

**Affordances for the guitar:
Chordal structures for performance
in the worship music of Chris Tomlin**

by

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Submitted in accordance with the requirements for the degree of

DOCTOR OF PHILOSOPHY

in the subject of

MUSICOLOGY

at the

UNIVERSITY OF SOUTH AFRICA

SUPERVISOR: PROFESSOR MARC DUBY

MARCH 2022

Declaration

I declare that **Affordances for the guitar: Chordal structures for performance in the worship music of Chris Tomlin** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

I further declare that I submitted the dissertation to originality checking software and that it falls within the accepted requirements for originality.

I further declare that I have not previously submitted this work or part of it, for examination at Unisa for another qualification or at any other higher education institution.

Signed: 

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Date: __02 August 2021_____

Summary

Title:

Affordances for the guitar: Chordal structures for performance in the worship music of Chris Tomlin

Summary:

Just as a door handle invites a user to either push it or pull it, certain aspects of guitar chords invite the player to move from one chord more easily to one or another chord. This user-friendly aspect of certain guitar chord structures highlights the presence of affordances embedded in the structure that offer an easy path to executing a different chord. The theory of affordances stems from early work in cognitive studies and ecological psychology by James Gibson and is demonstrated by Don Norman's architectural design work in door handle structures. Norman's position is that as a person approaches a closed door, the design of the handle should suggest whether the individual should push the door handle or pull it to open the door.

More recently, cognitive scientists have considered the quality of embeddedness of certain affordances, much like the jigsaw puzzle piece that shows the puzzle worker where it belongs by certain traits that it carries. Similarly, affordances embedded in the chord structures of Chris Tomlin point the guitarist to an easy path for quick chord changes, allowing the beginning guitar student to learn quickly and the guitar-player-worship-leader to offload attention from the hand and chord shifts, freeing up attention for other worship-leading details.

The application of embedded affordances is useful in design principles like Thaniya Keerepart's graphic user interfaces for handheld internet devices. Music composition

practices such as Herbert Clarke's trumpet compositions also rely on embedded idiomatics, and Joel Krueger, Marc Duby, and Rob Withagen are just three of many who have considered the sonic affordances inherent in certain types of music, leading to specific action possibilities. This research specifically studies the chord structures found in the music of CCM artist Chris Tomlin in relation to the science surrounding cognition, ecological psychology, and embedded affordances. The primary idea driving this research is that there are specific guitar chord fingering patterns and structures that allow for easy transitions from one chord to another more so than other patterns and structures, and those chords are represented in Tomlin's music.

List of key terms:

affordances; Christian Contemporary Music; Chris Tomlin; cognition; embedded; embodied embedded cognition; Gibson; guitar chords; perception; perception-action cycle

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Preface

In August 2009, after over 25 years serving local congregations as a Minister of Music, I made a major life and career change and started teaching music and worship classes at a small private Christian university on the outskirts of Oklahoma City, Oklahoma. Over the course of my first semester with university-level guitar students I was struck by two disparate thoughts. First, these students were able to play almost anything. They could be assigned a worship song, watch a YouTube video, spend 45 minutes with it and play in the chapel band on a regular basis. Second, the students were essentially *not* able to play *anything* if they did not have a YouTube video to watch. If I asked a guitar student to play a simple folk melody, that was a task far beyond his or her capacity. In third semester theory class, *none* of the students were able to do simple melodic or rhythmic dictation. What I quickly learned was that my students were talented singers and players insofar as their talent required having a video they could watch and duplicate.

This research began as a quest to address that theoretical dearth in the students' musical upbringing. It quickly zeroed in specifically on guitar students and why they could play some songs more readily than others, and what led them to program particular songs into the chapel worship sets. I could have picked on the vocalists, or singled out the drummers or any one of a number of instruments and players. It might have been beneficial to hone in on music theory education for junior high-aged church worship bands, but others like Ken Stephenson and Richard Sorce were starting to fill that gap. Instead, I chose to look first and foremost at guitar players in Christian worship bands, leaning specifically on the music most frequently played in worship services at the time. It was during those early conversations about the width and

breadth of what I was seeking to accomplish that my supervisor pointed me in the direction of cognition and affordances, and the possibility that affordances may have a part in the journey.

And it has been a journey educationally and personally. What started as an irritant in a seemingly negative academic situation whereby my students lacked basic musical understanding and theoretic application to their instruments slowly took on a gentler tone as I began to understand the cognition processes and ways that thinking about those processes have transformed over the last five decades. I found myself looking not at the negative side of “why don’t these kids know anything?” but instead striving for ways to rethink how I teach guitar lessons and music theory in ways that build on what the student is already capable of accomplishing.

This research does not speak to the perceived lack of basic musical understanding but looks specifically at the ease of transition in certain chord structures which allow for quick chord changes and enable the beginning guitar student to achieve a basic level of skill quickly and early in the learning process. Those same chord structures allow guitar-playing worship leaders to focus on the worship experience and engage with their congregations more fully.

I express my appreciation and gratitude first and foremost to my supervisor, Professor Marc Duby, for his initial direction and guiding hand throughout this research process. He has provided wisdom for the journey and grace for my straying off the path in measures beyond imagination. Several of my colleagues at Southwestern Christian University have been instrumental in my journey, as well. Dr Reggie Wenyika initially pointed me to Unisa and got me started, Dr Bongsi Wenyika and Dr Adrian Rus provided proofreading and academic input, Dr Jim Poteet has been a constant

encourager and prodder, and Dr Adrian Hinkle has encouraged me with words, time, grace and input. My thanksgiving would be incomplete without acknowledging the help from members of my family. My sisters Dr Judi Roman Carlstrand and Dr Barb Roman DeRose have supplied input and literature, my sons Joshua and Nate have proofed and added expertise both musical and mathematical, and my daughter Kate and son Isaac are continually after me to finish. There have been a host of others helping, prodding, encouraging, but no one more faithfully and lovingly than my wife Becky, who has proofed, suggested, clarified, argued, supported, and persevered these long years, quietly encouraging me while praying for the completion of this work.

This dissertation examines specific guitar chord structures as represented in Contemporary Christian Music written by Chris Tomlin and performed throughout the world by worship leaders and players in church worship bands. Chapter Three provides the basic questions used in a survey of guitar players, and Chapter Four details the results of those surveys. The actual survey is included as Appendix 1 and a comprehensive list of the videos used for analysis is provided in Appendix 2. This information is provided for the benefit of any who would like to do further investigation into these chord structures and affordances.

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List of Abbreviations

ACM@UCO	Academy of Contemporary Music, at the University of Central Oklahoma
APS	Affordance Perception Survey
CCLI	Christian Copyright Licensing, Inc.
CCM	Christian Contemporary Music
CNN	Cable News Network
DVD	Digital Video Disc
EEC	Embodied, Embedded Cognition
GMA	Gospel Music Association
GUI	Graphic User Interface
IPA	Interpretive Phenomenological Analysis
IREC	Infrared Light Emitting Diode
LED	Light Emitting Diode
LNE	Letter Name Encoding
NNS	Nashville Number System
OPP	Optimum Path Paradigm
ORU	Oral Roberts University
RNE	Roman Numeral Encoding
RWTH	Rheinisch-Westfälische Technische Hochschule
SCU	Southwestern Christian University
TED	Technology, Entertainment and Design

Introduction

“I just picked songs based on not having to move my capo.”

- *John Campbell, leading worship team practice at St. Mark’s United Methodist Church on 24 Jan 2021*

Over the past five decades worship in the worldwide Christian church has seen monumental transitions, as congregations have strived to connect with the younger generations by adopting musical forms and content reflecting the tastes and styles of current music trends. A huge influence in the early transition was Calvary Chapel in Costa Mesa, California when Pastor Chuck Smith opened the church to hippies and surfers, kicking off what became known as The Jesus Movement. Smith and Calvary Chapel played host to a number of young Christian musicians attempting to sway their generation to follow Jesus - Larry Norman, Keith Green, the band Love Song, Second Chapter of Acts, Andre Crouch, Michael and Stormie Omartian and many more - and provided a pillar in the foundation of what has become a genre unto its own: Christian Contemporary Music.

Countless churches today reflect that early influence in the way they provide worship experiences for their congregations. While high-energy bands play music found on popular Christian radio stations for the big church services, youth groups gather in rock-concert styled worship spaces for singing led by their more talented peers, and in the childrens’ department yet another set of musicians energise the youngsters with upbeat music and hip-hop dance moves. Within the youth department framework, it is common for the younger musicians to rise through the ranks as they learn and practice the basics of playing chords on their guitars, sustaining string pads on a

keyboard, performing a simple rhythm on a stripped-down drum set, or imitating the latest worship-song vocalist from the Christian music formatted radio station. For the last couple of decades, that music has included a large dose of essentially four or five main artists: Paul Baloche, the bands Hillsong and Hillsong United, Bethel Church, and Chris Tomlin.

The learning process for many of the young players is to watch videos of the performers in order to figure out the songs. Bands have taken advantage of platforms such as YouTube, Vimeo, and church-hosted websites to make their music available, with some performers even providing teaching videos of their songs. Consequently, young people have a familiarity with their instrument that allows them to play adequately for a church youth group, sometimes even progressing to the big church stage. However, the basics of music theory do not make their way into the lexicon of the young musician, and when faced with the necessity to make musical decisions based on actually knowing music, they are at a loss for words.

Tomlin's music has been some of the most frequently played in today's churches, largely, I believe, due to the simple nature of his music and chord structures. This simplicity allows a young guitarist to play a wide range of songs with very little formal education in music theory, including no training that advances guitar technique. John Campbell, a worship leader at St. Mark's United Methodist Church, was joking when he commented on his song selection process for the worship service, but his conversation speaks specifically to the training provided for young guitarists in the church today. He or she simply learns four simple chords, slips a capo on the guitar, and the high school student can make a group of young worshippers happy.

