diatonic mode discussed by Antokoletz (1993: 27) – C D E F# G A B♭ C – with some chromatic filing in. These chromatic pitches do not seem to resolve to a basic form as would be expected in a functional tonal setting. There is also the consideration that my analysis is a vehicle for my argument, rather than the argument itself. Accordingly, my greater familiarity with Bartók over other, more recent composers, led me to select one of his quartets for this purpose as I believed it would allow me greater clarity in explaining my thinking.

Section 4 covers the various problems that came up throughout this dissertation[3] that were not foreseen in the limitations sub-section. Section 5 outlines my suggestions for future research. Lastly, Section 6 presents my concluding remarks.

1.3 Limitations of the Study

As this study is approached primarily as a literature review, with a discussion tempered by my own musical experience, the resulting conclusions must be read as a proposed hypothesis. Their applicability outside of my own perception must still be tested. Furthermore, the scope of this study limited me to a single musical source during analysis. Any further testing involving a larger cohort of participants must then also consider a wider range of musical styles within the broader non-tonal classification. Lastly, the more conservative choice to analyse Bartók leaves much room for later discussion and exploration.

[3] As it is referred to in the University of Cape Town Faculty of Humanities postgraduate studies handbook 9b, 2023.

1.4 Why Revisit Closure?

1.4.1 Theoretical Motivation

Closure is commonly understood in terms of an implication-realisation model of cognition. In the discussion of closure in works from the context of the tonal, common practice era, one typically has recourse to a high degree of stylistic regularity in the form of harmonic syntax and melodic tendency, not to mention formal schema which play on thematic relationships and tonal centres and many other typical schemata at the phrase and sub-phrase level. Of course, there are differences between the musical languages of various musical periods[4] – for example, the degree of chromaticism common to the Baroque Period versus the Romantic Period – but much is also shared. However, in the pluralistic context of the Twentieth Century, many composers avoided making reference to these regularities to a greater or lesser extent, even while these structural norms remained prevalent in much of the commercially available music of the Twentieth Century and well into our own[5]. In doing so, they cut their works off from the depth of learned responses available to other, more consistent or widely listened to styles. As a result, any analytical discussion of these non-tonal works has to draw on stylistic regularities present at the composer or work level of grouping (regularities present within a single work or within the oeuvre of a specific composer), rather than corpus-level regularities. At best, one might learn the style of a given ideology or school of thought favoured by a group of like-minded composers[6].

Despite this, certain features in non-tonal compositions are still recurrent at larger grouping levels than that of the work or composer, such as the expectation that a metrically and/or rhythmically undifferentiated ascending chromatic line will continue to ascend. Whether these regularities are a hierarchically higher form of regularity in the Western traditional idiom or a natural product of our cognitive processes – as might be argued with the Gestalt Law of Good Continuation, for example – is of less interest to me here than the simple

[4] A classification which I acknowledge as approximate, though it is useful at this point of the discussion.
[5] A side effect of the uptick in the modern music industry's capacity for recording and marketing.
[6] The Second Viennese School being the first that springs to my mind.

observation that these regularities do seem to be present. Furthermore, in the absence of common practice tonal syntax, these regularities take on a much more structurally significant role, and in doing so they potentially move the production of closure away from schematic or syntactic means and towards a consideration of closure in much broader processive terms.

Complementary to these observations from within the world of musicology, there has been much development in the field of cognitive psychology over the past few decades, and a review of this body of literature allows for the establishment of possible criteria for what is involved in an experience of closure. Importantly, these criteria would be isolated from the circular logic of using music theory alone to determine what is musically closural. In the following dissertation, I have leaned most heavily on Event Segmentation Theory (EST) to provide these criteria. For the most part, EST seems to confirm existing discussions – which is in itself valuable – but EST also allows for an expanded view of when closure fails to be experienced or is denied purposefully.

1.4.2 Personal Motivation

Aside from the musicological and psychological reasoning for considering closure, it is also important to situate myself within this study. My interest in this subject is motivated by my work as a composer first and foremost.

Closure is an undeniably profound part of our musical experience, with theories proposing that it effects our emotional responses (Meyer, 1956), our identification and recollection of thematic material (Zacks et al., 2007), our perception of felt-time (Merino-Rajme, 2022), and many other facets of musical experience. It is for these reasons that an understanding of closure in non-tonal contexts appears to me as a vital part of the study of any composer seeking to make use of the diverse materials made available by the Twentieth Century. Finally, in the interest of artistic sincerity, I believe it is important to undertake not just an academic study of closure, but a study of one's own sense of closure.

1.5 Overview of Important Literature

1.5.1 Tonal Cadence

Most of the literature dealing with closure in Western music approaches the topic from a tonal[7] perspective – the use of cadence at the phrase level or the return to the tonic key acting as a closural device within a complete form – and while my focus is rather on non-tonal means, the tonal literature offers a useful point of orientation when discussing less-familiar mechanisms of closure. William Caplin's discussions of cadence provide a stylistic analysis of cadence in the conventions of the Classical Period (Caplin, 2004), and Romantic Period (Caplin, 2018). Both of these papers advocate for a more specific understanding of the term "cadence" as one of many closural techniques available to a composer – specifically a harmonic-syntactic one – and suggest that the cadence's closural effect is limited to the musical phrase. Mark Anson-Cartwright (2007) takes a broader perspective, making a study of a variety of definitions of "closure" within the literature on tonal music. Anson-Cartwright also commits a good portion of his article to a discussion of the location of closure and how this relates to the sequential ordering of a work's segments.

1.5.2 Psychological Considerations in Musicology

There are many psychological inquiries into tonal cadences by David Sears and associated authors, approaching topics such as the role of cadential categories in the perception of closure (Sears, Caplin & McAdams, 2014; Sears, 2015), the schematic nature of our subconscious knowledge of cadences (Sears, 2016), and patterns of predictability at cadences (Sears et al., 2018, 2019). Leonard B. Meyer has written several notable texts, two of which I considered in the writing of this dissertation. *Emotion and Meaning in Music* (Meyer, 1956) provides an account of affect in tonal music based on an implication-realisation model; the

[7] Throughout this dissertation I often distinguish between tonal and non-tonal music. By tonal I mean specifically music which is organised in terms of a pitch centre and according to the system of scales and harmonic syntax typical of the common practice period.

central hypothesis being that affect is the product of an inhibited tendency to respond. *Explaining Music* (Meyer, 1973) is more concerned with the types of structures present in music and how we perceive them than it is with relating those perceptions to affectual experience. This book considers the topic of analysis, describes various types of intra-work musical relationships, and provides an in-depth discussion of implicative patterns. In order to expand on this discussion of musical structure, expectancy, and affect, one may turn to some of the writings of Narmour (1990, 1991).

1.5.3 Non-Tonal Closure

The literature that interests me the most, for its relevance to this dissertation, discusses closure through non-tonal means. These sources are valuable in that they give accounts of closure without referring to closural devices whose effectiveness is pre-supposed due to a stylistic convention; an example of this being cadences. In doing this, these sources are more closely aligned with my inquiry than much of the literature. *The Art of Ending: Closure in European Instrumental Music c.1900–1970* by Charles Tebbs (2002) offers a critical discussion of closure on a conceptual level, as well as a wide variety of techniques associated with ending and closure[8] in the music of the Twentieth Century. Kristy Bryden (2001) is more concerned with the late Twentieth Century and specifically discusses the patterns in intensity across multiple parameters – dynamic level, registral space, number of active voices, etc. – comparing the discussed works in terms of where their various parameters climax and abate and how this relates to closure. Clare Eng's (2012) analysis of motivic usage in Bartók, Britten, and Fauré considers the use of motifs to create musical structure and narrative completion. The challenging music (in terms of closure) of John Adams is discussed by Catherine Pellegrino (2002). Her article addresses the use of closure in Adams's music, prompted by Pellegrino's statement that her experience of closure in Adams's seemingly abrupt and inconclusive works "is somewhat problematic" (Pellegrino, 2002: 147). Alden Ashforth (1978) discusses Schoenberg's use of non-tonal melodic structure and texture at endings in his twelve-tone compositions, describing a number of rhetorical devices as well as some which are arguably

[8] The distinction between ending and closure is central to Tebbs's discussion.

genuinely closural; for example, motivic dissolution/liquidation, a term which is reviewed later.

Kurth's (2000) chapter in *Music of My Future* walks the line between tonal and non-tonal interpretation. In his discussion, Kurth addresses how tonality is not absent from the twelve-tone works of Schoenberg but is instead transformed beyond its familiar means of expression. Walking a similar line is an oft-cited article by Anne Blombach (1987). In her work, Blombach offers a helpful entry into the conversation of style-agnostic definitions for the terms "phrase" and "cadence", definitions that might be applied to a much broader span of the Western musical tradition than just the common practice period. This article is of interest in that it looks at a perception of musical structure that is unaided by functional harmonic syntax in a way that, to me, represents a transitional stage between tonal and non-tonal modes of analysis. Hasty's (1984) theory of phrase formation in post-tonal music provides a valuable lens through which one can consider the literature on endings and closure. Augmenting the above sources, Barbara Herrnstein Smith's *Poetic Closure* (Smith, 1968) provides valuable insights from outside of musicology, looking at the role of structure and generative principles in the closure of poems.

1.5.4 Event Segmentation Theory (EST)

Throughout this dissertation, I will make use of EST as a means of establishing criteria for judging musical closure. In the study of music, we are constantly confronted with the need to describe an unbroken, whole, temporal span in abstract terms such as phrases or sections. This fracturing of continuous time into contiguous segments is discussed in the psychological literature on event perception as being a part of every-day life; a core part of how humans form psychological representations of goal-directed activity. EST further proposes that these time segments are natural holons within the perception of time, much as objects are natural holons making up our perception of space. Many of the terms in the study of events can be seen outlined by Zacks and Tversky (2001), such as the definition of an event: "A segment of time at a given location that is conceived by an observer to have a beginning and an end" (Zacks & Tversky, 2001: 3). This definition is rather general, allowing for it to be applied at most hierarchical levels of temporal perception, with event hierarchies featuring both

taxonomic and partonomic relationships (Zacks & Tversky, 2001: 5–6). The parts of events – basic actions – and a comparison between events and objects are also discussed, along with many other foundational principles.

The formal proposal of EST is made in *Event Perception: a Mind/Brain Perspective* (Zacks et al., 2007) – the article that I make a reference to in the title of this dissertation – and I am aware of three further articles providing summary descriptions of EST, each offering their own insights (Zacks & Swallow, 2007; Kurby & Zacks, 2008; Radvansky & Zacks, 2011).

EST provides a theoretical account of how the sub-divided perception of time comes about and what its role is in our day-to-day functioning as individuals. It is proposed that event segmentation is a subconscious process, occurring at multiple hierarchic levels, in which the observer or participant uses prediction error to detect the boundary between two events. This prediction error detection relies on the observation of changes in either the activity or in the observer's hypothesis about an actor's goals and forms an important part of a human's predictive mechanisms allowing for the planning of an action or response to their environment (Zacks et al., 2007: 277).

Since its proposal, EST has been a foundational principal in a diverse and sustained body of research. For example, EST has been cited in a study of reorientation systems; the capacity to interrupt a current task and respond to a potential opportunity or threat (Corbetta, Patel & Shulman, 2008) and the hypothesised hierarchical structure of events, as well as the relationship between event models[9] and event schema[10], which correlates with the findings of research into *hierarchical reinforcement learning*[11] (Botvinick, Niv & Barto, 2009).

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[9] A complete representation of the ongoing event, held in an individual's working memory (Zacks et al., 2007: 274–5). This might exist as the interpretation that boiling the kettle is the initial action of the event "making a cup of coffee". Upon implementing the appropriate event model, this leads us to predict that the individual we are observing will complete all actions necessary to preparing their coffee, an event which is understood to have ended once the coffee is poured and any milk or sugar is added.

[10] Information stored in long-term memory, regarding the commonalities between previously encountered events (Zacks et al., 2007: 275).

[11] *Reinforcement learning* describes a subset of machine learning in which no prior guidance is given as to correct vs. incorrect behaviours. Learning is instead motivated by a subsequent reward signal following correct behaviour (Stone, 2010). *Hierarchical reinforcement learning* modifies this by presenting a problem as being made up of subproblems. This allows for more efficient processing as subtasks can be learned and reused independently of the context in which they were encoded (Hengst, 2011).

The work of Baldassano et al. (2017) showed considerable correspondence between neural behaviour and the predictions of EST; notably, that "cortical responses to naturalistic stimuli are temporarily organized into discrete events at varying timescales" and that these events correlate well to the event boundary judgements of observers (Baldassano et al., 2017: 719).

Much research has also gone into the relationship between event segmentation and memory. In an experiment by Sargent et al. (2013), results show that the robustness of an individual's memory is predicted by their ability to segment a temporal span into events, more so even than general cognitive ability. In a similar line of discussion, Richmond, Gold, and Zacks (2017) discuss the observation that the ability to identify event boundaries is predictive of an individual's accuracy in recall and task execution and suggest the correction of an individual's segmentation as the basis for cognition improvement. The proposal of Richmond, Gold, and Zacks was later reviewed by Radvansky (2017), who largely agreed with their conclusions.

EST has played a role in investigating the nature of our memory of events. Baldassano, Hasson, and Norman (2018) investigated the schematic representation of events in human memory by presenting participants with movies and audio narratives which conformed to one of two scripts[12] at a higher organisational level – such as arriving at the location or purchasing an admission ticket. However, these narratives were diverse in their lower-level details – such as specific lines spoken, characters present, or generic conventions. It was observed that neural activity was specific to the script of the stimulus presented to the participant, showing neurological evidence of human sensitivity to schematic structure.

A parallel field to the study of perception is the investigation of machine learning as a means of simulating human cognition. Shou et al. (2021) cited EST in their introduction of Generic Event Boundary Detection (GEBD), a machine-learning task intended to imitate how humans perceive event boundaries without a fixed taxonomy of event classes. However, this relationship is a two-way street, and in their consideration of hierarchical reinforcement learning, Eppe et al. (2022) sought to integrate the insights of cognitive psychology regarding compositional abstraction and predictive processing into machine learning. Here, EST describes the role that forward predictions play in sensorimotor abstraction – an important

[12] A stereotyped temporal schema or sequence of actions.

ability that enables transfer learning, and planning, and thus improves the efficiency of problem-solving.

Event segmentation has been shown to impact our perception of approximate duration. Lositsky et al. (2016) propose that it is the more heavily segmented time spans which we perceive as lasting longer, with the same problem being approached from the perspective of temporal attention by Merino-Rajme (2022). In another study, participants were shown to judge items as being closer together temporally if the items were encoded as having a shared context, despite all items in the experiment having the same temporal distance (Ezzyat & Davachi, 2014).

One basic element of EST that has been revisited is the proposal that event segmentation relies on prediction error. Shapiro et al. make the case for an alternate "temporal community structure" (Schapiro et al., 2013: 490) model which demonstrates a segmentary mechanism in scenarios where transitional probabilities are too weak to support the prediction error hypothesis. In these cases, elements are grouped due to their repeated temporal proximity, regardless of any ordering or lack thereof. To test for this, Schapiro et al. produced fifteen distinct and unrelated visual stimuli grouped into three clusters of five stimuli each. A sequence of stimuli was generated by both random selection and by a semi-random selection in which each stimulus was shows exactly once. Both means of generation presented stimuli taken from the same cluster as adjacent in the sequence. For example, a set of six stimuli in two clusters might be [(A, B, C)(D, E, F)]. This could generate the sequence [A, C, B, F, E, D] but not [F, A, D, B, E, C]. After a cover task, participants were shown to be able to detect boundaries between the clusters suggesting that stimuli were associated with one another regardless of order (Schapiro et al., 2013). Another proposal is that humans incorporate an inference-based mechanism into their event segmentation (Shin & DuBrow, 2021). This model is concerned with similar contexts to those that interested Shapiro et al. – ambiguous transitional probability – but focusses its discussion on the problem of activating the appropriate event model over the segmentation mechanism itself. Shin and DuBrow favour a statistical explanation, suggesting that event models are grouped into generalised types[13] and stating that an observer is more likely to activate an event model belonging to a type that

[13] These "types" are the equivalent of the event schemata mentioned previously (Shin & DuBrow, 2021: 114).

they have encountered frequently. To put it another way, if we encounter an ambiguous event boundary, an observer is more likely to group discreet actions into an event if we have observed them previously participating in an event. If two actions are not usually part of the same event, then we assume that an interpretation which groups them into the same event is less likely. For example: it would be typical for fetching a coffee mug and boiling the kettle to be part of the event "making coffee", but fetching a coffee mug is unlikely to be associated with retuning a guitar when determining event boundaries.