Is it that simple? Cognition science has been exploring the ways our brains work and how we learn things for over a century, and in the last half of the last century James J. Gibson (1962, 1968, 1979/1986) opened up a new line of inquiry with his research in ecological psychology. Don Norman (1988) expanded Gibson's notion of affordances into the realm of architectural design, while Clark (1999, 2001), Chemero (2003, 2009, 2013), Rowlands (2010), Windsor (2004), Windsor and de Bezenac (2012), Withagen and Chemero (2012) and a host of other cognition scientists explored the interactions between agents and environments. Meanwhile, Sayegh (1989), Radicioni and Lombardo (2005a, 2005b) and others have investigated various ways to map fingerings for guitar passages, looking for short cuts and efficiencies in patterns. Windsor (2004), Huron (2006), Huron and Berek (2009), Krueger (2011a, 2011b, 2014), DUBY (2013, 2019, 2020), Clark and Chalmers (1998), and Gjerdingen (2009) are just a few who have scrutinised the connections between affordances and music, delving deep into the psychologies behind some of our favourite tunes.

These researchers and others provide the basis for this thesis, which explores the nature of affordances in the guitar chord structures used by Tomlin. Because of those structures his chord changes are simple to perform for even the least experienced guitarist, and an experienced guitar player is able to play the chords seemingly without thought, allowing him or her to focus attention on other aspects of the performance. While affordances, per se, are present in all guitar chord structures, they do not necessarily promote the same ease of changing chords that Tomlin's structures provide. This research explores guitarists' perceptions regarding the relative ease of execution of certain chord progressions, and analyses characteristics of those chord structures through video analysis.

The perceptions of guitarists are measured via a survey designed to assess the degree of complexity attributed to the specific chord structures by the guitarists over the span of four sections. The survey includes chord structures of Tomlin's as well as standard chord structures, and even two structures designed by Paul Baloche. Results of those surveys are tabulated and presented in the fourth chapter. The chord structures are analysed through video analysis of performances by Tomlin, Baloche, and comparison artist David Gungor.

Following an introductory first chapter, the second chapter provides a detailed presentation of both the research framework and literature related to the study. The third chapter provides details on the survey instrument and the video analysis process, and the fourth chapter describes the findings. The fifth chapter concludes the work with a brief discussion of conclusions and recommendations of the findings in light of the overarching research question, which asks if there are specific guitar chord structures that allow for easier transitions between chords than other chord structures? And if so, what are those structures?

CHAPTER 1 INTRODUCTION

1.1 THE QUESTIONS

In the summer and autumn of 2013, Relevant Magazine published two articles about a leading worship musician and his accomplishments. In July 2013, an artist profile in the section of the magazine titled ‘The Drop’ averred that “it came as a surprise when Cable News Network (CNN) hailed worship leader Chris Tomlin (b. 1972) as the world’s most-sung artist” (Relevant Magazine 2013a:32). The article, citing figures from Christian Copyright Licensing, Inc (CCLI), indicated that Tomlin’s songs received over 3.1 million plays in 2012 and that on any given Sunday an estimated 20 million people sang at least one of his songs (ibid.). By his own admission, Tomlin’s songs are simple and catchy, intended to appeal to the spirit, rather than the intellect (Relevant Magazine 2013b), arguably this combination propelling him to the top of Christian contemporary music charts. Despite the extensive body of work related to the texts and success of Tomlin, however, there is virtually no scholarly literature or research written on his music. Using the music of Chris Tomlin as a case study, this research will add to the perspective of musicological analysis as it relates to the concept of affordances found in the performance of chord structures on the guitar.

After discussing the extent of his influence in contemporary church music, the intent of this thesis is to provide research on the music and performance practices of Chris Tomlin, drawing on current studies in the area of affordances in music. Central to the issue to be raised are the actual chord structures used by Tomlin, and the research first seeks to answer the following question:

Are there specific chord fingering patterns and structures that afford ease of transition from one chord to another more than other fingering patterns and structures?

The process of addressing that question will necessitate addressing the following questions as well:

Do the chord fingering patterns in Tomlin's music reflect the use of a wide array of chords?

What are the chord structures that promote ease of transition between chords?

What are the affordance-related properties of those chord structures?

I believe that Tomlin uses a very restricted set of simple, yet innovative chord fingering structures combined with fairly repetitive progressions that are readily accessible to even the beginning guitarist. After an introduction to the concept of affordances and music, the study will briefly discuss the history and development of standard chord progressions, then look at more recent innovations in chord fingering structures and how the concept of affordances relates to those structures.

Why look at the music of Chris Tomlin, one of hundreds of contemporary artists plying their trade throughout the world today? Is there value in singling out Christian Contemporary Music (CCM), or a CCM artist in particular? A quick glance at the relatively young history of CCM shows that the development of the music from the Jesus Movement in the late 1970's and early 1980's, which predates the contemporary Christian music movement, came from publishers like Hosanna Integrity, Vineyard, Maranatha! Music and Bill and Gloria Gaither's marketing company Spring House

(Cusic 2002). The measures for determining widespread use of particular artists have changed over the past fifty years as the CCM industry has worked to remain compliant with copyright laws and artists' intellectual property rights, offering a way to specifically track the use of artist's music.

Transitions came in several ways, including the rising popularity of Christian music and creation of a new radio market. Southern Gospel music had long enjoyed a small share of the radio audience, but with the rise of songwriters and publishers Bill and Gloria Gaither and the start of the Gospel Music Association (GMA), there was a marked increase in the number of listeners, sale of records and amount of money to be made (Cusic 2002). The Dove Awards, instituted in 1969, had been dominated by Southern Gospel artists but in 1977 that changed as well with the inclusion of Evie Tornquist's light pop style winning the award for female vocalist of the year (ibid.). In the following years, Christian music artists like Amy Grant, Sandi Patti and the Christian rock band Petra continued to shape a new way of appealing to the radio market while ministering to the Christian community.

Following the increased popularity of worship songs in the late 1990s, Paul Baloche (b. 1962), a music minister born in New Jersey who served most of his career in Texas, won the Dove Award for Song of the Year in both 2002 and 2003, and was named Songwriter of the Year in 2002. He gained influence with a series of instructional videos encompassing topics ranging from worship leading to music styles to guitar technique to music theory (Baloche et al 2008). To date, Baloche has produced 15 albums and dozens of instructional videos (Baloche & Swanson 2005a, 2005b).

While Baloche was recording videos that would shape a generation of church musicians, Chris Tomlin was studying physical therapy at Texas A&M University,

and working with Charlie Hall, Nathan Nockels and Louie Giglio to create the first Passion event, held in 1997. Four years later Tomlin released his first album *The Noise We Make* and since then has been shaping worship music, church services and young worship bands. In 2004 his album *Arriving* sold over a million copies. During an interview with Deborah Evans Price (2006), Tomlin indicated that “the album had another kind of success, which was to open doors on Christian radio for worship songs.” The popularity of *Arriving* “showed radio that this is what people love and want to hear, not just me, but this kind of music is what people really love” (Price 2006:10).

In addition to popularity among the Christian music market, with 20 Dove awards and over 40 nominations to his credit, Tomlin has gained status in other markets. His 2010 album *And If Our God is For Us* was nominated for, and won, the 2012 Grammy Award for Best Contemporary Christian Music Album. That same year, his song ‘I Lift My Hands’ was nominated for the Best Contemporary Christian Music Song award.

Articles abound which catalogue Tomlin’s success (Caufield 2012, 2013a, 2013b, Price 2001, 2006), and theologians have scrutinized his texts (Ruth 2007), but the actual musical structure and progression analysis of not only Tomlin’s works but the body of Christian contemporary music is virtually untouched. What are some of the common theoretic patterns of melodic structures and chord progressions that have emerged in the music of today’s Christian church music songwriters? Very little research has been done on the tunes, the patterns, or the construction of the actual music.

1.2 INTRODUCTORY LITERATURE SURVEY

The concept of CCM as a genre unto itself has recently come into the foreground of the music world with comprehensive historical documentation (Cusic 2002, Schaefer 2012, Bowler & Reagan 2014), and this section provides an introductory survey of literature that addresses CCM as well as issues of affordances. The emergence of Tomlin as a leading force in the CCM movement is chronicled in numerous articles detailing facts as far-ranging as his place on Billboard Magazine top song charts and copyright licensing charts (Price 2001, 2006; Caulfield 2012, 2013a, 2013b) to major awards from the Gospel Music Association's Dove Music Awards (Price 2006) and even the Grammys. Numerous articles have been written regarding his history, his theology and the texts of some of his best-selling hits; however, there is very little research on the actual chord structures, harmonic progressions, chord progressions, song forms, and other musical aspects of Tomlin's songs, even though he continues to strongly influence worship leaders and churchgoers throughout the world.

In preparation for research, it is helpful to look at some of the conventions that could be used in analysing Tomlin's work. Music study and analysis methods have been practiced for centuries, and the 20th century has seen a proliferation of music theory books and textbooks, from Paul Hindemith's "Elementary Training for Musicians", first published in 1946, to the two volume "Materials and Structure of Music" by William Christ et al in 1972. Richard DeLone's "Music Patterns and Style" offers a brief introduction to musical analysis, including the use of Roman Numeral analysis, before expanding into a study of form variations. Jazz and Ragtime music forms are explored briefly in "An Introduction to Twentieth Century Music" by Peter S. Hansen (1979). Analytical practices by Heinrich Schenker offer a method of deconstructing

compositions to a very basic form through the process of diminution (Forte 1959), studying the voice leadings, and more specifically the linear progression of the basic chord patterns, to arrive at the core structures of the music (Forte 1959, Temperley 2011). Jane Piper Clendinning and Elizabeth West Marvin's "The Musician's Guide to Theory and Analysis" (2011) provides foundational work in applying Roman Numeral Analysis to contemporary song forms. In her text, Clendinning speaks of the quaternary and verse-refrain forms as used in popular music, using the term 'bridge' for the b section (Clendinning & Marvin 2011). The use of a bridge has become standard in the formula for contemporary church music writers (Herman 2015), and Clendinning's work serves as one resource for theoretical analysis and content of the form.

There have been several authors who have attempted to address the need for a music theory curriculum applicable to the Christian university setting. Ken Stephenson (2006), in his article "Reforming Music Theory: God's Voice and Balaam's Ass", offered five proposals on the study of Christian music theory, and although he only developed the fifth proposal fully in his article, Stephenson's second proposal, "to make as the object of study not pieces *per se*, but the acts of composition, performance and listening" provides a starting point for further research into what Christian music theory might look like (Stephenson 2006:225). In fact, the first question posed under his second proposal is "What musical patterns tend to be commercially successful?" and the concluding question speaks specifically to the need for contemporary church music leaders to be educated in the things of music theory as well as theology. Paul Baloche et al (2008), CJ Watson (2006) and Jason Blume (2006) have all written on

the topic of composing songs for the Christian church worship leader that sell in today's market.

Richard Sorce (1995) spoke of the Theory Gap in his "Music Theory for the Music Professional" and the perceived disparity between common practice analysis and the study of popular music (Sorce 1995). Other authors specifically addressing the need for music theory for current worship leaders include Tom Brooks in "The Language of Music: Practical Music Theory for the Worshipping Musician" (2013), Steve Bowersox, "The Worship Musician's Theory Book" (1997) and Ralph Turek, with "Theory for Today's Musician" (2007). Top Christian music artist Paul Baloche attempted to address the issue with a DVD titled "Music Theory Made Easy" (2005a).

Several parallels are apparent between the rise of popular CCM artists and the use of radio as a performance venue and marketing strategy. Brad Kelly speaks of this in his article "Christian Radio: Not Just a 'Niche Format' Anymore", which attributes a growth rate of about 35 percent in radio audience market share during the periods of 1998 to 2002 to the rise in popularity of both Gospel and Contemporary Christian music (Kelly 2003). In an exhaustive study for her doctoral dissertation at Kent State University, Alexandra Vago analysed the lyric content of top Contemporary Christian Music songs heard on the radio station WFHM-FM 95.5 The Fish in Cleveland, Ohio, a station that had made a format change from classical music to contemporary Christian music with great success (Vago 2011). Kate Bowler and Wen Reagan (2014) referred to the combination of song-use tracking and radio airplay in describing the rise of musicians such as Darlene Zschech and Israel Houghton, and Joshua Bentley (2012) explored the correlation between CCM radio and station web site traffic.

The current CCM phenomenon permeates church music practices of today, impacting and influencing young people in how they worship, what they sing and/or play in leading that worship, and how their musical sensibilities are formed. Songs used by church youth groups and churches around the world are, for Evangelical churches, generally taken from the body of works aired on Christian radio stations, and it is in these churches and youth group bands that prospective church worship leaders form their musical tastes. As Christian music has transformed through the years to more closely resemble popular music, the form and structure of the music has become almost a genre unto itself, with simple patterns and easy chord structures that make for a successful, energetic worship experience, and also offer the opportunity for quick transmission from artist to worldwide community.

Over the course of the last century, researchers have been seeking to expand critical thinking and study in music as it relates to other disciplines. Traditional musicology has been focused on three basic areas: historical studies, systematic approaches and ethnomusicology. Historical studies concern themselves with the essentials of a work such as the date and setting of the composition, the composer and various trends occurring at the time. Systematic studies are centred on models of theory such as compositional shifts and practices, and ethnomusicology explores the expansion of musical studies to include the cultures in which the music was produced. More recently there has been a shift toward the critical study of music, detailed by such authors as Henry Botha (2012) and Susan McClary (2000), bringing the techniques of music study on a level equal to that applied in other disciplines.

McClary (2000) cites the shift as starting in the mid 1980's, expanding systematic musicology to embrace research concepts from cognitive psychology, sociology and

philosophy, and aesthetics. Botha (2012) expands that to include critical ideas borrowed from literary theory and literature, as well as critical theory and social studies, terms popularized by Max Horkheimer in the late 1930s (Botha 2012, see also Eagleton 1996). A similar shift was occurring in biblical studies as theologians incorporated various forms of exegesis such as textual criticism, grammatical criticism, literary, form and redaction criticism into the discipline (Hayes & Holladay 1982).

In the area of psychoanalytic literary criticism, Terry Eagleton (1996) developed a four-phase process of critical exploration. Working from Eagleton's framework, Botha makes the case for incorporating similar structures into the work of musical criticism. Essentially, Eagleton's four areas were criticism that can attend to

- the author of the work,
- the work's content,
- the formal construction of the work, and
- the reader, or in the case of music, the audience (Eagleton 1996:155)

and, when applied to the critical study of music, expanded the depth and breadth of musical critique (Botha 2012).

A natural result of applying research techniques from other disciplines is the application of affordances to studies in music. The concept of affordances came out of studies in psychology and sensory perception, as related to structural design, by James Gibson, and is detailed in "The Senses Considered as Perceptual Systems" (1966) and his follow-up "The Ecological Approach to Visual Perception" (1979/1986). The idea of affordances, according to Gibson, centres on what we perceive to be the use of something, and not on the actual object, or by transference,

an event (ibid.). W. Luke Windsor and Christophe de Bezenac (2012) attempted to clarify the understanding by describing an affordance as a “property of an event or object, relative to an organism, which represents its potential for action” (Windsor & de Bezenac 2012:103). In his work, Joel Krueger (2014) developed that idea further, saying that affordances are action possibilities in an organism’s environment (or the environment of a perceiver) “that are specified relationally” (Krueger 2014:2). Krueger’s relationship of action possibilities carries two particular features: one, that considers the structural features of the environment and the things in it, and two, takes into account the various sensorimotor capacities of the perceiver for detecting and responding to the features presented (ibid.). In other words, as Windsor puts it, affordances are perceived through the pickup of structural information, and are available through any modality (Windsor & de Bezenac 2012). Windsor and de Bezenac and Krueger set up the use of affordances as applied to the study of music.

Before heading down the path of music and affordances, it may be helpful to consider two classic examples, stemming from Gibson’s work and referred to by Windsor, Krueger and others, to set up the discussion. First is the chair: an adult will look at a chair, see the angles, design, height, and other structural features, and determine that one can use the chair for sitting: the chair suggests, or affords, sitting. A toddler, on the other hand, may not have the sensorimotor capacity to think of the chair as a seat, but may instead crawl under it as a makeshift shelter, push it as a play toy or find any number of other uses without ever considering the idea of sitting in the chair. The shape of the chair suggests different action possibilities to various individuals.

The second example comes from the architectural design application of affordance and involves door handles. Generally, according to Don Norman (1988), when one

approaches a door in a commercial establishment, the door handle will appear to be longer one way than the other; usually a door handle positioned horizontally will be pushed to open the door, while a vertical handle will be pulled. That action of pushing or pulling the door handle is suggested by the design of the handle (Norman 1988). Both examples illustrate how a structural design affords (a certain perception of) the use of the object or environment.

Applying Gibson's theory of affordances to the critical study of music is a recent development, with Windsor and de Bezenac, as well as Krueger being three of the more prominent writers in the field of musical affordances. Windsor and de Bezenac take as their starting point the second of their two tenets, that affordances are available through any modality (Windsor & de Bezenac 2012). As they state it, there are specific links between the performance of a piece, its composition, and the reception by the viewer, and all of these are factors of structure and environment that act in a mutuality of perception and action: that affordances are not fixed, per se, but are imparted through the interaction of the musical piece (organism) and the audience (environment). Consequently, the same musical structure, or composition, or component of a composition, may elicit different, even opposite, responses from an audience based on the environment, based on the performance quality or based on any number of other variables (ibid.). Windsor and de Bezenac carry this a step further, citing studies by Tia DeNora (2000), John A. Sloboda and Susan A. O'Neil (2001), and Bruno Repp (1995) that suggest possible relationships between music and mood modification. They aver that "there is a commonplace view that musicking" can be used to stir emotions and bodies (Windsor & de Bezenac 2012:111).

Referencing Windsor and de Bezenac's 2012 work in the introduction to his thesis, Krueger makes the claim that music can be used in advancing behaviour as well, saying that a "sustained and responsive engagement in which the acoustic structure...draws listeners into a patterned response..." and has the capacity to influence the listener toward certain activities (Krueger 2014:3). This follows from his compilation of other researchers' materials that show the ability of music to promote action readiness in listeners. He specifically refers to the following actions and researchers: combat (Gittoes 2004; Protevi 2010), athletics (DeNora 1986/2011), erotic encounters (DeNora 1997/2011), dining out (Caldwell & Hibbert 1999) and studying (Rauscher et al 1993) (see Krueger 2014). The astute student of music history might point out that the modal system of music was used to stir emotional sensibilities as well, a Greek concept known as the Doctrine of Ethos.

Krueger developed his idea around the concept that musical affordances are used to draw the listener into an emotion-inducing response. Because the music has certain structural features, it can be determined to be "an event that unfolds dynamically and coherently" and that these features can be designed to evoke a fairly predictable interaction (Krueger 2014:4). The musical event, experienced over a specific amount of time, shapes the way we perceive and react or respond to the music, physically and emotionally. The music shapes our reactive behaviour (ibid.).

The area of music stimulation on physical and emotional aspects of humans constitutes a vast, wide-open area of research that exceeds the scope of this thesis. It is important, however, to venture briefly into the field, to stick a toe in the water, as it were, and introduce some of the ideas related to the current thesis. In developing their ideas, Windsor and de Bezenac borrow from psychological studies surrounding

the idea that actions are specified directly through patterns of stimulus information (Windsor & de Bezenac 2012). They suggest that as a perceiver is exposed to specific patterns of music, the perceiver is moved toward specific actions. DeNora (2000) asserts that music can provide a structure against which actions may be carried out and has done extensive research in specific areas, mentioned above, working to show just such effect.

Researchers George Stefano, Wei Zhu, Patrick Cadet, Elliott Salamon and Kirk Mantione (2004) have begun research in a more physiological area, using brain wave mapping as they look for chemical responses in the brain when specific music is played. Stefano et al has been able to demonstrate that through listening to particular music, subjects in the study showed a potential to have lower blood pressure levels (Stefano et al 2004), while Peter Keller and Sylvie Nozaraden (2015) have illustrated that through musical entrainment, brain activity (neural responses) can show a response to rhythmic patterns. Their work is an effort to show that an endogenous component may be used to incite a temporal prediction (Keller & Nozaraden 2015).