When engaging with music, these predictive mechanisms and perceptual effects can be present in us as participants – as members of an ensemble, or when dancing, etc. – and they can affect us as observers – when listening either actively or passively. I will be focussing on the experience of the observer.

2. The Production of Closure

The following section provides a theoretical discussion of closure in abstract terms. I begin by outlining the concept of closure and stating the working definition that I will be employing throughout this dissertation. This is followed by a more in-depth discussion of the psychological mechanisms at work, in terms of Event Segmentation Theory. The final two sub-sections are concerned with what is necessary for the achievement of closure, in light of our conceptual and cognitive-psychological discussions, and with the eventualities of either non-closure or closural failure.

2.1 Discussion of Closure as a Concept

2.1.1 Closure in Non-Musical Literature

Etymology of Closure

Closure's etymology is traced by the Oxford English Dictionary (OED) Online and the Merriam-Webster.com Dictionary back to the Latin *clausūra*, the stem of which is *claus-* of *claudĕre,* meaning: to shut or close ("Closure, n", 2023; "Closure", n.d.).

In current usage, the OED offers the following definitions relevant to this thesis:

1. "The act of closing or shutting."
2. "Closed condition."
3. "A bringing to a conclusion; end, close."
4. "In gestalt psychology, the process whereby incomplete forms, situations, etc., are completed subjectively by the viewer or seem to complete themselves; the tendency to create ordered and satisfying wholes."

I have omitted four definitions pertaining to phonetics, human physiology, cricket, and legislative debate respectively.

The formulation of closure as a psychological principle was originally proposed by the Gestalt school of psychology, though the definitions were quite diverse and subsequently, the concept is rather difficult to navigate with any concreteness. Wasserstein's (2002) article provides a useful overview of the array of positions. However, I will limit myself to mentioning the uses of "closure" that are concerned with perception. Köhler (1920) characterised closure in terms relating to psychophysiological processes which underpin perception. An English translation of this text can be found in *A Sourcebook of Gestalt Psychology* (Köhler, 1938). The translated definition describes a psychophysiological gestalt as a closed structure (Köhler, 1938: 35). Köhler later describes this structure as containing a process which is either in a

constant state or periodically entering a constant state[14]. This constancy is interesting for our purposes when paired with Köhler's later application of the principle of *Prägnanz*: the tendency of a process – physical, biological, or otherwise – towards a lower state of energy or maximum point of entropy.

Closure was one of the gestalt principles described by Wertheimer (1923) in *Untersuchungen zur Lehre von der Gestalt II*; an article which has been translated into English in two publications that I am aware of (Wertheimer, 1938, 1958). Wertheimer – while also discussing perception – was more concerned with the visual properties of the stimulus, describing the principle of closure as the tendency of an observer to prefer to interpret a shape as a single closed process, rather than as a collection of independent segments. Bobbit summarises closure in perception as follows: "As applied to perception, the term may be defined as a tendency on the part of the organism perceptually to complete stimulus representations which are physically incomplete" (Bobbit, 1938: 137). Bobbit goes on to clarify that the stimulus is not physically completed, but rather that the parts that are present are arranged as if belonging to a complete whole. This statement is reflected in the work of Kanizsa (1976) on the topic of amodal completion, an article which is cited by Tebbs (2002) in his work on musical ending and closure, though Kanizsa is only one of many scholars to produce work on the topic of amodal completion (see Gerbino, 2020 for a review).

Though these descriptions seem to assign "closure" to slightly different subsets of a broader meaning-field, some common elements do recur, namely: (1) the preference for the perception of a continuous whole, (2) the simplest or lowest-energy state of that whole, and (3) the acceptable – if not absolute – conclusion or completion of a process which defines the whole.

2.1.2 Closure in Musical Literature

"An ending is an event, a point in a musical score, that is understood as the conclusion of a process" (Eng, 2012: 13). This quote captures many of the recurring elements given in the

[14] Köhler states that at the time of writing, no experimental evidence was available in favour of one interpretation over the other.

definitions of closure in recent musicological and literature: (1) a terminal musical point or gesture in a given musical segment, (2) a musical process that defines the given segment, and (3) that the final gesture is also understood as the logical completion of the process. Admittedly, Eng uses the term “ending” instead of closure – a terminological distinction that is valuable because not all endings necessarily evoke closure[15] – but given the context of the quotation, I believe her to be discussing what I will be referring to as an ending which would evoke closure; a *close*. Pellegrino offers the complimentary proposal that "if the end of a work is to be experienced as closure and not simply as an arbitrary stopping point, the nature and placement of the point of closure must be anticipated. In other words, for closure to occur, the tonal organization of the music must either define its own endpoint or participate in a system in which a given endpoint is already defined" (Pellegrino, 2002: 150). A further point of interest is seen in Lachenmann’s *Kadenzklang*. While this concept is not concerned with closure, the terms “closure” and “cadence” are so frequently used as interchangeable (Ashforth, 1978; Blombach, 1987) that I feel the use of cadence in this context offers a useful insight. A *Kadenzklang* is described as a sound-as-process in which the time required to perceive the complete process is the same as the duration of the sound (Tsao, 2014)[16]. The example referred to by Tsao is a sound which begins in near silence, moves to a point of an exaggerated dynamic level, and concludes by returning to near silence (Tsao, 2014: 218). This shows an association of (1) cadence – as synonymous with closure – and (2) the concurrence of the ending of a temporal segment and the completion of a process.

Returning to the distinction between ending and closure mentioned in relation to Eng’s statement; the relationship between ending and closure is a key point in Charles Tebbs’s (2002) thesis, so much so that it informs the two major sections of his work. In discussing endings and closure, Tebbs turns to Kofi Agawu’s classification of an ending as the “terminal elements” of a linear musical structure, whilst closure is an effect derived from the experience of the entire structure (Agawu, 1987: 4). A similar concept of closure can be seen in *Poetic*

[15] EST suggests that an ending may be detected through discontinuity in the musical surface – bottom-up processing – independent of any preparation or process (Zacks et al., 2007: 10–11).
[16] See also Lachenmann’s original article (Lachenmann, 1996)

Closure[17] by Barbara Herrnstein Smith[18]. Smith (1968: 2) suggests that closure is the "experience" of arriving at a terminal gesture which has been predetermined by the structure of a work. It is important to note here that both scholars define closure as a product of the internal relationships of a whole. Smith goes on to say that "…the sense of closure is a function of the perception of structure" (Smith, 1968: 4). Tebbs (2002: 16) does qualify Agawu's distinction by pointing out that modern styles such as minimalism and "moment-time[19]" challenge the assumption of closure as being rooted in the experience of the entire *event*, with endings as subordinate to closure. However, while I agree that endings need not be subordinate to closure, I still find that a sense of closure is rooted in the perception of the *event* as a whole. In contrast to Tebbs's suggestion, I rather see these styles (minimalism, moment form, etc.) as challenging the idea that a musical work is necessarily closed when it is ended. For example, Kramer offers the following description of moment form: "A proper moment form will give the impression of starting in the midst of previously unheard music, and it will break off without reaching any structural cadence" (Kramer, 1978: 180).

A challenging point arises from Agawu's and Smith's definitions of closure, defined as (1) an effect derived from an experience and (2) an experience respectively. Both definitions imply that closure is not a quality of the object being perceived; it is instead a quality of our experience of the perceived object. To put it differently: if we are to consider the terminal gesture as a sign[20], then the concept of ending is its object. In the case that closure is perceived, closure is the interpretant – the defining relationship between sign and object. To discuss closure in music is to attempt to understand the experience or effect born of a subconscious interpretation of an arguably arbitrary, aesthetic *event*. Therein lies the complication of discussing closure: it is contingent. It is potentially highly inconsistent, even for the same work heard by the same listener, effected by factors such as memory, appropriate listening strategy, stylistic familiarity, etc.

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[17] This is admittedly a text on poetry, not music. However, it is often referenced in musicological discussion.
[18] Whilst this is a text on poetry, the author's main concern is with linear processes which conceivably would translate well to music. Furthermore, she draws constant parallels to musical structure, cites Leonard Meyer's work as an influence, and has been cited in several subsequent musicological papers and dissertations (Agawu, 1987; Pellegrino, 2002; Tebbs, 2002).
[19] My assumption is that this is synonymous with moment form, though this not confirmed by Tebbs.
[20] In the terminology of Peirce (Peirce, 1955; Chandler, 2017: 29).

2.1.2 A Working Definition of Closure

For this dissertation, I find that it is most useful to adopt the following definition of closure: (1) Closure is a percept – a perceived quality – describing our experience of a musical segment. This percept encompasses both the (2) conclusion/termination of the event and the (3) felt completeness/integrity of the event. Furthermore (4) the closure percept may be present to a greater or lesser extent; it is not an absolute/binary concept but a relative/graded one.

I would also like to make a distinction between finality or "endedness" – as the quality of being at the end of a work – and closure. Whilst closure shares an ending's quality of non-continuation, closure has an added element of unbiasing implied in its resolution of tendency. An ending might be "open-ended", leaving the listener with the sensation of reaching out for something, a bias towards an expectation that is external to the piece, even at its end. The effect of a narrative cliff-hanger springs to mind; the novel is satisfactorily ended but you are left with unanswered questions which may suggest the opening to a sequel. Endings may also be seemingly arbitrary as noted with moment-form; an ending which simply stops. Curiously, this implies that a *close* – an ending co-occurring with a sense of closure – is more open than an ending. The *close* does not imply that nothing will follow. Rather, it removes (almost) all bias as to what might follow, apart from the prediction that any subsequent event will likely be narratively unrelated. "Closure, then, may be regarded as a modification of structure that makes stasis, or the absence of further continuation, the most probable succeeding event" (Smith, 1968: 34). The close is a transition point, with subsequent elements belonging to a hierarchically prior event. The open ending, with its latent expectancy, has in fact fewer implied continuations than the close even if our experience suggests the reverse.

2.2 Event Segmentation Theory and Closure

Having discussed closure on a conceptual level, I will now turn to the cognitive psychological framework that will underpin my discussion.

EST proposes that our experience of continuous time is broken up (segmented) into contiguous, abstracted time segments or "events". An event is defined within EST as being "a

segment of time at a given location that is conceived by an observer to have a beginning and an end" (Zacks et al., 2007: 273). Within this broad definition, Zacks et al. comment on many variations, such as the vagueness of spatial boundaries and whether an animate agent is necessary, concluding that they are concerned with "the core of the category *event*: events that involve goal-directed human activity and are of modest duration (seconds to tens of minutes)" (Zacks et al., 2007: 273). This is the definition that I shall apply throughout this dissertation. However, as "event" is a fairly common word, I shall italicise it to specify the above meaning and to distinguish it from other authors' writings.

EST is principally concerned with describing the psychological mechanisms that underpin endings; the terminal gestures which separate one *event* from the next. An understanding of endings will be key to understanding closure in that, as I have discussed, closure is a percept derived from the experienced relationship between an *event's* ending and the process(es) of that *event*. The experience of closure at an ending implies that the *event* is not arbitrarily ended but expresses a sense of logical completion; the ending "makes sense" to the observer. EST provides us with criteria for differentiating between types of endings and if EST is interpreted alongside an understanding of closure as a concept one can hypothesise as to which endings might stimulate an experience of closure and which endings might not. EST also offers (1) a hypothesis as to what the purpose of the abstraction of continuous time into contiguous *events* might be and (2) discusses both the mechanisms of endings and their purpose in a manner which combines top-down[21] and bottom-up[22] processing; two elements which will prove valuable to an understanding of musical structure.

2.2.1 Mechanisms of Event Segmentation

EST (Zacks et al., 2007) proposes that *event* segmentation results from patterns in prediction error – the degree to which the observer's predictions regarding the ongoing *event* conflict with their perception of that *event*. An observer perceives an *event* boundary when they experience a sharp increase in prediction error. This increase in the observer's prediction

[21] An understanding of cognition as being regulated or biased by prior experience.
[22] An understanding of cognition which begins with stimuli that are then processed by innate, basic mechanisms.

error is attributed in EST to two phenomena: (1) environmental changes or change on the part of the actor(s) and (2) the interaction between the observer's perception of the *event* and their expectations regarding that *event*, based on their prior knowledge. This results in two broad categories of segmentation mechanisms:

1. Parametric discontinuity – which results in a retroactive segmentation as the observer's expectations have been negated. A new *event* has clearly begun, but unresolved expectations are lingering from the previous *event*.
2. The perceived arrival at an expected goal – resulting in a proactive segmentation. As all of the existing predictions have been resolved, there is no available data to develop new predictions. The observer knows that a new *event* is about to begin but has yet to determine the defining process.

Parametric discontinuity refers to any unprepared parametric change. Musically, this may refer to an unexpected shift in texture, dynamic level, timbre, melodic motion, etc. Goal arrival is reliant on the fulfilment of the observer's expectations, which may include parametric discontinuity. The distinction between the two categories is that the observer is responding to the perceived arrival at a prepared goal in the second, rather than an unprepared "breaking-off" in the first. These observer expectations are further refined in EST into (1) domain-general, conventional expectations and (2) localised, *event*-specific expectations.

There has been recent work in music psychology studying observer expectations in a Western classical tonal setting indicating that music becomes increasingly predictable when approaching a cadence, after which predictability drops sharply (Sears et al., 2018). Similarly, work in machine learning has shown that a support-vector machine can detect perfect authentic cadences with a high degree of accuracy and a negligible false-positive rate, using a set of binary parameters (Bigo et al., 2018). While the work of Sears et al. and Bigo et al. on cadences doesn't show a causal relationship between a fall and rise in prediction error and closure, the presence of the prediction error pattern hypothesised by EST at a point traditionally associated with the termination of a phrase does seem to corroborate the work of Zacks et al. and its applicability to music.

Interestingly, EST proposes that parametric discontinuity and goal arrival trigger segmentation differently; parametric discontinuity prompting segmentation in a bottom-up manner and goal arrival doing so in a top-down manner. There is also a proposed difference in the grain[23] at which each phenomenon seems to trigger a segmentation response. In theory, change in the surface parameters of the *event* triggers segmentation at a finer grain, while observer expectations are more prevalent at a coarser grain. Furthermore, EST suggests that observer expectation seems to be the dominant of the two phenomena when both are present. In goal-directed activity, the observer will prefer to segment the time stream according to their expectations rather than changes in the *event* surface (Zacks et al., 2007: 281).

In a musical context, we see a problematic interaction with this hypothesis. Peebles designed an experiment to determine whether or not "musical experience is segmented unconsciously, hierarchically, and consistently among subjects" (Peebles, 2011: 81). Peebles noted that in the segmentation of Mozart stimuli, participants were more consistent in identifying a nested musical structure – fine-grain *events* nested within coarse-grain *events* – if they had first identified fine-grain boundaries before identifying coarse-grain boundaries during a second hearing. However, in the Bartók task, participants showed greater consistency if they first established coarse-grain *event* boundaries before moving on to the fine-grained boundaries (Peebles, 2011: 107–8). Assuming that the listeners were more familiar with the style or language of the Mozart stimuli than the Bartók stimuli, one could infer that the Mozart stimuli would be segmented more readily according to goal arrival while the Bartók stimuli would have been segmented according to parametric discontinuity. And yet it would appear that Mozart is more easily segmented at the fine grain while segmentation of Bartók is more consistent at the coarse grain; an apparent contradiction of EST's proposal of parametric discontinuity acting at the fine grain and goal arrival acting at the coarse grain.

This may indicate that a known, goal-orientated structure adjusts our temporal perception of grain in a hierarchic manner, such that truly "fine-grained" *events* are those that are contained within the smallest known-goal-orientated *event,* relatively independently of the

[23] Grain is synonymous with temporal resolution, with smaller-grain gestures referring to shorter timespans that typically occur at a lower hierarchic level.

objective duration of the *event*. This hypothesis would rely on the observers in both the Bartók and Mozart conditions attempting to segment the stimuli at the same hierarchic level initially, thus the participants in the Bartók condition producing inconsistent results when attempting an initial fine-grained segmentation; when failing to perceive goal-arrival their search kept expanding, eventually including conflicting data from two (or more) *events* which would potentially further confound their segmentation. An alternative interpretation would be that an observer unconsciously looks for a goal-orientated structure first as their smallest hierarchic unit. Failing this, the points of greatest discontinuity are naturally easier to perceive as boundaries and so the coarse-grain boundaries are more reliably segmented. However, these are at present untested hypotheses to the best of my knowledge.