The idea of affordances stems from the development of a concept pioneered in the area of ecological psychology by James J. Gibson (1962, 1968, 1979/1986) and translated into the discipline of music more recently by Krueger (2011a, 2011b, 2014), David Temperley (2011, 2014), Temperley and Trevor de Clercq (2013), Windsor (2004), Windsor and de Bezenac (2012), David Huron (2006), Huron and Jonathon Berc (2009), Robert Gjerdingen (2009), and Douglas Scott (2009), to name a few. Mads Soegaard (2014) identified two differing approaches to affordances as put forth by Gibson in 1979 and Norman in 1988. According to Gibson, affordances are relative to action capabilities of an object; for Norman, the design of an object suggests

various possible uses, affordances are user-observable and based on both actual and perceived properties (Soegaard 2014). Recent researchers such as those just mentioned suggest that concerning the idea of affordances there is a stimulus-response compatibility, and affordances of an object invite a response to that object.

At least two theories of affordances have been put forth as incorporated into the field of musicology. One theory is to look at the more concrete or physical properties of music making, and how affordances impact compositional practices. In their study on musical idioms, Huron and Berec (2009) looked at instrument-specific affordances; they studied music written for trumpet by both players and non-players, comparing the technical difficulty of the pieces and relative playability. Gjerdingen suggests that there exist two orders of affordances, the second level being derivative of training in a particular style - for example, that compositions by Herbert Clarke lend themselves to a particular ease of playability not only because Clarke was a trumpeter for the John Philip Sousa band, but also because he wrote one of the major method books for trumpet study. Consequently, because students studied his method book, the compositions flowed easily from their fingers (Gjerdingen 2009).

Working at the Ohio State University research lab, Gary Yim (2011) used work by Trevor de Clercq and David Temperley (2011) in developing his theories regarding chord transitions and flow in popular guitar music. Yim looked specifically at chord progressions and related them to either functional harmony or affordant harmony but gave only a cursory nod to the idea that specific chord formations might in some way suggest using certain following chords. By his own confession, Yim's study did not focus his research on the use of power chords by guitarists (Yim 2011). Power chords are configured using three fingers (normally the index, ring and little fingers) and

sliding the hand up or down the fretboard to obtain different chords sounding the one, five, and one (octave higher) notes.

This area of chord formations or structures will serve as the first part of this research. It is the belief of this researcher that much of the music composed by Chris Tomlin is based around four chords that incorporate an anchored little finger and ring finger on the chord hand and can be easily performed by even the least accomplished guitarist. These chords are based on the open chord concept, which has been a staple of guitarist for decades (Petrucci 2012:[sp]). Open chords have been used by guitarists such as Alex Lifeson of the band Rush and Greg Lake of Emerson, Lake and Palmer fame (Lake 2009).

Paul Baloche made use of open chords in the key of E, anchoring the little and ring fingers to create the chord and moving that position up and down the fretboard (similar to the power chords mentioned earlier) in what he called train tracks. (Baloche & Swanson 2005b). According to Baloche, these simple chord structures, based on playing the standard formation of an E chord in first position and moving that chord up several frets to play an A chord and a B chord, allowed the guitarist the freedom to be creative, not tied down to looking at chords except to occasionally make sure one is in the right fret area.

In a second theoretical practice, scholars have explored the relationship of affordances and entrainment and how “musical affordances invite different forms of musical engagement” (Krueger 2014:1). Windsor and de Bezenac examine the integration of action and perception, and how actions are specified directly through patterns of stimulus information. They suggest a link between music and mood modification, citing the works by DeNora, Sloboda and O’Neil and others (Windsor & de Bezenac

2012). In his introductory comments, Krueger claimed that “we listen to music to elicit powerful feelings” (Krueger 2014:1) then expanded on that idea of action-readiness. For him, the musical affordances provide a path to tap into powerful emotions “by quite literally pulling these emotion-inducing responses out of us” (Krueger 2014.:7). In the thick of that, Windsor points out that affordances are not necessarily fixed, but are affected by the relationship between the organism and environment (Windsor 2012). Scott has similar concerns, at one point affirming that music alone cannot drive one to do one thing over another (Scott 2009). It is these types of discussions surrounding affordances that will inform the latter part of the research which looks at how some of the patterns may have gained prominence due to the ease of attainment, and the development of a simple idiomatic construct. This research is based on the idea that the aforementioned constructs are evident and represented in the music of popular artists from Christian worship music, most notably the music of Chris Tomlin. Citing Windsor’s relationship between organism and environment mentioned above, the genre of CCM provides a rich environment for the guitarist to make use of the affordances to be found in the guitar chord structures of Tomlin’s music.

1.3 METHODOLOGY

The focus for this research is the simple structure of chord fingering patterns as used in the music of Chris Tomlin, arguably the most successful singer/songwriter in today’s CCM market. The research will be a case study formulated around a corpus selection, and phenomenological analysis based on inductive surveys and interviews. Approaching the essential and most of the sub-questions will involve survey research based on corpus analysis along the lines of de Clercq and Temperley, while the latter

question will be approached from a phenomenological research perspective involving a survey and interviews designed to gauge perceptions of difficulty in performing specified chord changes.

The idea of identifying a specific artist or body of works for the purpose of research is not new (Temperley & de Clercq 2013); as a methodology, statistical corpus analysis dates back almost a century to researchers such as Helen Budge (1943). However, the idea of corpus analysis for music as a discipline is more recent, arising in conjunction with expanded theory analysis and music psychology (Huron 2006). In building his body of work, Temperley (2014) settled on a process of identifying specific music using prevailing charts and a music analysis software titled Humdrum Toolkit obtained from Ohio State University. His work launched from a Rolling Stone Magazine survey identifying top rock songs over several decades as determined by various well-known musicians and music experts. Yim (2011) began his research with the same body of songs identified by Temperley and de Clercq, then set up parameters to narrow his corpus to a manageable size.

For the purpose of this research, the initial list of songs comes from statistical records maintained by CCLI. The total number of songs that have some level of attribution to Tomlin numbers just over 360, but the number of songs that have made the top twenty-five over the last ten years is much smaller; this list provides the corpus for the case study.

Specific methods will be used in order to determine actual chord structures used by Tomlin. First, the CCLI companion site SongSelect provides charts, most based on the original versions as sung by the artist, and those charts use standard chord symbols that can be observed and evaluated. Additionally, most of the songs are readily

available in video format on YouTube, Vimeo, and other web-based video resources, and the analysis process will involve observing the fingering practice and the use of a capo as applied to each song.

The foundation of this research rests on the actual fingering analysis, for it is the idea that something can be readily played with chord fingering positions which promote movement to another chord that plays out in the discussion of affordances. Researchers generally lean on standard guitar chord structures for discussions about harmonic progressions or difficulty in performing various musical passages (Temperley & de Clercq 2013, Yim 2011). However, the position of this research is that the discussion should focus on the action possibilities found in the fingerings, and the changes that occur within those fingerings during chord changes are important in developing an idea of affordances in harmony. As stated earlier, Yim explored the idea of affordant harmony in popular, guitar-driven rock songs, comparing and contrasting the use of chord progressions in rock music against progressions in specific classical music. His study, however, did not focus on the fingering patterns, and he admittedly stayed clear of power chords.

When illustrating guitar chords, it has become popular to use a standard guitar chord chart formatted on a grid to indicate strings and frets on a guitar. The following example (Figure 1.3.1) from the London Guitar Academy illustrates a standard G major chord in first position as played on the guitar.

In this example, the horizontal lines indicate the frets of the guitar, with the top, thicker line being either the nut, or the fret closest to the nut, which is the end of the guitar where the tuning pegs are located. The vertical lines represent the different strings of the guitar, with standard



Figure 1.3.1
Standard G

tuning left to right (EADGBE). The solid circles with numbers below them show where fingers are placed, and the number, usually below the circle on a given vertical line, represents which finger is to be used in playing that chord. In the illustration, the 3rd finger, also known as the ring finger, is placed in the third fret space on the low E string, which sounds the G note. The 2nd, or middle finger is placed in the second fret space on the A string, sounding B. The next three strings are played without any fingers, or open, and the little finger, 4, provides the higher sounding G note (Figure 1.3.2).

This system of charting guitar chords is very useful for students learning how to play guitar, and for showing quickly and easily how chords are produced. However, there are a number of ways to finger different chords, and a variety of chord chart books are available to the beginner. Also, figure one demonstrates the standard beginning way to play one of the simplest G major chords in first position on the guitar, but there are a multitude of positions, inversions, and other variables in the execution of a G major chord.



Standard G Chord



Modified (Tomlin) G Chord

Figure 1.3.2 Standard vs. Tomlin G chords

In his work, Yim adopted a system for illustrating chords in writing that presented the chord in the line of the text; for example, the G major chord was 320003, reading left to right as being top string to bottom string on the guitar.¹ This method proved sufficient for his research but falls short of providing all the necessary information for this research; the fingering is a key component, and so must be displayed whenever possible. To accomplish this, the symbols for this research will include letters that indicate which finger is used. The standard fingering from classical guitar study provides useful and well-known way to differentiate which finger is used:



the first finger, or index finger, represented with an I

the second finger with an M for middle

the third finger, an R for ring, and

the fourth finger, an L for little.

Figure 1.3.3 Finger letters

Using this system, a standard G chord in first position is represented by the sequence 3R2M0003L. A quick analysis of video shots from live concert recordings featuring two of Tomlin's songs shows the use of a standard formation with a slight alteration. In these examples, the fingering for the G major chord is modified slightly by placing the little finger on the bottom string, third fret, and using the Ring finger on the second from bottom string, also third fret (see Figure 1.3.2). The resulting modified G major chord structure is 3M2I003R3L, and when played without a capo in first position the notes that sound are G, B, D, G, D, G. This process of identifying the chords not only

¹Guitar-speak can be confusing on this matter. On the guitar, the "top" string, or highest in physical position, sounds the lowest "E" possible; the "bottom" string is the "E" that sounds higher. So, when one plays "down" the strings, he or she is actually playing "up" in pitch.

in terms of harmonic function or Roman Numeral analysis, but the actual fingering patterns used, will play a significant role in the research of Tomlin's music, and the video performances will be analysed visually in order to determine, as far as possible, whether the fingerings are consistent across the different songs.