Of the two segmentary mechanisms, EST suggests that a segmentation response will prefer goal attainment over discontinuity if the two would provide conflicting segmentations in a given series of *events*. This is suggested by Zacks et al. (2007: 281) to indicate that surface activity has a lesser relation to segmentation in goal-orientated activity. This hypothesis was addressed by Peebles (2011: 111–14) in an experiment which showed that a greater degree of surface discontinuity increased the chance of a segmentation response in both Mozart stimuli (representing the more familiar musical structure) and Bartók stimuli (representing a system in which listeners would rely more on discontinuity for their segmentation of *events*). However, a greater level of discontinuity was needed in the Mozart stimuli to elicit a response than in the Bartók.

A further effect can be observed in Peebles's experiment testing the musical application of EST's hypothesis that *event* segmentation may result from the arrival at a goal, followed by a rise in prediction error. During the experiment, participants were first asked to predict *event* boundaries in Mozart stimuli. Typically, these were cadences. They were then asked to rate the degree of closure in short clips from those same movements (Peebles, 2011: 165). When considering the rating of the degree of closure, Peebles notes that cadences that had a lower response time also had a higher rating for closure. This effect of response time on closure rating was further enhanced by an increase in the expertise of the participant. Overall, this, in conjunction with the previous body of results is interpreted by Peebles as confirming that arrival at a predicted event boundary results in a sense of closure. However, Peebles (2011: 180) was not able to measure this rise in prediction error. It also seems that the predictability

of the *event* boundary or ending correlates with the perceived strength of closure for that *event*, an observation which agrees with the work of Sears et al. (2018, 2019).

To summarise: the stronger our predictions regarding an ending are, the more likely we are to ignore conflicting data in favour of a segmentation response when arriving at the predicted ending. In addition, the stronger our predictions are, the greater our rating of closure for that ending is if and when they are fulfilled.

2.2.2 Purpose of Event Segmentation

Having briefly described the segmentation mechanisms of EST, let us now turn to the purpose of these mechanisms. Zacks et al. state that "perception can be described as a roughly hierarchical process in which sensory information is successively transformed into representations that form the basis for action", going on to highlight the importance of the resulting "perceptual predictions" in the motivation of an action (Zacks et al., 2007: 273). To this end, EST proposes that *event* segmentation serves to:

1. Ensure that the appropriate *event* model is in use, where "*event* model" is understood to mean a complete working-memory representation of the current event, allowing for predictive perception.
2. Update our *event* schemata, should they prove to be insufficient. In EST, "*event* schemata" are long-term memory representations of information used to construct the *event* model in a top-down manner (in conjunction with the bottom-up input of perception).

Implementation of the appropriate *event* model is central to perceptual prediction. As an *event* progresses, the observer compares their perceptual input with the predictions provided by the *event* model. If the input agrees with the model, then the *event* is perceived as stable. However, should perceptual input disagree with the *event* model, EST hypothesises that a gating mechanism is activated that causes perceptual input to undergo additional processing. This allows for the appropriate *event* model to be implemented, by comparing the perceptual input with our existing *event* schemata. Importantly, EST proposes that this model-updating process is entirely subconscious and occurs at multiple grains simultaneously, though an observer may electively attend to one grain more closely than the others. This subconscious

and hierarchic segmentation was subsequently shown to be consistent in a musical context (Peebles, 2011: 107).

On the second point mentioned regarding the updating of *event* schemata, research suggests that adequate segmentation of a timespan into *events* aids in an individual's long-term recall. Some of the examples cited by Zacks et al. show that: (1) older adults with and without dementia of the Alzheimer type (DAT) were better able to recall a film if they were showed a group-typical segmentation of the film's *events* (Zacks et al., 2006), and (2) participants were more able to recall how to assemble a musical instrument if the instructions were segmented (Zacks & Tversky, 2003). Zacks and Tversky's experiment involved a twenty-one-step instructional on how to assemble a saxophone. Participants' recollection of the steps was improved when the steps were grouped into seven tasks[24]. The updating of *event* schemata also shows an interaction with the model-updating process; the additional processing of perceptual input that occurs at *event* boundaries – associated with *event* model implementation – may also result in the gestures which immediately follow a boundary being more accessible in long-term memory (Zacks et al., 2007: 279).

Table 1: Summary of EST

Segmentary Mechanism:	Parametric Discontinuity	Goal Arrival
Process Type/Path:	Bottom-up	Top-down
Observer Preference:	Secondary	Primary
Preparation:	Unprepared	Prepared
Purpose:	Enabling predictive processing by: 1. Updating the selection of the active *event* model. 2. Updating *event* schemata	

(Zacks & Tversky, 2003: 90)[24] As an example, task "take out the saxophone" consisted of the steps "open the saxophone case", "take out the saxophone body", and "take out he swab" (Zacks & Tversky, 2003: 90).

2.3 The Evocation of the Closure Percept

Whilst closure was first developed as a cognitive-psychological concept by the Gestalt school, the application of gestalt principles to music faces several challenges, not the least of which is that gestalt principles were originally developed for the study of visual, not auditory perception. Mark Reybrouck (1997: 64–65) describes four challenges that this modal discrepancy poses:

1. Whilst a visual object is perceived as a simultaneous whole[25], musical figures are perceived sequentially[26].
2. The structuring of music as a multi-layered texture requires the analyst to direct their attention selectively, dividing the stimulus into component parts rather than describing the musical *event* as a whole.
3. Music – due to its sequential presentation and layered organisation – requires both simultaneous and successive decoding. Simultaneous decoding is further separated into actual simultaneity and virtual simultaneity.
4. Two possibilities exist to account for how the listener engages with the music: either the listener interprets the stimulus directly and completely, or the listener interprets a mental representation of the stimulus.

The first challenge noted by Raybrouck highlights the fact that musical perception involves a sensitivity to temporal location, a parameter which replaces that of spatial location in visual perception. That is not to say that we are insensitive to the spatial location of a sounds source, but for the majority of the music under consideration in this dissertation, spatial location is not an ordered parameter. That is to say, spatial location does not play a major role in our perceptual predictions and therefore in our sense of closure. This is largely why I have turned to EST to inform my psychological understanding of closure as it considers sequentially presented elements and their perception as whole *events* rather than a simultaneously

[25] Admittedly, this is a simplification made in service to highlighting the contrast between visual art and music. Any visual work which cannot be held within one's immediate field of view, such as a larger image or a sculpture, falls outside of this. One might be better served by stating that visual art can present more information simultaneously than music can and that sequential presentation is a central feature of how music is perceived.
[26] A similar point is raised by Tebbs regarding visual and musical modes of closure in that "in the former case the viewer fills in the gaps instantaneously, whereas in musical contexts the listener experiences ambiguities that are progressively resolved by the music itself" (Tebbs, 2002: 7).

perceived object. EST is made all the more appropriate to my ends as it concerns goal-orientated activity and perceptual prediction, predicted process completion being a key criterion for an ending which coincides with an experience of closure (according to its present working definition). However, given the modal discrepancy, a point of departure that music has from EST is the understanding of what goal-arrival entails.

Much like gestalt psychology, EST focusses on visual perception. In visually perceived, objective-orientated activity – such as buttoning up a shirt – once we are aware of the objective, we do not need to perceive the remainder of the shirt being buttoned up in sequence for the perception of the finished product – the buttoned-up shirt – to be understood as the end of the *event*. The finished product is a sign[27] that the *event* has occurred and so we are capable of inferring the intervening activity of the *event* if our predictions for the ending are satisfied. Button number 3 has been done up, therefore we can infer that the perceived action of doing up buttons 1 and 2 is likely to have been repeated at button 3.

This ability to infer is not available in the perception of music. As with the difficulties in applying gestalt closure to music, the segmentation of an *event* based on auditory stimuli – as opposed to visual stimuli – relies on our sequential perception of the entire *event.* The listener cannot perceive the entire *event* simultaneously, nor am I convinced that we have access to a sign capable of representing the entire *event*[28]*.* I propose that we are not so much sensitive to merely the arrival at an objective as we are to the completion of the psychological object that is the musical *event,* with all its elements stated in sequence.

While I believe that it could be the case that some elements within the *event* could be inferred, I expect that it would require the satisfaction of the following conditions: (1) the inferred elements cannot be the initial or terminal elements; (2) predictions regarding the inferred elements and those elements which follow them must have already been formed; (3) the predictions regarding the elements following the terminal elements must have been satisfied.

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[27] Likely an indexical sign in the case of the shirt.

[28] Wiggins (1998) offers a discussion on the reconciliation of the syntactic-semantic dichotomy in music.

An insight regarding what the sequential statement of a stimulus would entail was raised by Barbara Herrnstein Smith in the context of poetry, though I believe that it translates well to music. Smith (1968: 24) stated that the perception of a generative principle within a system was sufficient to create a figure/ground effect between the system and its context. This perception of a generating principle implies a separation of the stimulus into ordered and unordered elements. Eng discusses a distinction between primary and secondary parameters, referring to the writings of Meyer. Here, primary musical parameters are described as those which are syntactically constrained and whose presence is expressed as a binary; either present or absent. Secondary parameters are unconstrained and therefore expressed in terms of a spectrum; present to a greater or lesser extent (Eng, 2012: 27). Similarly, discussions of EST propose that the properties of an entity that are represented in the *event* model are those that are relevant to predictive perception (Radvansky & Zacks, 2011: 612). These points suggest that a top-down process of discriminating between structurally relevant and irrelevant data is at work. In complement to this, there are also proposals of bottom-up means of discrimination. In the field of EST, evidence suggests that individuals adjust their sensitivity to prediction error based on the uncertainty or "noisiness" of the environment, leading to the proposed formula of "prediction error X learning rate[29] = magnitude of *event* model update" (Shin & DuBrow, 2021: 113) and Meyer makes an analogous observation that in everyday life, observers experience the tension of unresolved inhibitions; These are "merely dissipated into the press of irrelevant events" (Meyer, 1956: 23). This awareness of ordered vs. unordered material won't necessarily evoke the closure percept, but it will direct the observer's attention to the parameter which expresses the *event's* generative principle – its sequential narrative.

Given that closure is the product of the fulfilment of the observer's expectations regarding the termination/goal of an *event* and given that closure requires the sequential perception of all of an *events'* elements, the question of evoking closure becomes one of how to imply that

[29] The degree to which prediction error updates expectations.

the final gesture will be of a specific configuration, and at which point in time[30] that gesture will occur. Both temporal and configurational predictions are needed.

2.3.1 Preparation of an Ending's Surface/Configuration

The subconscious inference by an observer that a subsequent element in a sequence will present a specific surface configuration is achieved by referring to the generating principle of that sequence. This can be loosely termed as a judgement of grammaticality. I have observed three broad categories of generating principles within the musicological literature, though these are my terms for them.

1. Linear principles: generating principles where the transitional probability is strongly predisposed towards a single continuation at a given point.
2. Branching principles: generating principles which present a small number of acceptable/typical continuations at a given point.
3. Family principles: generating principles which present any, or almost any continuation as possible to the ear of the listener, so long as the continuation is still drawn from the same pool of elements (or family) as the rest of the sequence.

Linear principles would include the following as examples:

1. Archetypal progressions such as a passing six-four progression: Any highly conventional successions would be familiar following sufficient exposure.
2. Circle of fifths or other fixed-motion principles: unvaried motion develops a strong expectation that we will hear more of the same.
3. Restated melodic fragments: Once a melodic fragment has become familiar, any statement which is identified as the start of that fragment will cause us to expect the fragment to be completed.

[30] Throughout this dissertation I will typically prefer to speak of the temporal dimensions or location of an ending, rather than describing an ending's arrival in terms of where in a musical process it falls. This is on account of my consideration for EST as a foundation for my discussion and my above-noted adaptation in which time replaces space as the dimension in which we form our musical predictions.

4. Ostinati: This is a subtype of melodic restatement in which we are able to predict the subsequent pitch and/or rhythm, whilst also being able to predict the repetition of the melodic unit as a whole; there is an additional hierarchic level at play.

Of the various branching principles in the musicological literature, two spring to mind:

1. Tonal syntax: Specifically, the harmonic grammar of the common practice period of Western music. However, an "artificial" syntax of tones is another workable example.
2. Melodic structures that favour certain types of motion: An example of this is described in the grouping preference rules described by Lerdahl and Jackendoff (1996), which describe the hypothetical conditions under which musical elements will be heard as continuations of their predecessor.

Possibly the most well-known example of a family principle can be observed in the serial music of Schoenberg, described in terms of anti-structure (Ockelford & Sergeant, 2012). Though there have been discussions of Schoenberg's techniques of suspended and fluctuating tonality, as in the work of Ashforth (1978), I would argue that these tonal principles are perceived at a different organisational level to the anti-structural surface studied by Ockelford and Sergeant. One could also question whether these principles of fluctuating and suspended tonality are emergent or generative, but that would be the topic of a separate paper. Another common approach to serialism is the description in terms of a linear principle, treating the tone-row as a rigid, prescriptive and perceivable structure (Palmer, 2014). However, Ockelford and Sergeant (2012) observe that it is the non-repetition that is perceived, rather than the specific succession of pitches in the tone row.

Looking over these three principles, a simpler typology can be proposed: contextual principles and static principles. Contextual principles would refer to the various branching principles, as the rule for determining an acceptable continuation is dependent on the specific preceding elements. Static principles would encompass family principles and linear principles as in both cases a constant rule is applied when determining an acceptable continuation, regardless of the preceding element(s).

2.3.2 The Temporal Preparation of an Ending

For an ending to be adequately prepared and for it to be perceived as belonging to an *event*, it must, hypothetically, conform to the generating principle(s) of the *event*. This presents a challenge as noted by Smith. She states that: “given any form generated by an infinitely repeatable or extensible principle, we cannot say if it is a whole or only part of a more extensive whole”, illustrating this point with the example that “a sequence of four squares is neither more nor less “whole” than a sequence of five or fifty” (Smith, 1968: 26). A similar idea is expressed by Meyer in his discussion of implicative relationships in music. Meyer states that patterns which lack points of structural stability tend to develop a “strong internal momentum” and so require an unambiguous breaking-off of the process for closure to be achieved (Meyer, 1973: 119).

Tebbs arrives at a pleasingly illustrative description for gestures that suggest continuous motion in a single direction: “gestures to infinity” (Tebbs, 2002: 49), and while he applies the term to motion in non-structural elements, I believe that this description highlights the difficulty that Smith was concerned with; uniform, directed motion – either conceptual or perceptual – implies continuation without a specified terminal point. There are certainly elements within that motion that have a lower transitional probability for the continuation of the *event* – consider the likelihood that a rising melodic line based on the whole-tone scale will terminate either at an octave above its starting pitch, at a point of hypermetric regularity, or (ideally) where these two conditions coincide – but these shifts in probability may still be relatively ambiguous in the context of the work and require the support of additional devices.

To highlight this, I will turn to the structure of a Classical period tonal phrase. If we develop the structure of the phrase according to harmonic syntax alone, then we are quickly left without a clear ending point. As Rohrmeier and Neuwirth (2015) point out, a merely harmonic description cannot distinguish between a cadential and a non-cadential V-I progression. Studies of cadence often highlight a rather specific formation of parameters surrounding the cadential progression, as well as devices preparing the cadence (Caplin, 2004; Bigo et al., 2018; Sears et al., 2018). These clarifying elements, such as reduced harmonic rhythm and various cadence-typical voice leadings may appear as surface details, but the cadence would be highly ambiguous without them, and the structure of the phrase would be muddied. While

this (harmonic syntax) is an example of a branching structure, rather than a linear structure, my goal is to highlight the following:

For an observer to predict the arrival of a terminal gesture or element, the *event* must either (1) establish the nature of the terminal gesture by reference to a prior *event* – allowing the observer to track the motion of the process towards the goal, (2) make use of a conventional process or sign – to much the same effect – or (3) establish the nature of the terminal gesture by a means contained within the current *event*, such as some means of the process being self-limiting or other behaviour specific to the *event's* process. The simplest example of scenario 1 would be a repetition or return of a passage of music, verbatim. Scenario 2 could be exemplified by a circle of fifths progression, but a functional-harmonic progression has similarly well recognised set of expectations that it generates by conventional means. Finally, scenario 3 mentions self-limiting processes, an example of this which is discussed later would be the gradual reduction of a texture to monophony – the approach of a musical vanishing point. Other process-specific behaviours in this scenario might include the completion of a palindrome or other processive return to the initial element (for example, an initial pitch), or it might be expressed as the motion towards an octave equivalent of the initial pitch.

Internal Signalling of Terminal Gestures

A solution offered by Smith (1968) to the problem of signalling termination is that of "terminal modification". Smith (1968: 38) establishes repetition as the foundation of structural form – the generating principle – and terminal modification can be defined as the deviation from an *event*'s generating principle as a means of indicating that the present or subsequent gesture or element will be terminal. Two examples referred to by Smith (1968: 50–55) are (1) the sense of closure derived from the introduction of a rhyming couplet following a series of quatrains at the end of a typical sonnet and (2) the breaking of the iambic norm in the meter of Shakespeare's seventy-third sonnet, line four. Notably, both examples show terminal modifications which close structures on the same hierarchic level as the modification.