Once these songs have been analysed, the resulting information will be used to determine the frequency with which certain chord structures are utilised. Based on initial observations, the chord structures seem to be consistent, even though the songs are performed in different keys. This is achieved by the use of a capo², which acts as a movable nut on the guitar fretboard, so that the same chord fingerings can be used regardless of the key. It is the belief of this researcher that as many as 80% of the chords used in the music of Chris Tomlin fall into one of four basic chord fingering structures, promoting the use of these particularly affordant chords, and the research will seek to provide the answer to that question.

The research previously outlined will look at the aspect of affordances in a physical sense: that specific chord structures afford the use of other, closely related chord structures on a frequent basis. The second portion of the research will venture into the phenomenological aspect of affordances, seeking to determine if there may be specific chord patterns that are used due to the affordances of the structures. In building the interpretive phenomenological analysis that propels us to an answer, the study will

² The use of a capo, a small clamp-like device that fits over the neck, fretboard and strings of the guitar, effectively moves the 'nut' of the guitar to that fret where the capo is placed, shortening the effective length of the string and raising the pitch of the guitar strings. Doing this allows the chord fingerings to remain the same as fingerings used in first position but playing the chords at a higher pitch. Guitar purists might prefer using barre chords, which have essentially the same effect of moving the nut of the guitar and shortening the string, but then the fingerings would have to be switched, or reconfigured, to accommodate the different use of the index finger, which is typically the finger used as the barre in the barre chord.

include interviews, surveys, and observations, as well as a brief look at related research.

Ground-breaking work in the relationship of musical affordances to a specific instrument was done by Huron and Berec (2009) in their work featuring the trumpet. For their research, they identified a number of specific parameters related to playing the trumpet, factors like fingering, tonguing, embouchure, dynamic shading and tone quality, and narrowed the research to six specific points for data collection. After assigning a rubric of difficulty-rating for each point, they had two individuals, a seasoned trumpet performer and a novice, rate each point in terms of difficulty. Using a Pearson's coefficient of correlation model, they assigned a rating to each of the factors (Huron & Berec 2009).

This study will follow a similar path, first identifying a set of difficulty parameters, then developing a rubric for assessing the degree of difficulty for each parameter. The parameters will then be evaluated by two participants, a guitar professor and guitar student, and their results will be correlated in arriving at a survey instrument. In the second phase of their work, Huron and Berec measured the performance difficulty in some of the standard trumpet repertoire, moving into comparisons such as transposition idiomaticism and tempo idiomaticism. This study will not go in that direction, but rather move into the use of interviews regarding comparisons of the ease of using progressions as structured by Tomlin versus progressions structured by selected artists in the field of contemporary Christian music who primarily use standard chord structures. Results of the interviews will be constructed in a conditional/consequential matrix (Corbin & Strauss 1996) illustrating the perceived

degree of difficulty for the selected pieces relative to the chord structures used in the composition of those pieces.

The primary subject of interview will be the composer, Chris Tomlin. Questions will be formulated that explore his use of specific chords, his musical and worship-leading background, and then move into song writing techniques and motivations. Additional information will be gleaned from the numerous articles about Tomlin, many of which include personal quotations. Secondary interviews will be done with contemporaries of Tomlin, similar in musical content, to provide a backdrop for analysing his music.

In the exploration of the subject for this research, it has been difficult to come up with musicological information on the topic as it relates specifically to Christian contemporary music. Most of the research has gravitated toward theological discussion, and the idea of viewing Tomlin's music, or any CCM for that matter, from either a musicological or psychological perspective seems to be somewhat suspect. Nevertheless, it is not the intent of this research to proscribe theological meaning to the process or results. Neither is it in the scope of this paper to explore the myriad of text variances or text-tune relationships. Tomlin's music has already proven successful in the marketplace, so that is not in question. This research does seek, however, to determine if there may be affordances representing music psychology principles at work that may point to reasons for its success. In his commentary on the piece by Huron and Berc, Gjerdingen (2009) referenced Norman's (1988) contention that some objects rather have perceived affordances or that they permit affordances, and it is very likely this research may show that certain chord structures permit affordances more so than other standard chord structures.

CHAPTER 2 FRAMEWORK AND LITERATURE SURVEY

2.1 INTRODUCTION

In the first chapter I referenced Richard Sorce's (1995) recognition of what he called the Theory Gap and listed some current music theory educators who are working to help young musicians understand the intricacies of music theory and analysis in the world of popular music. Learning these simple musical tasks is fundamental in helping the elementary guitar player make progress on his or her instrument. For the guitarist who is striving to be a worship leader in the local church setting, having a working knowledge of the language of music theory allows for efficient communication with other musicians. In both cases, having a toolkit of chords that are simple to execute allows for the offloading of that action from the mind to the fingers and frees up thinking space for the guitarist (Snyder 2000, see also Kahneman 2011). The study of actions such as the performance of guitar chords and transitions between chords leads to the realm of action sciences (Gibson 1962, 1968, Norman 1988, Greeno 1994, Haselager et al 2008, Chemero 2003, 2009, 2013, see also Doby 2019) and is foundational in organising what is known about perception and cognition, wherein perception is for, or leads to, specific action (Chemero 2009). Affordances in the context of action sciences is illustrated fittingly in how the student guitarist learns the physical structures of guitar chords, as well as how he or she³ transitions from one chord structure to another.

³ With the understanding that guitar players come from all walks of life and every known and unknown gender, when referring to the guitar player for the remainder of this thesis, the pronouns 'he' and 'she' will be used to represent all guitarists.

From Aristotle's framework of causality featuring four possible causes for why we do the things we do (Hutchins 1952, Heft 1989/2007, 2003, Stacey et al 2000, Falcon 2019), to contemporary studies of Embodied Embedded Cognition (EEC) and 4E Cognitive Science (Chemero 2009, Rowlands 2010, Withagen et al 2012), scholarly debate has centred on the relationship between the mind and its environment. On one side of the debate there is the idea that all perception and cognition takes place within the confines of our minds, generally accomplished through the building of representations based on our perceptions and memories (Marr 1982, Heft 1989/2007, Hurley 1998). On the other side, it is believed that cognition is a direct process which involves complex interactions between the cognising agent and the environment in which it is situated (Gibson 1979/1986, Greeno 1994, Heft 1989/2007, Chemero 2003, 2009, Rowlands 2010, Withagen et al 2012). The process of playing guitar chords involves coordination between the mind and the hand usually coupled with visual and haptic input, with the performer working to produce quality sound from the guitar. The guitarist striving for proficiency in the chord performance may be considered as working within a complete, situated environment.

This chapter lays out a brief introduction of the fundamentals and developments in cognition science and affordances, encased in a discussion of the overarching framework for this study. After the framework is established, this chapter will review literature from work related to cognition sciences, as well as work encompassing music as related to cognition and affordances and conclude with a survey of current literature related to guitar chord mapping.

2.2 THEORETICAL FRAMEWORK

Early cognitive scientists such as Kurt Koffka, Max Wertheimer, and Wolfgang Kohler, who worked from a Gestalt framework (Harrower-Erickson 1942), understood that our brains are capable of filling in gaps, categorizing items, deciphering code, and completing tasks, such as compiling and reorganising memories, that comprise perception and cognition. These tasks have been shown to be part of an ever-developing functional relationship between an organism and its world, or Umwelt (von Uexküll 1934/2010, Reybrouck 2001).

Combining the relationships of the environment and organism with the introduction of ecological psychology and the notion of affordances (Gibson 1962, 1968, 1979/1986, Norman 1988), interest arose around attempting to couple the cognitive processes of the brain with information available in the environment, which eventually opened the gateway to 4E cognition (Rowlands 2010). While the brain is essential to the cognition process and acts as the owner of cognition (ibid.), EEC and 4E Cognition recognize that some cognitive features are dependent on factors outside the brain: embodied cognition, wherein people rely on features of their bodies to enable cognition (Clark & Chalmers 1998, Clark 1999, Chemero 2009); embedded cognition, in which people use specific aspects of the environment to achieve cognition (Clark 2001, Malinin 2016); enacted cognition, which happens as people interface and interact with the environment (Rowlands 2010); and extended cognition, which relies on processes that are not necessarily recognized as part of the internal structure of the brain (ibid.).

Various researchers have endeavoured to connect the study and understanding of affordances to different musical processes (Reybrouck 2001, 2005, 2012, Temperley

2011, 2014, Krueger 2011a, 2011b, 2014, Yim 2011, Duby 2013, 2019, 2020, Windsor & de Bezenac 2012, Huron & Berc 2009). This broadening of the scope and interpretation of affordances beyond the optic array (Gibson 1979/1986, Norman 1988) embraces areas such as the sonic environment (Reybrouck 2001, 2005, 2012, 2015, Krueger 2011a, 2011b, 2014), idiomatic musical structures (Windsor & de Bezenac 2012, Huron & Berc 2009), power and movement (Duby 2013, 2020) and harmonic concepts (Yim 2011) to name a few. More recently there have been calls to hone in on specific ideas of affordances, most notably linking them to motor action possibilities (Menin & Schiavio 2012). In the realm of literature about musical affordances, much has been written regarding embodied cognition and affordances of music specifically directed toward the sonic environment (Krueger 2011, 2014, Reybrouck 2015). However, the other three E's of 4E cognition have been, for the most part, ignored; for example, very little can be found that addresses the area of embedded cognition and how affordances might operate in that musical framework.

This research centres on certain physical chord structures commonly used by guitarists while playing the music of artist Chris Tomlin and seeks to connect these chord structures with 4E cognition and, more specifically, affordances within those structures that are evidenced in the embedded cognition thesis. These chord structures offer features of the guitar player's environment that promote quick learning and easy facilitation for sounding the chords. Worship leaders who play guitar and guitarists who play in worship bands operate in a very specific niche, a bubble of experience that can assimilate the Tomlin chord structures and appropriate, or accommodate, them into the worship-leading Umwelt; the presence of affordances in these chord structures makes them more compatible with the action capabilities of the guitarist.