Meyer (1973: 131–241) discusses several types of implicative relationships in tonal melodies which offer a means of preparing a terminal element. One example, the "gap-fill melody", offers a technique where the initial structural elements delimit the registral space that the

process takes place within. Here, Meyer (1973: 145–57) describes a melody in which an initial melodic leap causes the listener to expect the subsequent elements to fill in the registral space. While this technique is discussed as being employed in melody, I expect it could be applied with ease to most parameters, for example a motion from an open chord-voicing to a closed one or the register that a gesture is placed in, etc.

Use of Conventional Processes or Signs and Reference to Prior Events

By conventional process I mean a structure comprising a loosely predetermined sequence of sub-schemata, an example of which may be a theme constructed as a parallel period. In other words, every subsequent element of the process is already anticipated – to a greater or lesser extent – rather than just the termination. However, all conventional structures rely on repeated exposure over an extended period, prior to the ongoing *event,* such that the observer's knowledge of the structure is encoded in long-term memory. If the exposure is more recent – presumably within the same work – then the interpretation of the closing gesture will be limited by how effectively it has been encoded into the observer's memory, the temporal distance from the most recent encoding, and the recognition of appropriate recall cues.

A conventional sign would refer to a cadence or cadence analogue, a style-typical ending gesture within a known and directed generating principle. However, I would suggest that these may also operate as conventional terminal modifications; they act as a combination of terminal modification and conventional structure. The structure of a theme is often conventional, in that the theme's type is defined by the functional and proportional relationships of its elements (phrases, subphrases, etc). However, the objective temporal duration of the theme is not nearly as conventional and so – in the case of a tonal cadence – the tonal-syntactic generative principle of the theme is hypothetically infinitely extensible, within limits. A conventional melodic structure may curtail the harmonic structure's extensibility to a degree. The structure of the (likely an authentic) cadence itself is also highly conventional, particularly the final V-I progression but also its preparation, leaving us with a conventional terminal modification to an almost infinitely extensible generative principle.

2.3.3 Familiarity and statements of "The End"

Familiarity and outright statements of "this is the end" present a challenge to our proposed need for temporal prediction in closure. Smith remarks that "we tend to impose closure on what is known, independently, to be the terminal point of a sequence" (Smith, 1968: 41). This suggests that if one is reading a score or is deeply familiar with a particular work, then one might well experience closure at a point where no preparation of that ending has occurred. Continuing with Smith, she later states that "as we shall see later, one of the most effective ways to close a poem is simply to announce that one is doing so" (Smith, 1968: 63). This operates in much the same way, though I suspect an arbitrarily declared ending may appear more abrupt than if one were anticipating the ending based on an earlier listening. Of course, one must reflect on the objections to comparing theories of poetry or language to those of music. An example of this would be Xenakis's (1987: 32) statement that the rich abundance of possible interpretations that are available to a musical work is far too broad to consider music to be a language. To account for this, I expand on this idea of a declared ending in a musical context in Section 3.1.5 as what I refer to as an "evoked cadence", though I do not mean to imply that this is the only example to be found.

These points of closure being experienced independently of any process are important factors in my decision to define closure as a percept, located in our experience of a work, rather than in the score itself.

2.4 Non-Closure: Openness and Closural Failure

Up until this point, I have focussed on the evocation of closure. However, I have previously suggested that not all endings or *event* boundaries coincide with an experience of closure. On occasion, an observer may not experience an *event* as satisfactorily closed despite it unambiguously arriving at an *event* boundary. Eng (2012: 81) uses the term closural failure to indicate an ending that seems arbitrary as it leaves the listener's expectations unresolved, an idea which is analogous to Smith's (1968: 213) definition of disappointment: an unjustified ending. Approached from a different angle, if one allows for an aesthetic in which closure is not automatically desirable, then one must allow for closure to be intentionally denied to the listener, either through the negation of expectations or the absolute lack of any generating

principle. This would be an expected instance of non-closure rather than a closural failure, though I would suggest the term “openness” is preferable so as to avoid treating closure as the default condition for endings.

Eng (2012: 78) discusses open endings in contrast to closural failure by way of reference to the Romantic Period works which she describes as open on account of their sense of incompleteness, achieved through the avoidance of a final cadence onto the tonic. This suggests a basic dichotomy of non-closural endings to begin our conversation: (1) open endings being endings that express non-closure in an expected, stylistically typical way and (2) endings of closural failure describing endings which seem to, unexpectedly, leave the listener with a bundle of loose ends. I think a suitable analogy could be the difference in experience between being left at an ending with a question as opposed to being cut off mid-way through a narrative; one is identifiable as an ending whilst the other feels more like a breaking-off than an ending.

As previously stated, EST hypothesises that an *event* will be perceived as having ended when either there is a distinct discontinuity in one or more parameters, or when the *event* arrives at a goal which is predicted by the observer. In perceiving discontinuity rather than goal-arrival, by the conditions set out in my definition of closure, the observer would not experience a close. This could conceivably result from (1) the observer failing to identify the generating principle by attending to a secondary or rhetorical parameter over the structural parameter(s); (2) the perceptual input of an *event* intentionally negating the expectations implied by the generating principle and/or the ending-orientated devices for that *event* – a structural misdirection in which the parametric discontinuity occurs in place of, and possibly at a different point in time to, the anticipated ending; (3) the complete absence of a perceivable generative principle underpinning the event – not to be confused with the presence of a consistent family or anti-structural principle; (4) the lack of temporal information regarding the terminal gesture; or (5) The complete lack of predictive information.

In the first two scenarios, it is conceivable that the observer would eventually orientate themselves. In the first scenario, this might occur by the listener acquiring the correct *event* model as repeated failure to predict the ending would hypothetically cause the listener to reformulate their *event* model until they arrived at one which allowed them to correctly

segment the continuity. In the second scenario, this orientation might occur by acquiring knowledge of a principle of open-endedness whereby they begin to expect the reversal of their expectations. Both of these contingencies would require repeated exposure to *events* displaying organisation that is consistent with the *events* of the work being listened to. I would expect that the disagreement between perceptual prediction and the perceived segmentations (in scenarios one and two) would produce a fatiguing effect in the observer, as they would be experiencing the increased processing theorised in EST at both the point where parametric discontinuity triggered *event* segmentation and at the point where their expectations were negated, requiring the updating of *event* schemata; that is, the effort of learning a new style from scratch.

The lack of a perceivable generative principle (scenario three) would not necessarily deny the observer access to temporal information. Generative principles are mainly responsible for forming our predictions of the configuration of subsequent gestures. Any predictive segmentation in this case would be reliant on the work's temporal structure and ending-orientated cues – such as hyper-metric regularity or highlighting effects (to be discussed later). In scenario four we have a similar experience to our third scenario, however this time in the inverse (we have access to configurational information but not temporal information). In both of these, the listener can only form partial predictions about the musical segmentation. This is heightened in our fifth scenario which would represent a completely unstructured work, devoid of generating principle or temporal cues. This would likely provide a similar experience to the first scenario, but this time without the allowance of the observer ever becoming orientated, and so eventually the listener would become increasingly desensitised to prediction error as a result of the "noisy" stimulus. Scenarios three and four would be similarly disorientating – either consisting of abrupt arrival at the expected ending gesture or arbitrary parametric discontinuities at predicted points – but I expect the presence of partial information would reduce the sense of randomness.

One must also account for a sixth scenario: an unsegmented musical work. This presents a unique scenario in which a musical work would lack any medial segmentation and ultimately have only one boundary: the perceived parametric discontinuity between musical and non-musical time. I expect this would prove less tiring than the constant reorientation produced

in scenarios one, two, and five – the observer would theoretically update their *event* model only when their expectations were negated or at the final discontinuous ending.

The following are a few comments on the suggested effects of non-closure.

2.4.1 Effect of Closural Failure on Predictive Processing

EST states that observers show a heightened level of cognitive processing at event boundaries. This is proposed to be an explanation as to why individuals who display more typical segmentation of *events* are generally seen to have a better recollection of the order of significant gestures/actions or elements (Zacks et al., 2007: 278–79). This suggests to me that if a listener is confronted with closural failure, which is usually associated with a negated prediction, it is likely that their recollection of that *event* will be hindered. This seems to be supported in the current literature (Sargent et al., 2013; Radvansky, 2017; Richmond, Gold & Zacks, 2017). If this is the case, in a hierarchically structured work where fine-grained *events* provide the basic gestures to make up a coarse-grained *event,* it is easy to imagine how closural failure at a lower level may well cause further errors in predictive processing at higher levels as information pertinent to generative principles for those coarse-grained *events* is potentially not complete.

2.4.2 Failure to Identify the Generating Principle

The failure to identify a generative principle (scenario one) is based on the idea that an observer does not automatically attend to the correct parameter(s) when identifying the generating principle. This would be an example of selective attention, which is often approached from the perspective of the cocktail-party problem, described by Cherry as: “How do we recognise what one person is saying when others are speaking at the same time?” (Cherry, 1953: 975–6). Another example of this selective attention is observable in the study of visual art. In discussing the stylistic detection of forgeries, Rousseau states that “a forger not only has to put himself into the skin of the artist and understand his times, but he also has to realize what in the artist's work is attractive to us today” (Rousseau, 1968: 252). In other words, the selection of elements that are seen as significant or relevant is not a

consistent factor when comparing styles. Therefore, a listener whose attention is misdirected will fail to identify structurally meaningful gestures and be left listening to "noise".

2.4.3 Temporal Effects of Closural Failure

The effect of music on felt-time is a well-acknowledged phenomenon; the ability of music to make a long period of time feel much shorter. Merino-Rajme (2022) proposes that this is a result of how our attentional resources are deployed, suggesting a modified attentional gate clock model to account for this. To summarise Merino-Rajme's idea, an observer has separate indexes for each ongoing *event*, as well as an internal clock that generates a tick at regular intervals. It is the observer's attention that determines where that tick is indexed to. For example: if I am both waiting for the kettle to boil and listening to a musical work, then I would cause the tick to be allocated to the "musical work" index if I were paying sole attention to the music. If my attention is more general, such that I am aware of the music and the act of waiting for the kettle to boil, then the tick would be indexed to both of those *events*. Lastly, if I stop paying attention to the music then the tick will only be added to the "waiting for the kettle to boil" index. The felt-time of an event is proposed to be based on the number of ticks associated with that *event's* index (Merino-Rajme, 2022: 18–19). Given that EST proposes *event* segmentation to be a control mechanism for directing attention, with the perception of closure through goal-arrival implying that our attention is placed appropriately if attending to a goal-orientated style, it suggests that the perception of closure correlates to our experience of the felt-time of a work.

2.4.4 Disagreement in Two or More Generating Principles

This is not something touched on in the literature that I have reviewed, but it was observed in the analysis section of this dissertation (Section 3.2, pg.54). I will touch on it more comprehensively at that point, but for now I will state that any disagreement in predictions

formed through observing the structural elements of an *event* seems to lead to ambiguous interpretations of endings and a high processing load for the observer[31].

3. Examples of Closural Devices

The following section serves as a review of devices that are employed in creating musical endings. The first subsection will discuss the procedures noted in a cross-section of the present musicological literature on closure and endings. The second section consists of a demonstration of those devices and the role they play in Bartók's String Quartet No.6.

3.1 Abstract Discussion of Ending-Orientated Devices

3.1.1 Processes of Intensity

Open Processes

Kristy Bryden's (2001) study of intensity curves – the change in the perceived intensity of a given parameter – shows many interesting recurring features in how composers manipulate intensity throughout a musical form. An example of changing parametric intensity might be increasing the number of active voices in a texture or decreasing the registral space that a gesture occupies, relative to the previous gesture. Bryden pays specific attention to how intensity plays a role in her six proposed principles of closure:

1. "Closural processes can operate simultaneously at several perspectives in a musical work,
2. closural processes involve changing degrees of intensity; in a phrase or phrasal gesture with a strong sense of completion, the intensity builds then subsides and then briefly builds and subsides again in the concluding moments,

[31] In the case of my analysis, the observer is me. I have not yet conducted any experiments regarding this observation with a large enough pool of participants to make any general claims.

3. closural processes involve a sense of building expectations and subsequent resolution,
4. closural processes incorporate a summary or return of previous musical events when approaching a conclusion,
5. closural processes include highlighting concluding events so as to emphasize the concluding moments of a phrase or phrasal gesture, and
6. closural processes include transitional techniques that anticipate the following event" (Bryden, 2001: 144).

What distinguishes Bryden's work from similar discussions is the analysis of "composite intensity curves". The production of a composite intensity curve entails first the normalisation of the various parameter-specific intensity curves and then graphing the average intensity over time. It is in this composite intensity curve that Bryden observes the majority of the recurrent features. Charles Tebbs (2002) includes a discussion of intensity in his dissertation but takes a more granular approach. Tebbs focusses specifically on abatement – as opposed to the entire curve which would also include onset, intensification, and climax – and treats abatement in rhythm and duration, texture, and harmony each in turn as possible ways a composer might signal an ending. Similarly to Bryden, Tebbs approaches abatement as a quasi-conventional, ending-orientated process. However, Tebbs also notes that these processes may be interpreted as terminal modifications, rather than independent processes.

Rhythmic/durational abatement refers to the lengthening of durational values and the reduction in the frequency of attack points when approaching an ending (Tebbs, 2002: 28–31, 38–44). These durations may be as simple as a single sustained pitch, or they may be more complex durations such as rates of change in harmony or texture. This abatement may also be presented as a terminal modification, as in the case of a rallentando.

Harmonic abatement describes the processive decrease of dissonance towards a point of relatively consonant stability (Tebbs, 2002: 83–9); a process from dissonance and noise toward consonance and clarity. The example of a medieval cadence is given in Tebbs's discussion where a sixth revolves outwards to an octave.

Before continuing, what I would like to emphasise through the above review is that all but one of the processes discussed do not have pre-determined limits or end-points. Any motion

towards a point of relatively lessor intensity limited only by arriving at a value of zero, and so unless the music completes this motion it fails to develop specific temporal expectations of the ending; each subsequent element is sufficiently prepared as to be a potential termination.

Highlighting Effects

The highlighting of concluding events is the fifth of Bryden's closural principles, and she notes that in the works she analysed, there is often an increase in intensity in one or more parameters in the concluding moments of a segment (Bryden, 2001: 126–35). Climactic endings and stasis are also discussed by Tebbs (2002: 31–35, 48–52). Tebbs remarks that we can sometimes experience a high intensity in some parameters in contrast to abatement in others at an ending, for example a higher intensity of melodic activity against a slower rate of harmonic change. Tebbs goes on to state that there is also the possibility of the use of a final stasis that does not reach a saturation point and prompt an expectation of change. Rather, the terminal stasis presents a Schoenbergian liquidation; a reduction of motivic or characteristic detail until a melody is reduced to its non-motivic elements (Schoenberg, 1967: 58). Pellegrino (2002) describes a related, though seemingly contrary technique in the third movement of John Adams's *Phrygian Gates* (1977): The movement is constructed of four harmonic cycles that are related though each are made up of the same process of harmonic transformation. However, there is a harmonic process present between the cycles: The basic chord of each subsequent cycle is made up of more pitches than the last, the first basic chord being a quartad, the second a quintad, the third a sextad, and the fourth a septad (Pellegrino, 2002: 150–51).

The highlighting of an ending may be completely unprepared. The manipulation of register is a device employed by Schoenberg (Ashforth, 1978: 220–22) and commonly appears as the sounding of a previously unheard register, characterised as "an abrupt eleventh-hour demarcation" (Ashforth, 1978: 220). I suspect this is largely a rhetorical device – its unprepared nature would disqualify it from serving a closural function, based on the criteria established earlier – and Ashforth himself frequently refers to this technique as a "fillip[32]". In

[32] A reinforcing device or action.

his discussion of special (highlighting) effects, Tebbs also gives the example of sudden registral extremes (Tebbs, 2002: 52–5). Special effects are described as the introduction of an element that is not prepared by a broader process – Tebbs gives examples of registral extremes in *Pierrot Lunaire* (1912) and the archetypical use of percussion (and other timbral transformations) at endings. Tebbs further relates such special effects as being terminal modifications.

As with open processes, the highlighting of an ending does not give specific information as to when and how that ending will arrive. It certainly heightens our general expectation of an ending, and so would reinforce a closural effect, but I would expect both highlighting effects and open processes to be insufficient as independent devices to evoke a sense of closure. The example of harmonic intensity in *Phrygian Gates* is the exception here as it does potentially present an example of a process that has a defined limit. The septad may be perceived as a fully saturated chord as the work is built on diatonic modes; the final seven-note chord uses all pitches available in the present system.

Potentially Closed Processes

Ashforth's discussion of the music of Schoenberg identifies a process that he terms "additive and subtractive cadences" (Ashforth, 1978: 213–216). This refers to the gradual increase or decrease in textural density at an ending, whether in homophony or polyphony. "Textural unification" appears as a similar technique discussed by Tebbs; the condensation of musical space into a single horizon or vanishing point, similar to a subtractive cadence specifically (Tebbs, 2002: 45–48, 82–3). Here, Tebbs gives examples of music ending on unisons, octaves, and fifths, especially in relation to a pedal and relates this vanishing point to the observed contrast between polyphony and homophony at cadences in much contrapuntal music. This reduction to homophony is a device that is also observed in Schoenberg by Ashforth (1978: 216). Similarly, Ashforth remarks on Schoenberg's use of registral expansion and contraction (Ashforth, 1978: 222–224); the motion towards a maximally broad or maximally reduced registral space.

Processes such as subtractive cadences, textural unification, reduction to homophony, and registral contraction all hypothetically provide information regarding the form and temporal

location of their endings, as all three processes have natural limits in the form of a vanishing point, and assuming that the rate of the process is consistent. As these techniques are capable of developing and satisfying specific expectations, I feel that they could be closural, independent of any other device. This would require the conditions that (1) no conflicting *event*-level process or secondary process were present to generate additional expectations that were left without realisation and (2) these processes were carried out until their conclusion or vanishing point.

Additive cadences and registral expansion found their way into this subsection by association with their corollaries (subtractive cadences and registral contraction), which I see as the basic form of these processes in the context of an ending. However, as additive cadences and registral expansion have no inherent limit, they are open processes.

Conclusion

In reviewing the role of intensity in endings, three subcategories present themselves. The first included quasi-conventional compound intensity curves, rhythmic/durational abatement, harmonic abatement, "additive cadences" in Schoenberg, and registral expansion. All of these processes have a sense of direction but lack a preemptable endpoint. Special effects and climactic endings make up the second category, and much like the first category they cannot be anticipated. The first two categories make up the majority of intensity-based techniques and suggest that, for the most part, intensity plays a rhetorical role at a close.

Of the techniques which engage with intensity, only those that have absolute (and known) limits – such as textural unification or "subtractive cadences" – or have locally defined limits – as with the case of the saturated chord in *Phrygian Gates* – can have a closural function.

3.1.2 Local Preparation

The local preparation of a work-level conventional closural gesture is a common approach in cases where a stylistic convention does not provide one. Two means of local preparation seem to recur: contextual closure gestures and framing gestures.

Contextual Closure Gestures

Contextual closure gestures refer to any feature which is recurrent at endings throughout a work. These may be present as textural or timbral changes as with Ashforth's observation that Schoenberg will at times effect a change in the prevailing timbre at endings within a work (Ashforth, 1978: 216–219). In the comparable use of melodic signs, Eng (2012: 58) discusses contextually defined phrase-level closure motifs. This describes the establishment of a motif which recurs specifically at endings. An example of this is the use of motif manipulation to create intertextual relationships (Eng, 2012: 137–155). Here, Eng describes the use of a single theme across a collection of several different songs, using shared motifs to create relationships between moments in the texts. When this is presented as a closural motif across several songs in a collection – as Eng believes they do in Britten's *Nocturne* (1958) – it creates a contextual closure motif on the hierarchic level of the complete work. The efficacy of this presupposes that the entire collection is to be performed at once. Both techniques involving closural motifs and gestures derive their effect from the accrued association between the recurring feature and the end of the ongoing *event*. However, neither technique provides temporal information and so both must be supplemented by an additional process for the ending to be a true close.

The restatement of motivic progression is discussed by Eng as operating in a similar manner. However, instead of creating relationships between endings, Eng's observation of restatement describes a technique in which the opening of the work provides the means of its ending (Eng, 2012: 67–73). The example of the restatement of motivic progression offered by Eng (2012: 68) shows a work in which the motion from motif X to Y characterises both the phrase structure, section structure, and the overall telos of the work; the musical structure is defined by a restatement of the X to Y progression at various hierarchic levels. The basic phrase structure alternates between motif X regions and motif Y regions, while the antecedent phrase tends to emphasise extended X regions and the consequent phrase emphasises Y regions. This is also true of the overall work, as in comparing the first phrase pair with the second we see that phrase pair 1 is more X-dominated and Y is more prevalent in phrase pair 2. Eng implies that this creates a local syntax, removing the need for closure to be supported by rhetorical parameters.

Contextually defined phrase-level closure motifs are reliant on the listener identifying the *event* boundary before they can associate the motif with the boundary. Unless the motif itself has a strong closural construction (relative to the phrase), the closural effect of the motif can only be relied on later in the work, once it has been learned, which relies on the motif being sufficiently distinct. With timbral contrast much the same is true, but it may also be experienced as a terminal modification if paired with a sufficiently directed process. This would allow for the ending to be anticipated and the technique associated with closure on the first hearing. My only reservation regarding this technique would be that changes in timbre (or whichever parameter is altered) would have to be reserved for the statement of ending gestures for this to be effective.

The restatement of motivic progression certainly provides configurational information regarding the ending and may operate as a local syntax. However, it lacks an inherent temporal limit that would have to be provided by auxiliary techniques such as hypermetric regularity or recognisable preparation of the ending.

Framing Gestures

Several techniques discussed in relation to closure refer to a specific sub-set of local preparation techniques in which a common distinguishable element is present at both the opening and ending of an *event*, creating a temporal bounding-box or frame. I have noted three basic types of frames mentioned in the literature: (1) framing sonorities, (2) framing motifs, and (3) palindromic forms.

Tebbs (2002: 89–93) shows several examples where a distinctive harmony, texture, or timbre is present at the onset and ending of an *event*, creating a framing sonority. The reiteration of a motif from the beginning of a work is a technique discussed by Eng (2012: 59–61) that, on the face of it, works in the same way as a framing sonority; as a return following a deviation, or as a recapitulation following a series of modified variants. This may be a complete restatement, or the restatement of a fragment as is shown in the discussion of this type of technique in the music of Britten (Eng, 2012: 97–99, 128–37). Eng shows Britten's use of an initial motif from the opening of "The Herd Boy", *Songs from the Chinese* no.4 (1958) to show that in this style, a motif's identity is defined by its use rather than any convention. There are

of course styles in which conventional closure motifs do exist (See Homan, 1964 for a discussion of typical cadential melodic shapes in Gregorian chant) but I have not seen a similar motivic convention discussed in relation to the Twentieth Century.

However, Eng discusses a separate example of a framing motif which suggests an additional level of complexity to this technique in instances where the framing element is itself a recognisable holon. Eng shows a motif which occurs at two notable event boundaries: (1) as an extended anacrusis or introductory gesture before the start of the opening theme and (2) at the ending of the work. This recurrence satisfies the intuition that recapitulation is an archetypical ending feature – much like the motif in "The Herd Boy" – but the structure of the motif itself appears to be as important as its reuse. The motif is constructed as a mode on the D melodic minor scale ascending starting and ending on C# (or mode 7 of D minor-major), with an E♭ added as a deviant pitch and a C♮ anacrusis. A reduction of the motif also shows that a rising C# augmented triad is at the structural heart of this motif. That is to say that the motif itself has a strong degree of stability as a recognisable musical shape within the broader Western idiom, thus making it an excellently suited gesture for preparing the return of the C# as the motif's final pitch and as the final melodic pitch of the work. This is reinforced through metric structure, with both the first and final C#s of the motif appearing on the downbeat of their respective measures. That is to say that the use of a more substantial ending gesture which contains its own internal rhythmic and metric relationships as well as its own distinct pitch structure allows for that ending gesture to be closed in its own right, a design which would conceivably enhance the effect of the restatement. Admittedly this is a tonal gesture discussed in a dissertation on non-tonal closure, though I believe the principle of an internally closed gesture acting as a framing gesture for a larger structure is applicable to the topic at hand.

Palindromic Forms

Palindromic forms refer to the use of a retrograded restatement of an established sequence to indicate an ending, a technique which I think is classifiable as being related to the framing motif despite the difference in length. Eng (2012: 67–73) describes the construction of a palindrome in a sequence of motifs as one expression of this principle. However, in Eng's

discussion of "In Full Flower" from *Two Pictures* (1910) by Bartók (Eng, 2012: 73), I get the impression that the palindrome is "post cadential"[33] and therefore more confirmational than closural. Pellegrino also refers to the use of palindromic form in the fourth movement of *Phrygian Gates* by Adams. In this case, the palindrome is present throughout the work and is expressed in the durational relationships between each of the movement's segments; the longest segments being the first and last, with segments becoming gradually shorter towards the middle point of the work. The difficulty with this specific instance is that the perception of the end of the palindrome relies on the listener being sensitive to a segment with a rather long duration being of the same duration as the segment from the start of the movement, with a considerable amount of intervening material.

Conclusion

Both the framing sonorities and the framing motifs provide information about the nature of the ending gesture, assuming that the listener has been made aware that the composer is employing this technique – priming them to be sensitive to the recurrence of that specific element as an ending – and that the framing elements are suitably distinctive and memorable. The listener must both expect to hear the framing element and be able to hear it. However, both framing motifs and sonorities would require an additional process to provide the temporal location of the ending. A conceivable exception to this would be if (1) the framing motif were itself closed in some way as with the example discussed, or (2) if the work were structured according to a framing motif principle but on a higher hierarchic level as a framing phrase or theme; a true recapitulation. As with the first exception, the framing phrase or theme would have to be closed for it to be effective without an additional process. In both of these cases, any deficiency of temporal expectation regarding the motif's arrival is made up for by the listener being able to predict the arrival of the motif's final element. It is worth noting that the ability of closure at the phrase-level to project closure onto the level of the section or work is not a given. The use of a palindrome is intended to account for this as it is a sequence with a self-defined limit – we expect to end where we began, retracing our steps

[33] I use this term not to imply that a true cadence is present, but rather to describe the function of the gesture. It comes after the ending's arrival, acting as an extension and confirmation.

– but the ability to predict the ending of the palindrome and recognise its terminal element is reliant on the palindrome itself not exceeding practical, perceivable limits.

3.1.3 Aposiopesis

Aposiopesis is, in my opinion, one of the most compelling techniques of terminal modification addressed in the literature that I have reviewed. Aposiopesis is defined by the OED as "a rhetorical artifice, in which the speaker comes to a sudden halt, as if unable or unwilling to proceed" ("Aposiopesis, n", 2023). Tebbs (2002: 104–113) devotes a considerable portion of his dissertation to the use of aposiopesis as a gesture of finality, heard as a breaking-off followed by continuation and completion in melodic processes, harmonic factors, rhythmic factors, and/or textural factors. The observation made by Tebbs is that a common way of ending an *event* which takes a consistent or static element as its generating principle – be it a linear "gesture to infinity" such as a uniformly rising melodic line, or perhaps a static texture – is to interrupt this principle and then resume it to provide the terminal element of the *event.* The concept at work here is that a given static element or directed process generates the expectation that the process or element will continue (to the point of saturation). If this continuation is interrupted, we are left with the unresolved expectation of hearing the next appropriate term. This can then be resolved by the reintroduction of the static element or the subsequent term in the process.

Harmonic aposiopesis is one example brought up by Tebbs (2002: 106–9) and refers to a pause following an emphasised dissonant harmony before that dissonance is properly resolved. Hypothetically, this would be a rhetorical device to heighten the finality of the resolution, but if it were to form a part of a sequence of alternating dissonances and resolutions it may well signal the final chord pair. The effectiveness of harmonic aposiopesis is also described as being heightened in contexts where a systematised grammar is present.

Motivic aposiopesis is perhaps the most prominent example (Tebbs, 2002: 113–14) and describes a technique where once a motif has been established as a stable entity, an incomplete statement may demand the completion of that motif. This effect is enhanced in works where the motif is repeated – either at pitch or stated in a sequence.

There is of course the danger that an interruption might be perceived as a discontinuity, prompting an erroneous segmentation response by the listener which would need to be revised. There are two possibilities which Tebbs discusses as avoiding this: (1) “One of the ways in which silence can be introduced into a composition without the risk of it sounding conclusive is through its [silence’s] association with an opening gesture or thematic group.” (Tebbs, 2002: 119). (2) The effect of the terminal modification may also be made less ambiguous by using continuities of dynamics, register, harmony and orchestration. These continuities can either relate the sounds on either side of the interruption as belonging to the same *event* through their similarity or by remaining present through the interruption (of other parameters) if they are not themselves modulated by the generating principle (Tebbs, 2002: 113).

Conclusion

I expect that in instances where the aposiopesis interrupts a linear process, or any process which is capable of developing expectations regarding subsequent elements without defining a temporal end-point, it would have a strongly closural effect. The linear process provides both the timing and nature of each subsequent element, while the aposiopesis would mark the delayed element as being terminal through a heightened need for resolution and by means of terminal modification.

3.1.4 Preparation Through Accentuation

In common practice era tonal styles of music, the typical behaviour of the pitches leads the listener towards the final through directed melodic motion – tendency tones, etc. – and through the accentuation of perceptually stable pitches such that harmonic areas and their syntactic ordering are perceived. Similar accentuation-based processes of biasing the listener

towards expecting a specific ending are noted by Tebbs and Ashforth as occurring in non-tonal music[34].

Tebbs notes a cumulative process where the use of agogic, dynamic, or metric accent, applied to pitches during the *event*, creates a sense of stability surrounding those pitches when they appear as the terminal element. This would appear to bias us towards expecting a goal element (Tebbs, 2002: 133–34). This type of technique can be observed in modal styles (Tebbs, 2002: 141–42). The repetition of an element or figure operates similarly to the accentuation of elements. Repetition provides a sense of centricity, allowing for the preparation of an element as terminal (Tebbs, 2002: 134–36). Going forward I will term this type of process "cumulative accentuation".

Motivic dissolution and pitch repetition are techniques employed by Schoenberg that are seemingly related to cumulative accentuation, but they operate slightly differently (Ashforth, 1978: 196–203). The synonymous term that Schoenberg uses for motivic dissolution is liquidation, defined previously; "There is nowhere further to proceed as the motive runs out of developmental fuel" (Ashforth, 1978: 197). This appears to be the reverse of the cumulative process proposed by Tebbs, yet I expect it functions along similar lines. The structural elements of a motif would likely be accented in some way and the nature of liquidation would see much repetition of these accented elements. The main distinction between cumulative accentuation and liquidation is that liquidation shows a directed motivic process towards the ending, potentially providing temporal information, whilst cumulative accentuation only provides information about the configuration of the ending.

Alternatively, Ashforth observes that Schoenberg might isolate a fragment of a theme and repeat it such that it runs out of steam or developmental tendency. It is interesting to note that in Ashforth's (1978: 198) example, the repeated motif becomes the basic unit of a secondary process: a descending chromatic line with a gradually contracting duration for each element. The repetition of a pitch is also used as a terminal sign in instances where pitch repetition is not a feature of the opening of the phrase (Ashforth, 1978: 201).

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[34] Raising the question as to whether non-tonal is really an appropriate descriptor, if motion towards an expected final pitch or pitch cluster is the ordering principle.

The use of unvaried repeated fragments is a fairly common device, with the meaning of the repetition being very context dependent. However, I don't believe that it could be independently closural as it doesn't allow for the temporal prediction of an ending. The technique's static nature implies either change or continuation – depending on context – but not termination. If it appears at an ending it will likely serve a rhetorical or confirmational function. Tebbs (2002: 34–5) addresses the difficulty in interpreting the significance of a static texture, suggesting that either formal or generic cues may be necessary, or a more exaggerated "extreme liquidation" may clarify the stasis' function. I would propose that if the repeated fragment becomes the basic element of a secondary process, then it is that secondary process which allows for prediction. A common example would be a melodic sequence.

Considering all of this, both cumulative accentuation and liquidation give a sense that certain elements within an *event* are central or more stable than others, and so as being the point of orientation for that *event* in a manner similar to a tonic scale degree. This allows the listener to experience their appearance at the end of the event as closural if the temporal location of the ending is also predictable.

3.1.5 Evoked Cadences

In my discussion so far, I have avoided using the term "cadence" as a catch-all for closural or ending gestures. This is mostly because I agree with Caplin's (2004) call for a specific vocabulary in music analysis, as well as his comments that not all closure is cadential. Despite this, I believe that the cadences of the common practice era may still play a role in the non-tonal repertoire of the last century.