Novice guitarists can use these chord structures to enable quick learning because the chord structures require minimal shifting of fingers and those shifts that do happen can be accomplished with very little movement. Worship leaders can offload the thinking processes usually associated with chord changes (Snyder 2000, Kahneman 2011), thereby freeing their attention to focus on engaging the congregation in the activities of worship. This offloading is possible because mental operations such as the transition of chords are "not confined to processes occurring in the brains of cognising organisms" but can extend to include external information in the environment or the organism's world. (Rowlands 2010:25).

2.2.1 Causality

Although not the first to address matters concerning how things are, or how things come into being, Aristotle (384-322 BCE) provided one of the earliest articulations on the causes of things (Stacey et al 2000, Hutchins 1952, Heft 1989/2007, Falcon 2019). Writing in *Physics*, he stated that "Knowledge is the object of our inquiry, and men do not think they know a thing till they have grasped the 'why' of it (which is to grasp its primary cause)" (Hutchins 1952:271). This early concept of cognition shaped the sciences for centuries following Aristotle's death; his idea was that "where a series has a completion, all the preceding steps are for the sake of that..." (ibid.: 276).

The Renaissance Era brought on new ways of thinking about perception and cognition, with René Descartes (1596-1650) as one of the leaders in rethinking cognition. Descartes put forth that cognitive processes all take place within the confines of our brain, beginning with perception stimulation and ending with an action or output (Marr 1982, Heft 1989/2007, Hurley 1998, Rowlands 2010). Descartes' views on the mind, how it worked, whether it took up space or not, came to be known

as dualism (Rowlands 2010), and shaped many of the early modern scientific explanations of perception. This dualistic, causal framework understood the perceiving organism, or animal, and the environment to be two distinct entities acting apart from each other (animal/environment), and early cognition theory ascribed the work of cognition to actions and processes that happen exclusively within the animal's brain, demonstrated using David Marr's Vertical Sandwich model (Figure 2.2.1) with respect to visual perception (Marr 1982).

2.2.2 The Vertical Sandwich Model and computational representations

Generally, the term computational representations has been used to describe that output of information which guides cognition for those who understand cognition to happen entirely within the head of the organism, and who believe that mental processes are identical with, or exclusively realised by, brain processes (Rowlands 2010). The sense of visual perception provides a helpful illustration; according to dualism or computational representations, light bouncing off an object in the environment strikes the retina (sensory perception), goes through a process of manipulations, and the brain identifies the object, whatever that may be (action output). The Vertical Sandwich Model (Marr 1982, Hurley 1998, Rowlands 2010) identifies the sensation of the retina receiving the light as the input, the final action of labelling or naming as the output, and the information-processing operations that take place between input and output as cognition. Perception is the result, and the Vertical Sandwich Model puts that perception as the lettuce of the sandwich, according to Cartesian cognition (Rowlands 2010:37)⁴.

⁴ Justin Skirry has provided a delightful and informative synopsis on Descartes' "Causal Adequacy Principle" for the Internet Encyclopedia of Philosophy, found at <https://www.iep.utm.edu/descarte/#SH5a>

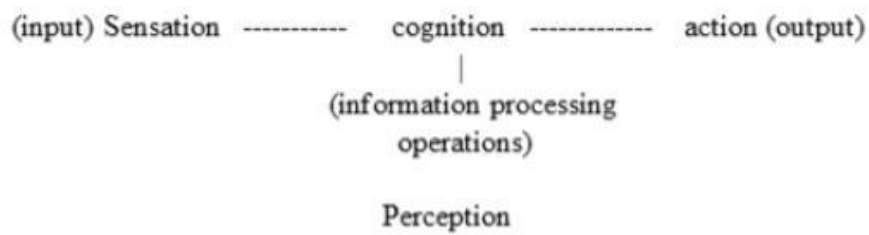


Figure 2.2.1 Marr's Vertical Sandwich Model

The workings between animal, or organism, or individual, and environment were seen to be mechanistic in that the environment impinged on the individual, thereby providing a perception stimulus (Heft 1989/2007, Withagen et al 2012). For much of early cognition science this mechanistic causality ('what is it doing?') held sway, along with the idea that the action of cognition was something that happened in the mind (Withagen et al 2012, Heft 1989/2007, Chemero 2009, Rowlands 2010).

2.2.3 Gibson, ecological psychology, and affordances

Writing on the subject of haptics, Gibson explored ways in which the hand and fingers serve as touch-sensory organs, resulting in the idea of active touch, which consists of the flow of stimulation to the brain which is both exterospecific and propriospecific⁵. The "purpose of the exploratory movements of the hand is to isolate and enhance the component of stimulation which specifies the shape and other characteristics of the object being touched." (Gibson 1962:478) This exploration of the hand is done with a purpose in mind, which is to register information, whether that refers to rigidity or stability (Gibson 1962), or even to determine the shape or nature of the object (Rowlands 2010). The combination of the processes taking place in the brain and the

⁵ Gibson expanded the understanding of these two terms in unpublished manuscripts titled "Purple Perils" and hosted online by the International Society for Ecological Psychology. Exterospecific refers to information that is about objects, places and/or events, while information about relations of one's personal body parts is propriospecific.

action processes implicit in interactions with the environment (active touch) are one of the ideas that laid the foundation for ecological psychology and the introduction of affordances.

Building on Gestalt studies and his work in haptics, Gibson introduced an understanding of the optic array that helped explain cognition processes as comprising more than just an event happening in the mind of the cognising organism. Mark Rowlands incorporated Gibson's optic array explanation as part of his preliminary staging for 4E Cognition - essentially, the optic array is comprised of that pattern of light that reaches the eye, thereby stimulating a perception response in the perceiving organism (Rowlands 2010); in this first step, the optic array is similar to the input of the Vertical Sandwich Model. All the information necessary for recognizing a given object is contained in this array and it is through the differing spatial intensity of the light waves, as well as the mixtures of the wavelengths, that the organism is able to distinguish the stimulus; as Rowlands puts it, the optic array is "external information becoming structure" (ibid.:35).

By merely having the observer shift positions, the nature of the light reaching the retina changes and the wavelengths are mixed differently and with various intensity, thereby changing the optic array. In this model, the optic array is specific to the environment, which is, as Gibson would say, its niche (1979/1986). The idea of the niche corresponds with the functional relationship identified by the concept of Umwelt, which is a growing, changing relationship between the organism and its world (von Uexküll 1934/2010, Reybrouck 2001).

2.2.4 Direct perceptions and affordances

Launching from his work with haptics and the optic array, Gibson argued that cognition does not take place entirely in the mind, but that perception is a direct process (Gibson 1979/1986, Chemero 2009, Rowlands 2010). Instead of relying on memories, which could be indistinct or incomplete, cognition is non-inferential, not coming from the result of a guess based on those possibly fuzzy memories already present in the cognising agent's mind. Also, cognition is non-computational, because although the initial impulses going to the brain are incorruptible, the follow-up processes contain the potential for fallibility. A strictly computational process starting with an incorruptible impulse might construct a primal sketch that could potentially be inaccurate. The model built on the basis of the primal sketch using information already present in the mind, the 2½ D sketch or 3D object representation, has potential to be flawed (Marr 1982). Instead, perception calls on information that is present in the environment (Chemero 2009) and that information contains meaning for the cognising organism (Chemero 2003, Withagen et al 2012); that is, information which is obtained through active exploration of the organism's environment, be that through haptics, through optics, or audiation, smell or taste. Perception, then, is active, and is for the guidance of actions (Gibson 1979/1986, Greeno 1994, Fuster 2004, Chemero 2009, Withagen et al 2012).

Gibson's perspectives on perception and cognition, including direct perception and the interaction of the environment and organism, resulted in the conclusion that what is perceived is affordances (Gibson, 1979/1986, Reybrouck 2001, Chemero 2009, 2013). "The affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill." (Gibson 1979/1986:127); "whatever it

is about the environment that contributes to the kind of interaction that occurs” (Greeno 1994:338). The interaction between the environment and the organism is an active, growing process allowing the organism to adapt to the environment. This ongoing development of the organism allows for increased actions shaped and formed by the environment through the affordances, a process described as the action-perception cycle (Fuster 2004).

Affordances either exist as action capabilities or they are not affordances (Soegaard 2014), and they are found in the context of an open, or living, system. Within that system, the affordances offer information that can be used by the animal in the interpretation of the cognition (Heft 1989/2007). This interaction, the direct process, has been noted to create an interdependency, an agency between the animal and the environment (Gibson 1979/1986, Heft 1989/2007, Greeno 1994, Withagen et al 2012) and in a sense echoes the concept of the organism’s Umwelt, in which there is a functional relationship that grows as the organism interacts with its environment in ways that are both familiar to it (assimilation) and in ways that make it grow and expand (accommodation or adaptation). The ideas of the Umwelt and agency both look back to Gibson’s idea of the niche and point forward toward physically situated cognition, a fundamental element of Radical Embodied Cognitive Science (Chemero 2003, 2009), Embodied Embedded Cognition (Chemero 2013, Van Dijk 2009) and 4E Cognition (Rowlands 2010).

Withagen et al (2012) built upon Gibson’s ideas regarding agency, claiming that “to improve an affordance is to make the environment more compatible with the action capabilities of the human body...” (Withagen et al 2012:253). The role of the direct representation is to act as an information-laden vehicle which has the potential for

guiding action. Using this as a guide, affordances took on specific roles in fields such as architecture (Norman 1988) and human-computer interaction (Borchers 2010, Keereepart 2018), that is, Norman's office building door handles dictating a pulling action or a pushing action (Norman 1988) and Keereepart's TED⁶ app button virtually screaming "push me!" (Keereepart 2018). In these cases, the mind of the cognising organism draws upon features (affordances) "that extend into the organism's body, and even into the organism's world" (Rowlands 2010:25). This understanding of agency and the improved compatibility of action capabilities as related to the affordances of an environment form the nucleus of this study, which seeks to show that there are certain structures used in creating chords that are an improvement of affordances in those structures, making them "more compatible with the action capabilities..." (Withagen et al 2012:253) of the guitarist, and these affordances are embedded in the actual chord structures, not in the guitarist's mind.