The use of triads at an ending is a technique employed even in non-tonal styles and is an easy gesture to simply pass over as common sense. However, there is much to consider if they are problematised. On the one hand, they may be considered to be stable terminal elements based on the principle of harmonic abatement. Alternatively, I would suggest that there is a semiological principle at play. The most likely answer is that it is a combination of these two principles that the listener is sensitive to.

Two examples of ending on consonant triads are discussed in the literature reviewed: ending on a consonant triad with extensions or ending on a consonant interval. Tebbs remarks that the use of either of these in the form of a unison, unison+octave, unison+fifth, unison+third, or unison+third+fifth at an ending is less common in the twentieth century, though not unheard of (Tebbs, 2002: 71–4). This is largely because the use of such consonant elements is context-sensitive and highly reminiscent of more tonal styles, with Tebbs going on to state that in more dissonant works, ending on a diatonic triad may be experienced as stylistically inconsistent, particularly as it is likely to not be a sound term available to the given system. Tebbs states that one observable solution to this inconsistency is to add dissonant tones to the triad in stacked thirds (Tebbs, 2002: 76–82). In contrast to the extended final triad, one might also simplify the final triadic sonority to an octave, unison or fifth which can also be seen to be extended using stacked intervals, similarly to the triads' extension by stacked thirds (Tebbs, 2002: 82–3). A key consideration in both scenarios is that in EST, an *event* model describes the relationship between terms, not the terms themselves. Thus, the finality of a chord cannot be found in the objective stability of the chord itself, but rather in its stability relative to the sound terms which make up the *event*. As to whether the consonant triad is an ending-orientated element or if it truly contributes to closure would rely entirely on whether the triad is established as the goal of the *event*.

However, in their resemblance to traditional cadences, the use of final triads – be they extended or simplified – presents an interesting challenge. How much of their effect as an ending is related to their relative stability and how much can be attributed to their evoking the concept of a cadence?

Evidence has suggested that listeners can rate different cadence types (authentic, deceptive, etc.) as being more or less closed, even when the phrase containing the cadence under consideration is heard in isolation (Sears, Caplin & McAdams, 2014; Sears, 2016: 324–50). Ratings of closure in the cited studies were given for a phrase and cadence heard individually, rather than participants being asked to rate two phrases in comparison to one another. In other words, an authentic cadence would appear objectively to be a highly closed gesture – as opposed to saying that an authentic cadence is subjectively more closed than a half cadence. It is true that the rated cadences were heard within the context of a tonal phrase, so awareness of tonic orientation would likely have played a major role in judgements.

However, the ability to distinguish between imperfect and perfect authentic cadences, not to mention evaded cadences, does speak to the possibility of a conventional knowledge regarding cadential function. Separately from this, the propensity for listeners to hear allusions to tonal styles even when they are not strictly relevant has been discussed, specifically in the works of Schoenberg (Kurth, 2000; Ockelford & Sergeant, 2012).

This suggests to me that the conventionality of the cadence might have allowed it to transcend its tonal origin and express its function, regardless of whether it is heard in a tonal-syntactic context or not. Through their highly consistent usage, cadences may have gained the quality of being symbolic of an ending in addition to their role as the terminal gesture in a tonal harmonic/melodic process. “We might say, then, that the poetic convention of one style is the poetic resource of all styles, and no ‘convention’ is ever wholly lost” (Smith, 1968: 31). Alternatively, it may be the case that the reported effects of tonal allusions were noted in individuals who were strongly primed to listen for a tonal structure in music by their prior listening experiences. In either case, a degree of ending is possibly still experienced.

Returning then to the technique of ending on a consonant triad, this is at first seemingly not enough to classify a gesture as a cadence. But do we need to perceive a complete, context-appropriate cadence sign for its content to be interpreted? I have previously made a brief description of theories of amodal completion. Whether it be through top-down or bottom-up means, humans are seemingly capable of subconsciously completing our mental representation of an object which is only partially perceived. In addition to this, a proposed mechanism of EST is that humans have a noise-gating capability, discussed in Section 2.3, pg.23. We are able to focus on relevant stimuli, or even relevant parameters within a stimulus, to interpret their meaning and improve prediction. This cognitive facility can also be approached via selective attention as discussed in Section 2.4.2, pg.34. Thus, if certain parameters necessary to the classification of an archetypical cadence were deemed structurally irrelevant within a specific *event* – by having previously provided incorrect predictions – then the listener may well exclude them from cognition. Between these two psychological operations (selective attention/noise-gating and amodal completion), I would suggest that it is reasonable to propose that a listener could perceive a cadence – or more specifically, the mental representation of one – if the musical parameters deemed as relevant to the musical *event’s* generative principle followed cadential norms. This suggests that the

terminal triad might not be cadential on its own, but may well evoke a cadential interpretation if, for example, it was the more consonant of a chord-pair and was prefaced by a change in harmonic rhythm. However, the perception of evoked cadences has not been explicitly tested to the best of my knowledge.

3.1.6 Miscellaneous

Some techniques mentioned in the current literature didn't fit well with the above categories, so I have discussed them below.

Under the sub-heading of closural congruence – and in conjunction with cadential morphology – Tebbs (2002: 182–85) offers the hypothesis that it is possible to gauge the strength of a given close based on the degree of agreement between archetypically closural features. In the case of tonal cadences, these could be cadential voice leading, reduced dissonance, a simplified texture, etc. In a non-tonal syntactic idiom, this would allow us to perceive antecedent-consequent groupings in the middleground (and so an *event* at a higher hierarchical level), based on a hierarchy of closed *events* in the foreground. Whether we would perceive the end of this middleground *event* proactively or retroactively would likely be dependent on whether the closed sub-*events* were gradually more and more congruent – creating an open process of closes – or if they showed a clear distinction between one or more weak closes preceding a strong close – forming an antecedent-consequent dichotomy. The open process would require us to perceive the start of a new *event* in order to understand the previous *event* as ended, while an antecedent-consequent pair is more likely to facilitate proactive segmentation.

The conversion of motif to harmony is a technique discussed by Eng (2012: 63–67), which entails the verticalisation of a horizontal structure. This is discussed as a typical ending gesture in the music of Bartók. I find this idea's closural force dubious unless the melodic structure's verticalization can be anticipated accurately (and is expected), never mind heard in the first place. If we consider the process of cumulative accentuation (pg.42) in which pitches that were marked as being structural, through an agogic or other type of accent, affected the closural force of the final harmony, we may find an argument for the efficacy of this technique as being more than a surface detail.

“Retrospective collage” in the music of Bartók (Eng, 2012: 75–7) describes a means of composition of a closing section based on (fragments of) previously heard themes or motifs. This process is described as closural as it “recalls moments from the past while discouraging the listener from expecting those moments to be developed or continued” (Eng, 2012: 77). I feel that this would require the constituent elements to be memorable, closed motifs or themes themselves. This recollection seems to be based more on a qualitative similarity than a recapitulatory return. Related to this is the “transformation of motives into tonal melody” (Eng, 2012: 94–7, 99–109); a melody which is heard as a culmination of previous motifs. This technique seems to be distinct from retrospective collage in that motifs are heard in full and are retroactively interpreted as having been derived from the final melodic theme. Retrospective collage and transformation of motifs would be less effective in settings where the listener is not aware of this stylistic norm, or in instances where the initial statement of the motifs is not memorable enough to allow for clear recall. However, the relationship to recapitulation may help to clarify the significance of this gesture.

The interval structure of a melody has also been noted as a closural device. In his discussion of the music of Schoenberg, Ashforth (1978: 206) references a type of melody which establishes an expectation only to behave deceptively, ending on an unexpected “twist” such as a conjunct melody ending on a large leap or disjunct melody ending on a stepwise motion. This melody type is suggested to create a forced “cadence” through this unexpected ending. This would certainly create an *event* boundary by merit of prediction error. However, I would argue against this producing a sense of closure as it is unexpected. In a more gradual ending, Ashforth (1978: 208) notes that melodic motion often progressively reduces to conjunct intervals at endings. The question to consider here is whether this is either an instance of melodic abatement or of a reference to convention – the descending whole-tone or rising semitone being a very common way to end a tonal or modal melody. Either way, I see the potential for this process as closural as it is a process with a defined limit and a predictable approach.

Typical structural patterns are another type of closural device, as they allow the listener to develop more or less specific expectations. Theme structures – periods, sentences, etc. – or larger forms are not necessarily sufficient to evoke closure as they do not provide specific information about the nature or surface of the ending. However, they often provide some

sort of idea that one is hearing a hypothetical final sub-section of a given *event*, which allows the listener to pre-empt when the *event* boundary might occur.

3.1.7 Conclusion

I believe it is worth noting that of all the above processes, only those with some sort of modifier can truly be closural. Linear processes such as abatement provide no information as to the nature or timing of an ending unless the listener is aware of a defined – natural or local – limit on the range of the process or a gesture is heard which announces the arrival of the ending as with aposiopesis. And while local preparation, accentuation, and framing all indicate the nature of the ending, they too provide no inherent temporal information.

After observing the techniques discussed in the above literature review, I have come to believe that closure is relative. Implications about the nature and timing of endings can be more or less specific, leading to different degrees of closural strength. It would appear that in some cases, analysts have reported a sense of closure for an *event* if its ending was the most specifically pre-empted gesture within that *event.* It is seemingly a matter of being more specific, rather than a binary of specific versus non-specific.

In Table 2 I have summarised the various ending-orientated features that I have reviewed. Features which are considered closural are simply listed. Non-closural features are accompanied by a second column describing the information which they provide – and by implication, the information is missing for them to qualify as closural. “Configuration” indicates that the feature allows the listener to predict the audible characteristics of the ending but leaves them without specific information as to when the ending will arrive. “Confirmation” indicates a feature which is purely rhetorical and confirms the ending, as it occurs or shortly after. “Temporal” would indicate that the feature provides information as to when the ending is expected to occur. However, none of the listed features seemed to provide temporal information to the exclusion of configurational information.

Table 2: Ending-orientated Features

	Technique	
Closural	Intensity Curves/Abatement when a natural end-point is present; that is saturation, gap-fill structures, or a "subtractive cadence"	
	Palindromic Form[35]	
	Motivic Dissolution/Liquidation	
	Aposiopesis	Information Provided
Non-Closural	Intensity Curves/Abatement	Configuration
	Highlighting Effects	Confirmation
	Closure Motifs	Configuration
	Framing Gestures	Configuration
	Accentuation	Configuration
	Isolation and Repetition of a thematic fragment	Confirmation
	Restatement of Motivic Progression	Configuration

3.2 Score Analysis: Practical Demonstration of Devices

Throughout this dissertation, I have described closure as an effect born of a listener's experience of a work. As I move towards the analysis phase of my dissertation, this poses a problem: I could proceed to discuss a work or body of works, documenting the role that various closural devices play in the endings, basing the interpretation of the location of an

[35] A challenging device, given the breadth of attention required. It is hypothetically effective yet potentially impractical.

ending on the presence of these techniques. However, this would be an analysis of the work based on the pre-supposition of the closural efficacy of the techniques I have reviewed. As I intend to analyse the techniques in terms of their effect, I cannot take the techniques themselves as an assumed value. Instead, I propose to aurally identify points of closure in a work, without searching for written cues, and then analyse the score to determine if the means of closure present at these identified points agree with the proposed techniques and my discussion in Section 3.1. I intend to analyse a real (my own) experience of a work, rather than use analysis to suggest what the experience would be. I will expand on my objection to a text-based analysis in Section 4.1.

To attempt to achieve this, I will model my analytic procedure on "Experiment 1" of Peebles's (2011: 85–102) study of *event* segmentation in music. I will begin with a practice task in which I will segment a previously unheard section of music. In Peebles's experiment, the practice task served the purpose of ensuring the participants had understood the instructions. In my analysis this was not necessary, but the practice task instead served to allow me to familiarise myself with the procedure for recording and timing my responses. All segmentations will include a rating for closure. This will occur over two listenings, first looking to identify coarse-grain *event* boundaries and then fine-grain boundaries. I intend to go from coarse to fine as this was the order that produced the most consistent results in the Bartók condition of Peebles's experiment. This practice task will be followed by the segmentation of the movement that I intend to analyse for this dissertation, following a similar two-phase structure as the practice task.

In the following table, I have collated the data reflecting my listening experiences of the second movement from Bartók's *String Quartet No.6* (1939), as performed by the Hungarian String Quartet (1962). Perceived endings are numbered chronologically and described according to the measure (abbreviated as m. for measure, mm. for a range of measures) and beat (abbreviated as b.) on which the ending was perceived to arrive, the speed of my response, the rating for closure I assigned to that ending during the listening, and if I detected a prolongation of the ending prior to the onset of the new event. Each of these descriptions is split into sub-columns to allow for the contrast of experience between the two listenings.

In capturing the above data, I made use of a physical copy of the score, the digital recording of the work, and a digital lap-timer application. My procedure for capturing this data was as

follows: Upon detecting an ending I would press the “lap” button on the timer. I would then make an annotation on the score to record the location of the ending and the rating of closure. If subsequent material was heard to be a prolongation, this was also indicated. The score annotations provided the “measure and beat”, “closure rating”, and the “prolongation” data. Comparing the timestamps recorded by the lap timer with the timestamps for the endings themselves in the audio recording allowed me to determine the “speed of response”. There is some concern that performing so many actions in real time would affect my experience of the work. To try to reduce this, I found that keeping my annotations simple – a forward slash for an ending and a “+”, a “-”, or a “0” to indicate closure rating – reduced my cognitive load significantly. Similarly, using the lap timer application provided minimal interference with my experience. I believe that this is reflected in the consistency of my responses to the music, with only four of the seventeen endings detected during the coarse-grain task failing to be subsequently detected in the fine-grain task as would be expected in a nested understanding of coarse-grain versus fine-grain *events*.

I have reported the speed of response as one of three possible outcomes: (1) “Ant.” indicates that I was able to anticipate the ending; (2) “<2 sec.” shows a response time that was after the ending but less than two seconds – I chose this distinction as there were many endings which I responded to in just under this time; (3) “>2 sec.” shows an ending that had a response time of greater than two seconds. No recorded response time exceeded five seconds.

Closure rating is indicated on a simple four-point scale. “0” is a neutral response; the ending was convincing within the context of the work but not closural. “-1” indicates an ending which only became evident through overwhelming evidence of a new *event* having begun and been sustained. “1” is reserved for endings which left me with a sense of closure; though I will admit that even these were often tenuous. The rating of “1+” will be touched on later.

The presentation of the following data is not intended to be a scientifically rigorous study of the perception of closure in the given string quartet, but rather a personal account. The purpose of this is to provide me with a means to discuss the reviewed literature in the context of a real musical instance.

Table 3: Endings in Bartók's String Quartet no.6, mvt.2

Ending no.	Measure and beat		Speed of response		Closure rating		Prolongation	
	L.1	L.2	L.1	L.2	L.1	L.2	L.1	L.2
01.		M.3 b.2		<2 sec.		0		N
02.	M.8 b.1	M.8 b.2	<2 sec.	>2 sec.	0	1+	N	N
03.	M.15 b.1	M.15 b.1	<2 sec.	Ant.	1	1+	Y	Y
04.		M.21 b.1		<2 sec.		1		N
05.	M.25 b.1		<2 sec.		-1		N	
06.	M.33 b.1	M.33 b.1	<2 sec.	Ant.	0	1	N	N
07.	M.42 b.4	M.42 b.4	<2 sec.	>2 sec.	0	0	N	N
08.	M.49 b.1	M.49 b.1	>2 sec.	>2 sec.	-1	0	N	N
09.	M.65 b.1		<2 sec.		1		N	
10.	M.73 b.1	M.73 b.4	<2 sec.	>2 sec.	1	1+	Y	Y
11.		M.88 b.4		>2 sec.		0		N
12.	M.93 b.5		<2 sec		-1		N	
13.		M.95 b.4		<2 sec.		0		N
14.	M.98 b.1	M.98 b.1	>2 sec.	<2 sec.	-1	0	N	N
15.	M.114 b.3	M.114 b.1	<2 sec.	<2 sec.	0	0	N	N
16.	M.122 b.1	M.122 b.1	<2 sec.	<2 sec.	0	1+	N	N
17.	M.138 b.3	M.138 b.3	<2 sec.	<2 sec.	0	0	N	N
18.	M.152 b.4	M.152 b.4	<2 sec.	<2 sec.	0	0	N	N
19.		M.166 b.1		<2 sec.		0		N
20.	M.173 b.4	M.173 b.4	Ant.	<2 sec.	1	0	N	N
21.	M.185 b.1		>2 sec.		0		N	
22.	M.191 b.2	M.191 b.2	<2 sec.	<2 sec.	0	-1	N	N

The excerpt from this movement that I will be discussing has been prepared in the appendices, pg.72. Figure 1 is an annotated reduction of the score. All detected endings will be indicated in the excerpt, with a thinner caesura representing endings detected on the first hearing and a thicker caesura representing endings detected on the second hearing. If an ending was detected during both hearings, then the caesurae will coincide.

In Figure 1 we see that I did not experience a simple hearing of the work – I only detected the first ending (m.3) on my second hearing, an interpretation that I have since revised, and the ending in m.8 received conflicting interpretations. Only the temporal judgements for the section ending in m.15 were in agreement, but even there my response time and closure ratings were different between listenings.

A number of my remarks refer to middleground features in each *event*. To avoid an arbitrarily produced middleground I have preferred to take the first pitch of each pulse as the structural pitch. In the instance where the first pitch of a pulse is tied over from a previous pulse, I have taken the first newly articulated pitch as structural within a pulse. Where a subsequent pitch within a pulse is agogically accented, I have taken it as structural over the first (newly articulated) pitch.

Figure 2 is a graph representing the intensity curves relevant to the work, limited to the section present in the reduced score. It displays the relative pitch height of the uppermost line, the attack density, the relative dynamic level, the registral space between the highest and lowest voice, and the compound intensity. The method for producing this graph follows the procedure used by Bryden (2001: 61–5). Following this, the data for each represented parameter was recorded and then divided by the difference between the highest and lowest value for that parameter, normalising the data to a scale of 0–1. This allowed for the compound curve to be produced by averaging the recorded parameters.

3.2.1 Ending 1: m.3 (or m.4)

The first ending that I detected was at the end of m.3 (but as I mentioned, this was later revised – something I will touch on shortly). I only experienced this ending on my second hearing, though as the first hearing was intended to segment larger *events*, I am not surprised by this. A few ending-orientated features contributed to my experience: Firstly, the more

active and dynamically prominent cello part presents a melody that (1) on the surface, moves through a very chromatic and ambiguous arc from E♭, up to G♭ and down to D♭, before clarifying into that descent from C♮ to A♮ which would not be out of place at a cadential point in A minor; (2) in its middleground presents a suitably ended gesture – the approach to F♮ via the E♭–G♭ enclosure followed by a descending F major arpeggio (marked with a slur, mm.2–3). The arpeggio is incomplete and therefore unstable – I find myself expecting the return to the F♮ root despite all pitches being present – but that sensation of unresolved expectancy feels acceptable as the ending of an antecedent *event*. In the rhythm of the cello, I also hear a possible terminal modification: on m.3 b.1, Bartók briefly changes from a pulse subdivision of three to a subdivision of two, suggesting an ending on the A♮. I have highlighted this in the score. The ending on A♮ is reinforced by the interruption of the F major arpeggio – the structural A♭ – on the subsequent beat.

The harmonic intervals of the *event* might have given some additional sense of structure. The phrase begins on a minor sixth (E♭ to C♭) with a lower-auxiliary type figure introducing a diminished seventh, before moving through alternating augmented fourths and major thirds in m.2. The final quaver of m.2 sounds an augmented fifth (enharmonic with a minor sixth) before we hear m.3 which starts and ends with major sixths (C♮ to A♮, and A♮ to F♯ respectively), separated by diminished fifths, a minor seventh and a minor sixth. This suggests an intervallic divergence and return playing out over the course of the *event* and within its final measure.

However, as I have mentioned, I have since reconsidered my interpretation and concluded instead that the first *event* ends on m.4 b.2, with the final D♭ and D♮ in the cello being heard as elision. Earlier, I emphasised my interest in analysing a real musical experience. Given this, basing my reinterpretation on read, rather than auditioned stimuli seems counterintuitive. I have only included it as it becomes relevant to the untangling of later ambiguities.

The first point that suggests m.4 as a continuation from m.3 is the repeat of the terminal modification rhythmic figure (dotted quavers), now in the upper voices. The harmonic intervals of m.4 are also a sequence of augmented fifth, augmented fourth, and major sixth – similarly to m.3. Next, if we allow for the ending in m.4 then the middleground reduction of

the upper line shows a more consistent structure than it did when ending in m.3. Now we see a descending chromatic line – apart from the whole-tone in m.3 – terminating on an appoggiatura[36] to curtail any expectation of continuation (marked with a slur). Finally, extending the *event* to m.4 completes the current intensity arcs more satisfactorily.

1. The combined attack density is at three attacks per pulse from m.1 b.2. This rises to its highest point of four attacks in a polyrhythm at m.3 b.1, before falling to two attacks per pulse over the next two beats.
2. The pitch height in both voices ends slightly lower than they started (by a fifth). While this is a small abatement, it is tangible given the small number of distinct voices and their largely coordinated motion.

That I did not initially pick up on the "correct" segmentation is interesting in and of itself as my focus on the cello seems to have distracted me from the later importance of the tripled upper melody. This may have resulted from the cello being both played at a higher dynamic level and with greater melodic activity in the opening bars, but there has also been evidence that musical training predisposes a listener towards attending to the bass voice, particularly at cadences; that is, points strongly associated with ending and/or closure (Sears, Caplin & McAdams, 2014: 411–12). The continuation of the harmonic and rhythmic material from m.3 into m.4 might also have been heard as the beginning of a new event, as the precedent for starting and ending *events* on sixth intervals has been established at this point and the rhythmic element has been modified melodically in m.4 such that I suspect I heard it as a bridging element. Furthermore, I would propose that had the chromatic descent in the upper voices not been marred by the whole-tone interruption it would have provided a clearly closural effect.

3.2.2 Ending 2: m.8

The second ending of the movement was detected in both hearings but with conflicting judgements. My initial interpretation focussed on the rising B♭ major seventh arpeggio in the

[36] The appoggiatura may be read as a terminal modification or as a "gap-fill" gesture. Either would unambiguously mark the F♮ as the end of the *event*.

middleground of the cello (m.5 b.2–m.8 b.1, marked with a slur), and the return of the terminal rhythmic motif in the upper voice (this rhythmic motif still plays a role in the second hearing). This would appear to be a phrase which we would expect to stimulate a strong closural response; the terminal modification in the upper voices coincides with the metrically accented ending of the arpeggio in the lowest voice, which itself is enhanced by an aposiopesis in the delayed return of the root. Despite this, my closural rating was 0.

However, on my second hearing, my attention seemed to move away from the lower voice as I extended the *event* to m.8 b.2, an interpretation which may have resulted from several features, starting with the characteristics of the intensity curves for this event:

1. The pitch height reaches its highest point at the A♭ in m.8.
2. The attack density decreases slightly at m.7 b.2, before recovering in m.8.
3. The dynamic level reaches its highest point for the *event* in m.8.
4. The registral space is at its widest (so far) at m.8 b.2.

Most of these characteristics were present in the hearing of m.8 b.1 as the ending, but the expansion of registral space and melodic climax is accommodated by the shift of hearing the ending a beat later. These points of heightened compound tension are not typical of larger endings – we would expect more attenuation or abatement. The climactic behaviour at this point leads us to expect continuation, but two features do retrospectively create a sense of a medial ending: pitch height and registral space. The broad registral space and melodic climax at the revised ending 2 allows for a strengthened boundary with the following *event* given the sudden decrease of space and height in m.9.

Another feature that the second hearing allows for is a repeat of the harmonic framing technique from the first *event.* The second *event* begins and ends on a minor third – if one takes the start of the *event* as the start of m.5 – much as the first *event* began and ended on sixths. However, as I originally heard the first *event* to end in m.3, I was likely unaware of this frame. This missed recurrent feature may have contributed to the ambiguity of my hearing. The minor third ending has a further closural effect in that contributes to a possible evoked cadence. In the upper voice, we see the rising semitone approach of a structural harmonic tone (A♭, m.8 b.2), a tone that forms a consonance with the lowest voice (the F♮ in the cello

part). In the case of this consonance being a third, there seems to be some sort of approximation of a deceptive cadence at play here.

Endings one and two also share metric features in that they end on the second beat of their final measures. However, a recurrent hyper-metric feature is present that I missed on account of my mishearing of an ending in m.3: the first and second *events* are of equal length – a feature which would have provided temporal information for a prediction of the ending.

Notably, while my response to this ending in my first hearing (b.1) was quicker than the second hearing (b.2), it is the second hearing that received the stronger rating of closure. I believe that this resulted from my initial hearing of an ending on b.1 – which coincided with many strong closural features – being deprived of its sense of closure by the apparent continuation of the *event* onto b.2. I was able to respond to the ending quickly but my experience of it was retroactively confounded by ambiguity. It is the resolution of this ambiguity that I believe made my response to the ending in the second hearing slower but stronger. I will expand on this in the final discussion.

3.2.3 Ending 3: m.15

The third *event* was heard to begin with a quaver up-beat just before m.9 and end in m.15, allowing for mm.16–17 to be interpreted as a prolongation of the ending and heard retrospectively as a transitional gesture before the onset of the fourth *event*. The third ending was identified as occurring on the same point in both hearings, but the response time and closure rating differed: In hearing 1 responded within the two-second window and rated the ending as closural. In the second hearing, my response was anticipatory, and the sense of closure was stronger than before, necessitating a distinction between “closure=1” and a new “heightened closure=1+”. This may have resulted from several factors, though I suspect that (1) I had remembered this ending from the first listening, (2) I had begun to learn where to place my attention more effectively by this point in the second hearing, and (3) the ending judgements of the two hearings being in unambiguous agreement made this realisation of expectations (the proposed life-blood of closure) all the more potent.

The effect of memorisation aside, there are several ending-orientated features present which should be discussed. Firstly, the tension arcs show many ending-typical behaviours:

1. The diminuendo in mm.12–14 brings the quartet to its lowest dynamic point thus far, with all four instruments playing at *piano.* The dynamic level reduces even further in mm.16–17 to a single voice at *piu piano,* effectively confirming the ending.
2. This diminuendo is also a convergence, reducing the sense of how many independent voices are present, as this is the first time that all four instruments are at the same dynamic level.
3. Registral space follows a similar pattern to the second *event*, moving from a double octave at the start of m.9 (a shared element between all three *events*) to a triple octave+augmented fourth in m15.
4. The pitch height of the upper-most voice drops by a minor seventh in m.10 (comparing the start of the first gesture on F# and the second gesture on G#, annotated with an arrow) before returning to the starting pitch of F# over the course of the *event*.
    a. This may also be loosely taken as a framing element, a gap-fill melody, or as an extended tonal device – establishing a pitch goal and moving towards it methodically.

There are also a few terminal modifications deployed: (1) The rhythm is syncopated for the first time in the third *event* and in the movement so far (upper voices, mm.12–13); (2) the rhythm of the cello in mm.12–15 slows down dramatically, a feature which can also be related to typical cadential behaviour. This slowed rhythm also contributes to a simplified texture in mm.12–15, moving from a complex contrapuntal texture to almost an implicit homophony.

Several remarkable features prepare the final C♮–F♯ sonority in m.15. The C♮ pedal sustained in the viola part (indicated with stemless note-heads, mm.12–13), interrupted by the C♭, likely plays a strong role in the stability of the C♮ when it returns in the cello in m.14. This arrival at C♮ is also prepared by the cello part itself, as the strong beats of mm.12–14 produce a scalar motion to the leading-tone in D♭ major. The weak beats in turn imply the motion to F♯ by forming a rising chromatic line. However, instead of hearing the F♯ played by the cello in continuation of the “fanning out” shape (annotated using slurs, mm.12–14), this arrival is delayed to m.15 and displaced to another voice. Furthermore, this delayed arrival at the subsequent element in a linear motion is an example of aposiopesis. This arrival on F♯ in the upper voice is reinforced through the contracted ending of a sequence of rising minor

thirds/augment seconds in mm.13–15 (indicated with a slur); {C♭–D; D♭–E; D♯/E♭(omitted)–F♯}. Interestingly, the omitted D♯/E♭ is the first pitch of the prolongation (m.16), though I am uncertain as to whether this has any audible effect.

I would like to point out that this is not the first time Bartók has delayed and displaced the ending of a scalar motion at an ending. Now that I am aware of this possibility, I can also see it at work in the reinterpreted ending of the first *event*, m.4. The descending F major arpeggio is completed by the upper voices after the E♮ interruption. However, admittedly this displaced completion seems to me to be less perceptible as it is a descending motion whose completion has been displaced to a higher point rather than a rising motion.

An element which Bartók has employed up until now is framing intervallic sonorities. However, this is not the case for the third ending. Instead, he begins the third *event* on a minor sixth (m.9) and ends on an augmented fourth in m.15. There is some argument to be made that the prolongation ends on a G♯, which would form an augmented fifth with the C♮ in the cello and so provide an enharmonic interval with the expected minor sixth, but they are not sounded together and so the contribution that this would make to a sense of closure is questionable. Rather I would suggest that Bartók has intentionally produced an analogue for the half cadence, as the final sonority is strongly dissonant, implying the need for resolution, and its structural pitches are approached by descending semitone and rising whole-tone – voice leading typical of a phrygian half cadence in a two-part counterpoint, though the final sonority in that case would be an octave or unison.

3.2.4 Discussion

Table 4: Excerpt from Table 3 – Endings 1–3

Ending no.	Measure and beat		Speed of response		Closure rating		Prolongation	
	L.1	L.2	L.1	L.2	L.1	L.2	L.1	L.2
01.		M.3 b2		<2 sec.		0		N
02.	M.8 b.1	M.8 b.2	<2 sec.	>2 sec.	0	1+	N	N
03.	M.15 b.1	M15 b.1	<2 sec.	Ant.	1	1+	Y	Y

Table 5: Summary of ending-orientated features – Endings 1–3

<table>
<tr><td>Ending no.</td><td colspan="2">Techniques Present:</td></tr>
<tr><td>01.</td><td><u>Second Hearing</u>
Reference to typical tonal gestures – discontinued potentially closed process
Terminal modification (rhythm)
Framing Sonority</td><td><u>Reinterpretation (score analysis)</u>
Framing sonority
Terminal modification (rhythm)
Typical tension arc behaviour</td></tr>
<tr><td rowspan="2">02.</td><td rowspan="2"><u>First Hearing</u>
Terminal Modification (rhythm)
Reference to typical tonal gestures – potentially closed process</td><td><u>Second Hearing</u>
Cadential reference – deceptive cadence
Surface Contrast
Terminal Modification (rhythm)
Tension arcs suggesting a climax</td></tr>
<tr><td><u>Missed Features</u>
Metric regularity (compared with event 1)
Framing sonority</td></tr>
<tr><td>03.</td><td colspan="2">Completion of typical theme structure – Metric regularity
Typical tension arc behaviour when considered alongside ending 2
Terminal modifications: rhythm
Simplified texture
Reference to typical tonal gestures
Aposiopesis
Cadential reference – half cadence</td></tr>
</table>

Of the three endings discussed, only ending 3 shows a consistent closure rating of 1 (or greater) and upon my second hearing, I was able to anticipate the ending. This anticipation is – according to the stated criteria of closure – congruent with the greater sense of closure experienced. It is also well worth noting that only ending 3 shows agreement with the location of the *event* boundary and the termination of the closed process present (the aposiopesis). This contrasts with how the discontinuous potentially closed process (the F-major arpeggio interrupted by the A♭) in ending 1 and the speciously employed potentially closed process (the B♭ major seventh arpeggio) in ending 2 confounded my hearing of their respective *events*.

Before continuing, I would like to address my usage of arpeggios in this analysis. Arpeggios are of course part of the tonal composer's toolbox, and so possibly seem a bit out of place in an analysis of non-tonal techniques. However, through my training and experience they are encoded in my ear as valid linear structures. Because of this, in an account of my hearing of the work I interpret them as linear processes where their closural efficacy is provided by accentuation through repetition of the root.

There are two further elements which may have contributed to the strong sense of closure at ending 3. Most notable is the number of ending-orientated features present and detected in comparison with the previous two endings. It is also worth commenting on how the tension arcs at ending 3 resolve the climactic behaviour of the tension arcs at ending 2. These likely contributed to the closural effect. However, due to the hypothesis presented in EST, I am most interested in how I was able to predict ending 3, but only on the second hearing. As previously stated, this may have resulted from recollection, reorientation of my selective attention, congruence in judgement (which would have been affected by recollection), or a combination of all of these. This variety of possible interpretations muddies the water, but if uncontradicted recollection did play a role – thus making an argument for the presence of strong closural processes less clear-cut – it would indicate that a strong boundary is nonetheless present[37].

[37] I say this in light of EST's hypothesis that long-term memories are encoded at *event*-boundaries.