2.2.5 Current strands of cognition science

One of the big shifts in cognitive sciences and our understanding of how we know things is the move away from computational representations toward the development of direct representations, and the wide fields of study resulting from that shift. Alongside cognition science, the field of neurological studies has resulted in advances that confirm much of what is now understood about how we know things (Haselager et al 2008, Menin & Schiavio 2012). Studies in canonical neurons, for example, indicate that certain 'visuo-motor' neurons are triggered upon seeing an object that has action possibilities, and are discharged when the subject takes that action. These

⁶ TED, which stands for Technology, Education, and Design, produces, records, and distributes talks and discussions via videos posted to its website, and Keereepart was responsible for the software team that developed the application specifically used for mobile devices such as iPhones and iPads.

neurons are discharged, for example, when a subject grasps the handle of a cup. Interestingly, research shows that the same neurons are triggered *simply by seeing* the cup, without *actually taking* the action (italics mine). This research supports studies surrounding the codification of affordances and demonstrates that “cognition can be seen as embodied, namely, it arises from the bodily interactions with the environment...” (Menin & Schiavio 2012:203). Damiano Menin and Andrea Schiavio were setting boundaries for what qualifies as affordances, specifically dealing with affordances in the arena of musicology.

2.2.6 Radical Embodied Cognitive Science

As early as 1998 the connections were being made that cognition might be aided by the environment surrounding the cognising agent (Clark & Chalmers 1998), and that it could be physically situated (Chemero 2003, 2009, Rowlands 2010). This constituted an awareness of the relations between certain “aspects of animals and particular aspects of situations” (Chemero 2003:184). For embodied cognitive science, the direct representations are considered to be action-oriented (Clark & Chalmers 1998) and are situated in a specific spatial locality or environment. An example can be found in the sensory perception of audio signals and the placement of the human ears on either side of the head. If the representations were to be computational, resulting from processes taking place inside the mind, then determining a location for the source of the sound would be impossible. However, because there are two ears that serve as receptors to the sound, the sound waves striking the ears at different times due to the distance between the receptors provide clues, or affordances, that are useful in determining the directional source of the sound (Chemero 2009).

Embodiment⁷ as related to music looks to the situatedness of musical affordances as being rooted in the action-understanding processes (Menin & Schiavio 2012), or as an interaction between the body, the brain and the world (Schiavio et al 2017). The structure of the modern guitar, with a fretboard and six strings specifically tuned, provides the basis for an environment in which the guitarist functions, and chord structures and musical passage fingerings have been studied and mapped by many scholars (Sayegh 1989, Heijink & Meulenbroek 2002, Radicioni & Lombardo 2005b).

2.2.7 Embodied Embedded Cognition (EEC)

Embodied cognition recognises the importance of the structural features of the body and how those structures affect interaction with the environment; embedded cognition considers the specificity presented by particular environments in which the organism is active. “According to Embodied Embedded Cognition, the physical structure of the body, the physical and social structure of the world, and the internal milieu of the organism’s body, all provide important constraints that govern behavioural interactions” (Haselager et al 2008:275). In EEC the environment shapes the experience of the cognising organism (Reybrouck 2012), and the structure of the environment contains certain action possibilities (Haselager et al 2008). The design features present in the body of the organism, acting in the specific environment, offer constraints and potentially limit action possibility options available to the organism (ibid.). As the body interacts with its environment, it takes advantage of the affordances and opportunities presented, and builds a bank of memories about this environment which serve to inform the brain about future potential actions (von Uexküll 1934/2010, Reybrouck 2001, Fuster 2004). This memory-building process

⁷ The different E’s of cognition will be unpacked more thoroughly in the literature review. This section attempts to set the ideas within the theoretical framework of the research study.

can include information from affordances already existing in the environment and can also be derived from “smart manipulations...to create manufactured external objects that offer new affordances” (Magnani & Bardone 2010:236).

For the EEC scientist, this situatedness of the organism is the embedded idea (Haselager et al 2008). The body of the cognising agent offers one set of constraints while the environment adds its own set of constraints and possibilities. The object is immersed in a particular environment that offers those constraints; to change the environment creates a different set of constraints and possibilities (ibid.). An example of this from the musical world is Huron and Berc, who used the language of idiomatic characteristics to describe properties of musical instruments and how those properties suggest certain modes of interaction or encourage certain musical functions (Huron & Berc 2009). Those properties, or instrument capabilities, can be viewed as opportunities (ibid.) and are specific to particular motor capabilities arising from the bodily interactions with the instrumental environment (Menin & Schiavio 2012). For Huron and Berc, the instrument is the trumpet, and certain properties of the trumpet allow for the performance of particular musical characteristics specific to the trumpet. One example cited was the passage from the popular tune ‘Sleigh Ride’ in which the trumpet player performs the sound of a horse neighing. This passage is assigned to the trumpet because of the idiomatic characteristics (Huron & Berc 2009), or affordances (Windsor & de Bezenac 2012), combined with the experience of the player (Gjerdingen 2009).

For the purpose of this study, the cognising agent is the guitarist; the body offering its constraints is the hand and fingers of the guitarist, and the environment surrounding the fretboard and strings offer another set of constraints and possibilities. The hand

and fingers of the guitarist operate in the environment of the fretboard, and this study looks specifically at chords in the first position on the fretboard.

2.2.8 4E Cognition

Rowlands took the 'E' motif two steps further, adding 'extended' and 'enacted' cognition to the mix. As with embodied and embedded cognition processes, the elements of extendedness and enactedness act in relation to the function in the brain, embellishing on how the brain interacts with the environment, and vice versa (Rowlands 2010). 4E cognition science recognises that a portion of the process of cognition is constituted by "wider bodily structures and processes" (ibid.:3) and involves offloading part of the process to elements in the environment.

The 4E concept of embeddedness expands slightly on the EEC version in that for Rowlands, cognition is embedded in the interaction between the object and the environment; the organism (guitarist) takes advantage of certain structures in the environment (chord structures), couples these structures with memories, other experiences, and tacit knowledge (Fuster 2004, Magnini & Bardone 2010) and this coupling essentially reduces the amount of processing required by the organism (Magnini & Bardone 2010). This is the point at which the possibility exists that certain guitar chord structures contribute to the reduction of cognitive processing that the guitarist must perform in order to transition from one chord structure to another. Embedded cognitive processes are dependent on the environmental structure and are designed to function in tandem with those structures (ibid.) Guitarists, playing the music of Tomlin with the chords that he has embedded into the songs, work within the framework of those chord structures. Because of this embeddedness, those chord

structures, constituting the guitarist's environment, offer easy, quick and efficient opportunities for the changes from one chord to another.

The foundation for 4E cognition rests on the idea that our cognitive processes are not simply representations that happen in the context of our mind, but accounts of interactions between organism(s) and environment(s). At its fullest, it is represented by what Rowlands labelled enacted cognition. His theory of enacted cognition recognizes that processes are not limited to the synapses in the organism's brain, but include the organism's actions, whether in response to, in tandem with, or because of the environment surrounding the organism. Enacted cognition incorporates the interactions that take place in the environment into the recognition process so that as the organism acts in the world, the world responds back to the organism with feedback (Norman's feedback loop, von Uexküll's functional relationship of Umwelt), and the organism assimilates that response into its cognition process.

As a result of these interactions and the development and growth happening within the organism, the organism uses those experiences to fill in future perception. For Rowlands, because we have seen a tomato in our previous experience, and we have possibly moved around the tomato so as to see it from different angles and have those images in our brains, when we next see a tomato, we have a reasonable expectation of what that tomato might consist of, and that it is most likely to be round (recall Gibson's optic array). This understanding combines the concept of neural interaction with environmental experience, resulting in enacted cognition.

2.2.9 Framing the study

It is helpful to understand that the action of a guitarist forming guitar chords is a haptic cognitive process, as well as visual and auditory, in which the guitarist visualizes the

placement of his fingers, moves the fingers to sense the appropriate position, and confirms the correctness of the chord structure and placement through audiation. Although Gibson initially applied his findings to haptics, early research in affordances mainly has stayed in the realm of visual perception (Gibson, interested in the optical array and how our mind sees the environment; Norman, focused on affordances in design theory and how seeing things opened (or closed) doors of understanding) and it is only recently that affordance theory has moved into other sensory processes. This research considers the sensory stimulation of touch, or haptics, and the many ways in which our minds (and bodies) make use of the cognitive processes associated with touch and feeling.

The structure of a guitar chord carries a certain amount of information. For example, a standard C chord in first position has the information embedded in it to convey a sound that has the quality of being a C major chord, with the sounding notes C4, E4, G5, C5, E5. The beginning guitar student will learn to place each finger in the appropriate position, press with a certain amount of pressure, strum the chord, and hopefully enjoy the sound. As the pupil progresses, the chord structure becomes memorized, and this memorization allows a conveyance of information without so much cognitive processing. The information, then, is present in this environment of guitar chording, or to borrow from Rowlands, “external structures carry information relevant to the accomplishing of a given cognitive task. This information is present in these structures” (Rowlands

2010:18). Fingering for this standard C chord uses the basic X3R2M01I0, and is represented in a chord chart as in Figure 2.2.2.



Figure 2.2.2
Standard C

Carrying this discussion a bit further, the possibility of affordances in guitar structures/environments comes in the different ways that the chords are structured. In the first chapter I referred to them briefly (section 1.2, p 22), and at a later juncture I will describe the chord structures of Baloché's railroad tracks, a form of chording that he uses in much of the guitar work he does with his music. The idea of railroad tracks bears similarity to our case study composer, Chris Tomlin, who also has specific chord structures that are easily learned and quickly memorized. In both these cases, information about the chords and chord changes is offloaded from the guitar player to the chord structures, much like learning the knots for the Kvinu (more in section 2.3.11, p. 73). And in Tomlin's case, this offloading is enhanced by learning a specific set of four chord structures, then inserting a capo into the equation to greatly expand the breadth of sounds available without additional memorization.

This process is somewhat reminiscent of my experience as a young guitarist, in which a fellow student led me on a mind-opening, guitar-picking, cognition journey. Despite not being a musician but a star fullback on our high school American football team, Scott showed me the wonders of using barre chords, and how the structures within the barre chord extended the first position chords I had previously learned. This 15-minute discussion on a boat at a party opened up a whole new world of possibilities in my guitar playing and exponentially expanded the chords that I could play. Without Scott, I would have probably reached that understanding eventually, slowly, but he gave me the information and incentive I needed to grow my guitar abilities in the scope of that 15-minute discussion, rather than over the course of months, possibly years.