Apart from the closure of ending 3, one other observation made of the above tables demands discussion. Ending 2 received two highly conflicting interpretations – likely as a result of the misjudged location of ending 1 – and yet we see a very strong sense of closure paired with a highly delayed response time on the second hearing. One possible explanation for the sense of closure experienced at this point, despite the delayed response, is the processing effort involved in the reinterpretation of ending 2 upon the second hearing. One conclusion made by Balakrishnan et al. (2014: 2) is that reaction time correlates to processing time. There are also many articles which associate reaction time with the expenditure of processing effort (Houben, Van Doorn-Bierman & Dreschler, 2013; Pals et al., 2015; Olive & Barbier, 2017). Finally, relating effort to closure, Fabb (2016) proposes – by way of relevance theory[38] – that Smith's concept of terminal modification draws its closural effect from the increased processing effort associated with change, and the subsequent search for a relevant thought to justify the expended effort. Considering the above, I find it reasonable that the difficulty – and subsequent delay – in re-processing ending 2 might have demanded a sense of closure. This suggests an alternative to the objective-orientated criteria for closure that I have relied on up until this point.

3.2.5 Conclusion

This brief analysis seems to confirm the discussion of closural devices made in Section 3.1, showing that closed processes had the greatest effect on my hearing of endings in this specific portion of Bartók's *String Quartet no.6*. We also saw behaviour congruent with EST's hypothesis that where discontinuity and goal-arrival are both present, the listener will prefer the interpretation that is based on goal-arrival; in ending 2 it took considerable effort to discard my initial judgements based on the tonal process and in ending 1 the discontinuity of the tonal process was central to my flawed hearing. The most surprising conclusion was that it is possible to attain closure through processing effort. However, both this conclusion and the general applicability of my earlier points outside of this narrow musical extract would require further testing before I would take them as fact.

[38] A useful source on this is Wilson's summative chapter (Wilson, 2017).

4. Problems

4.1 Analysis and the Complexity of Musical Experience

Much discourse on closure focuses on the written form of music. In his thesis, Tebbs (2002: 15) remarks on the frequent reliance of analysis on the supposition of an objective effect associated with musical structures. This type of analysis tends to proceed by the analyst proposing a hypothetical experience of a score in terms of how an appropriately acculturated listener, applying the appropriate listening strategy, would hear the work. This middle-of-the-road approach is, I believe, a common answer to a core challenge of musical analysis: the prediction of the experiential outcome (affect, perceived closure, etc.) of what is a highly complex process (human cognition). However, in an increasingly pluralistic cultural space, the existence of a hypothetical ideal listener becomes ever more unlikely. Simultaneous access to the music of over a thousand years of musical history (albeit in terms of contemporary interpretations of the past century), to say nothing of the breadth of cultural exposure available to the modern listener, has created a rather unstable jumble of potential listeners, with few individuals limiting themselves to a single musical style (be it period or culture-specific). Musical cognition is complex, and analyses based on linear cause-effect abstractions sit on tenuous ground. Tebbs's response to this is to support his analytical discussion with references to empirical study. This is an approach that I have emulated, but I have found it further necessary to acknowledge my highly subjective experience of the music under discussion. For this reason, the personal nature of musical hearing has informed my analytical procedure in Section 3.2.

4.2 Primary vs. Secondary Parameters

Several discussions of closure separate music into primary and secondary parameters. Section 2.3 (pg. 23) contained a paragraph showing several examples. These terms – primary and secondary – are synonymous with structural and rhetorical, respectively. Alternatively, we could refer to them as significant stimuli and noise. I do not mean to imply that secondary

parameters obfuscate our musical experience and should be tuned out. The comparison to noise is only meant to reflect on how secondary parameters are perceived as unordered and therefore do not contribute to our predictions regarding the onset and ending of *events*.

This separation into primary and secondary parameters is not without some difficulty. The earlier discussion of selective attention, EST as a controlling mechanism for attention, theories of amodal completion, and the observation of perceived tonal structures in the 12-tone music of Schoenberg all point towards the capacity of a human listener to create a highly individual interpretation of a musical work. We are capable of ordering the music in the terms that we expect it to be ordered, an expectancy which is entirely dependent on individual, prior experience. So, we must ask which parameters are to be considered primary; whose perceived ordering principle is correct? This is a subset of the issues facing text-based analysis discussed earlier, but I believe it deserves to be pointed out on its own as the primary/secondary dichotomy is a common analytic tool.

4.3 A Retrospective Sense of Closure

One issue I have not been able to touch on is an event which is perceived to be closed, but only through a retrospective interpretation; an ending which reveals itself to have been the goal, but only after the fact. This topic can be seen discussed as “surprise” in the work of Smith (1968: 213). However, EST is ill-equipped to deal with arrival at a retrospectively perceived goal, apart from suggesting that this realisation will help the listener to implement an appropriate *event* model in subsequent hearings – an ending, but not closure. For this reason, I have reserved this topic for later consideration.

5. Proposed Future Research

Throughout this dissertation, I have identified a few topics that I believe could form the basis for further study.

1. The disparity between (1) EST's proposal that parametric discontinuity is more prevalent at fine-grain boundaries while goal-arrival is the prevalent mechanism at the coarse grain and (2) Peebles's observation that Mozart stimuli are more reliably segmented when working from fine-grain to coarse-grain, whilst the reverse is true of Bartók stimuli (as discussed on pg.19).
2. Hypothetical listener fatigue resulting from the misidentification of generative principles and structural misdirection (as discussed on pg.32).
3. Following the discussion in Section 4, I think that there would be great value in the development of a music-analytic procedure which accounts for the complexities of human cognition. This would have to account for issues such as the effect of acculturation on musical listening and the complex nature of human creativity and would have to strike a balance between the benefits of listener-based analysis (the discussion of a true musical instance/experience) and the practicalities of text-based analysis (accessibility and clarity).
4. An interesting paper could consider the role of Smith's "surprise" (1968: 213) – closure through retrospective interpretation – in a musical sense of closure as I have described it.
5. Expansion on the current project to include a group of outside participants and a broader set of musical examples could provide could prove fruitful and contribute to research task 3.
6. The composition of a work systematically exploring the principles expressed in this document as a means of evaluating my results.

6. Closural Remarks

To summarise the position expressed in this dissertation, closure is a quality of our experience of a perceived object, not a quality of the object itself. In the context of music, this experiential quality encompasses the sense that the musical segment or *event* is both ended – has reached a boundary with any subsequent temporal span – and that the process defining the *event* has been completed. It was also noted that closure is not a binary value, but rather a graded one.

Closure does not slam the narrative door shut but is instead a relative unbiasing of expectation; a novel process has yet to begin and so we are left with relatively little directed expectation at the hierarchic level (temporal grain) of the closed *event*. The greater the sense of closure, the less expectation we are left with regarding the ended *event*.

This sense of completion and ending is reliant on the formation and satisfaction of expectations regarding both the temporal location and configuration of the ending of the present *event*. In the absence of a well-developed semantic-syntactic structure, it would seem that this is achieved through the presence (and perception) of static principles (be they linear or family principles) in the form of either a self-limiting process – such as a palindrome or gap-fill – or of a style-appropriate supplementary sign appended to the process as a modification, such as the aposiopesis or the allusion to a tonal cadence. If either temporal or configurational information is missing, we experience an ending, but not necessarily closure. Furthermore, in the instances where expectations of closure are developed and subverted, this discontinuity of process seemed to be a stronger predictor of ending than the collective discontinuity in several other unordered parameters. This hypothesised need for both forms of preparatory information was shown to possibly have one major exception in the use of heightened processing effort as an alternative means to stimulate a sense of closure.

As a final point, it is important to reiterate that this dissertation has largely been an account of my own musical experience, examined through the lens of the available literature. Quantitative testing of the above conclusions with a broader sample size would be necessary to confirm any of my conclusions. Beyond this, my principal desire is that my work will be of value to the creative individual.

Appendices

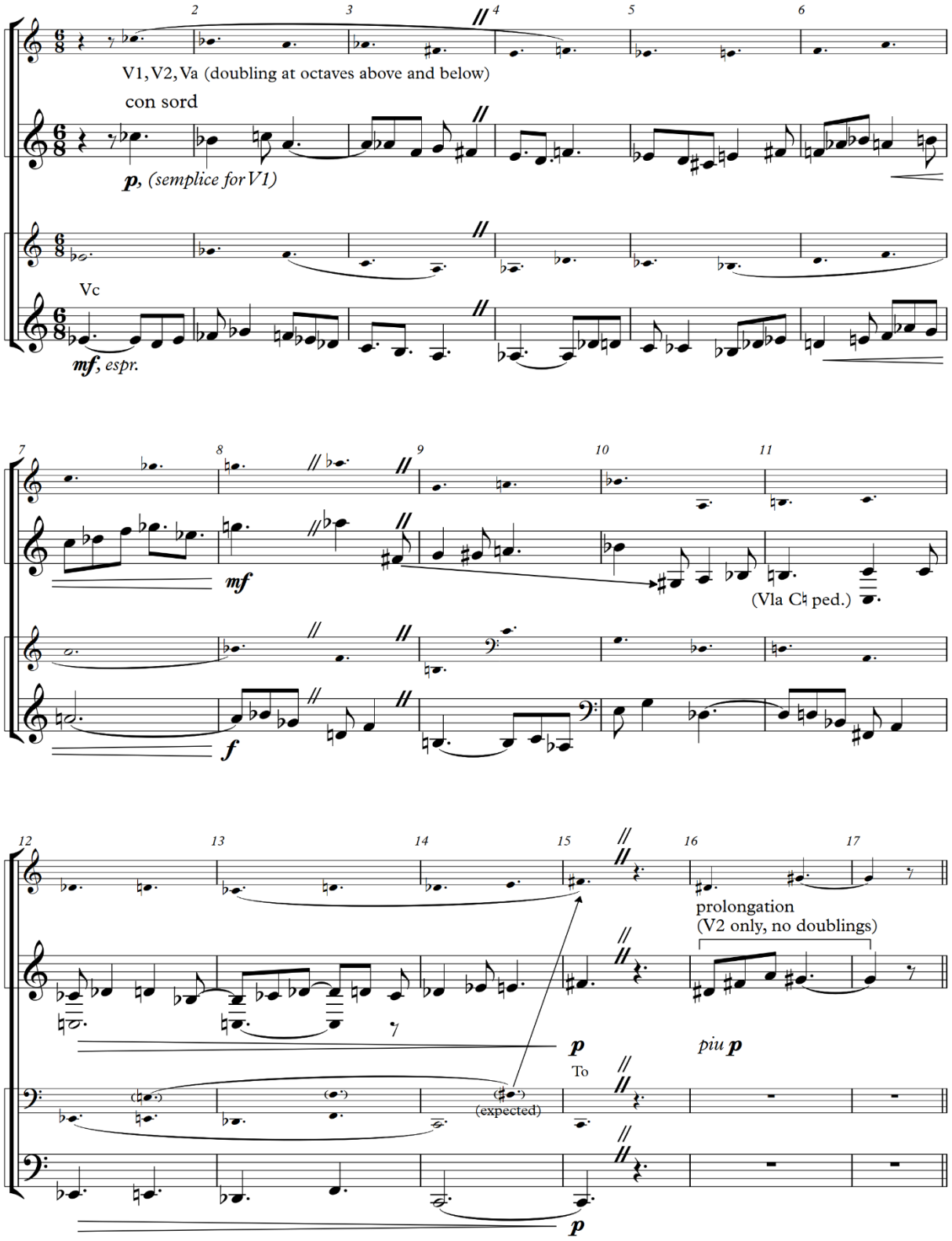

Figure 1: Reduction of Bartók String Quartet no.6, mvt.2, mm.1–17

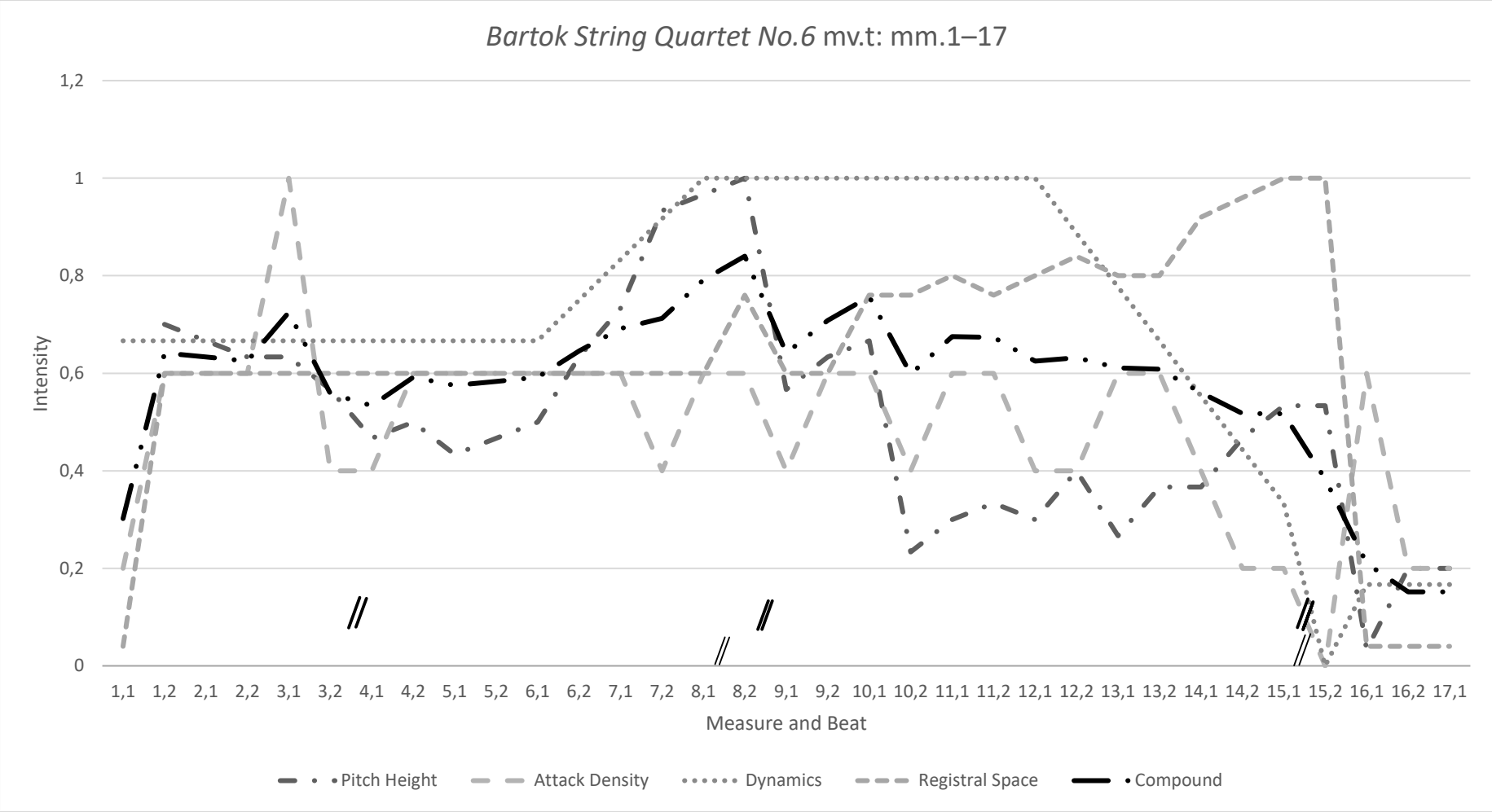

Figure 2: Bartók String Quartet no.6, mvt.2 – Intensity chart

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Glossary

Amodal Completion: “The representation of those parts of the perceived object that we get no sensory stimulation from.” (Nanay, 2018: 1)

Aposiopesis: The rhetorical interruption of a statement, prefacing its conclusion.

Cadence: A functional-harmonic close that is idiomatic to the common practice period of Western classical music, eg. a perfect authentic cadence.

Close: A musical sign, sequence or gesture that is a subtype falling under ending and that correlates with the experience of closure.

Closure: The perceived quality of completeness and conclusion of a musical statement (or other temporal span, ie. an *event*).

Cumulative Accentuation: The preparation of an element as terminal though its repetition within an *event*.

Ending: The terminal gesture within an *event*.

Event model: A working memory representation of the ongoing event (Zacks et al., 2007).

Event schema: A structure that contains previously learned information about the sequential structure of an activity (Zacks et al., 2007).

Event: “A segment of time at a given location that is perceived by an observer to have a beginning and an end.” (Zacks et al., 2007)

Evoked Cadence: A musical gesture which mimics cadential norms within the parameters shown to be primary within a given *event.*

Generative Principle: The ordering principle expressed in the primary parameters of an *event*; The characteristic process of an *event*.

Holon: A constituent part-whole within a hierarchy. Simultaneously a self-contained whole and the part of a larger structure.

Tonal Music: Music which is orientated towards a final pitch as its primary organising force or tendency. This organisation is achieved according to the system of scales and harmonic syntax typical of the common practice period.