Considering the nature of affordances in the guitar chord structures, we can go to the discussion regarding off-loading of guitar structures by Tomlin and Baloché, placing the burden of the process on the structures themselves. The supposition is that, due to the affordances present in the way chord formations are structured, chord shifting can be, in a sense, offloaded to intuitive and simpler, faster thinking processes, freeing up the mind to focus on other aspects of performance, or audience engagement, or lyric memory or any number of functions.

The purpose of this research is to demonstrate the perception that the offloading process of guitar chord structures and affordances is a function of embedded cognition. In embedded cognition theory, mental processes taking place within the cognising organism function conjunctively with a specific environment that is not part of the brain of the subject (Rowlands 2012). Two ideas drive the embedded process; the first sets up perceptions and cognitive processes as dependent on the environmental structures in which they occur, and the second recognizes a specific role for the cognitive process.

The first idea of the embedded cognitive process relies on what Rowland refers to as functionalism (Rowlands 2010, also Menin & Schiavo 2012, Ryan & Schiavo 2019); the cognitive processes rely on specific environmental structures and cannot function without the presence of these structures. In fact, processes are “designed to function in tandem with those structures” (Rowlands 2012:68). As an example, consider which chord changes Tomlin plays. These chord changes presume the structure as designed by Tomlin, and they work within that framework, but not outside that framework. To be more precise, playing a G chord in first position with standard fingering, then shifting to either a C chord or D chord in first position with Tomlin fingerings is

possible (Figure 2.2.3). However, in both instances three of the fingers are required to move, rather than having certain fingers planted on the fingerboard. Playing the Tomlin format for G with the Tomlin format for either C or D, two fingers are anchored throughout the change, and only two fingers make minor shifts to create the chords.

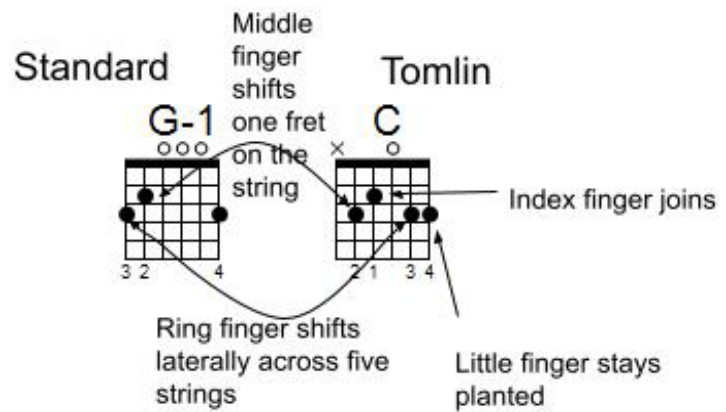


Figure 2.2.3 Standard G to Tomlin C shift

“In accomplishing cognitive tasks, an organism can *utilize* structures in its environment in such a way that the amount of internal processing it must perform is reduced” (emphasis mine) (Rowlands 2012: 69). This is known as environmental embedding, which can be described as offloading the tasks from the organism to the structures (ibid.), a hallmark of the second idea of the embedded cognition theory. Going back to the Tomlin chords, the reduction of motion required to make the changes represents offloading of motion processes from the organism (guitar player) to the environment (interaction between fingers and fretboard).

Such offloading, it is my contention, results in several advantages to the guitarist. First and foremost, the time spent learning to play specific chords is reduced, as less activity is required, and fewer fingers are deployed. A second advantage for the guitarist is that he can focus attention elsewhere once the guitar chords and changes are learned. Two of the fingers are anchored so that the guitarist is not required to use cognitive

energy to determine where the fingers need to be; lateral motion on the fretboard is at a minimum so that the hand can maintain a relatively stationary position. A third advantage to the guitarist is that the process of changing keys is relegated to simply moving a capo up or down the neck of the guitar to a different fret, while chords are fingered the same way. There is no need to learn new chord structures, just move the capo. In short, the Tomlin chords provide guitarists a way to learn to play the guitar quickly in a way that allows them to concentrate less on the playing of the guitar, and more on auxiliary tasks, such as singing or speaking directions to a congregation or audience.

2.2.10 Restating the research in the language of cognition and affordances

In a nutshell, there are certain guitar chord structures which can be used that present a greater opportunity for the guitarist to offload the thought process onto the structure, freeing the mind for other interactions. From dropping the pitch of a certain string down so as to sound a pitch lower than normal, thereby adding the sonic element of a constant bass note (Greg Lake of the band Emerson, Lake and Palmer), to using a modified chord structure moving up and down the fretboard of the guitar (Paul Baloche of early CCM), to anchoring two fingers and moving two other fingers in parallel motion (Chris Tomlin of later CCM), players have found innovative ways to structure their chords so as to allow concentration on other aspects of performance while maintaining the flow of chord changes. The chord structures used by Tomlin have certain affordances that align with embedded cognition theory, and when the guitar player uses these structures, there is an ease of movement from chord to chord that works within the Umwelt of the guitarist and makes the movement more compatible with the action possibilities of the performer.

These chord structures, championed and almost universal in the guitar playing of Tomlin, provide for a perception-action sequence that allows for quick learning by the novice guitarist, as well as the previously mentioned off-loading of chord changes by worship leaders and other performers. Taken individually, the chord structures are simple to construct, but so are the standard chord structures. It is in the actual movement from one chord structure to another that the affordances come into action, and these affordances suggest a clear and easy path from one chord to another chord. In this movement, this action, the affordances which are embedded in the structures show themselves in ways that are advantageous to the novice and the worship-leading guitarist.

2.3 LITERATURE SURVEY

Traditional musicology has generally focused on three basic areas of study: 1) the historical settings of composers and compositions and the societal trends and influences of the specific time periods; 2) systematic approaches to the art of composition, such as compositional practices and shifts that have occurred within those practices, as well as the analysis of form, harmonic progressions and other aspects of music theory; and in the early 20th century, and 3) the study of ethnomusicology, which led to the inclusion of cultures and culture-specific aspects of music and musical settings. However, the last four decades or so have seen a rise in cross-disciplinary studies related to music, and one of those developments, the field of music psychology and the presence or absence of affordances as part of cognitive process, is the focus of this research.

Within the last century, the framework for musicology expanded through the development of ethnomusicology, with its roots in anthropology (Merriam & Merriam

1964, Solis 2012), and has continued to spread. Such a shift had already been occurring in other disciplines; for example, scholars of Biblical theology had begun incorporating various forms of exegesis⁸ for Biblical studies into the classroom and research projects in order to gain a better grasp of the ancient Biblical texts. Traditionally, Biblical studies had followed much the same path as musical studies, with a focus on the historical settings for the text and linguistic analysis and comparisons, but as the interest in scholarly rigour expanded, Biblical exegesis took on such broad forms as textual criticism and grammatical criticism, as well as several other types of criticism. John Hayes and Carl Holladay have described textual criticism as the “quest for the original wording” and discussed it with regard to the threefold aims of a) determining the process by which a text has been transmitted and has come to exist in variant forms; b) establishing the original wording, when this is seen to be a possible or feasible aim, and c) determining the best form and wording of the text which the modern reader should use (Hayes & Holladay 1982:35).

The process of applying textual criticism was characterized by the quest for original sources and seeking to be true to the original author’s intent. Other forms of exegetical study include literary criticism, tradition criticism, and form criticism, and describing their final critical method, that of redaction criticism, the authors honed in on the final written stage of a passage to determine the intended meaning in context to the entire text (Hayes & Holladay 1982). In the late 1980’s, Dennis Shrock was insistent on using original sources in music research, claiming that “primary source information...provides a framework of perception -- an understanding of basic

⁸ Hayes and Holladay describe exegesis as the “reading out” of the meaning, or arriving at a critical explanation or interpretation of a text (1982:5).

philosophies of practice that suggest parameters of perception and application within which a diversity of interpretation can take place” (Shrock 1988:4).

Another area that has recently been reflected in musicology is that of psychoanalytic literary criticism, which bears some resemblance to Biblical exegesis. The discipline of psychoanalytic literary criticism developed a four-phase process of critical exploration (Eagleton 1996) introduced in the first chapter and is another example of how musicology has borrowed from other disciplines to enhance its own processes.

2.3.1 Perception, cognition, and affordances

It is in the area of psychology and neurology that music studies have more recently benefited from cross-disciplinary techniques. Psychology, and more specifically cognition and the sciences surrounding perception, has seen tremendous growth and exploration in the last half of the previous century and the first part of the 21st century. Wertheimer, Koffka, Kohler, Gibson, Norman, Harry Heft, Anthony Chemero, Rowlands and many others have contributed to empirical research surrounding perception and cognition, as well as the phenomenological understanding of how cognitions and perception work in the world as we experience it.

The field of ecological psychology gave rise to the notion of affordances and how affordances interact with our minds in the perception process through the work of Gibson (1979/1986). The idea of affordances, along with an expanded understanding of the optic array, as described by Gibson, has factored heavily in recent developments of design for fields such as architecture, computer application design, and information technology applications (Norman 1988, Chemero 2003, 2009, Heft 2003, Rowlands 2010, Borchers 2010, Keereepart 2017).

Other disciplines have co-opted the language of cognition and affordances (Heft 1989/2007, 2003) and musicology has its share of researchers (de Clercq & Temperley 2011, Duby 2013, Huron & Berc 2009, Krueger 2014, Yim 2011) who have drawn connections and conclusions, contrasts and comparisons between music and a variety of understandings and interpretations of affordances. Once an initial understanding of sensory perception and cognition processes has been established, this section will explore more deeply those connections between affordances and music, including guitar chord structures and the music of Chris Tomlin.

2.3.2 A case study in musical affordances

As a vehicle for the study of affordances in music, this research focuses on the musical compositions of CCM artist Chris Tomlin. One of the top producers of CCM hits, Tomlin has a proven record of creating songs that can be easily played by worship bands of all ages throughout the world. Using some of the techniques of Temperley and de Clercq pertaining to identifying a corpus for study, this research presents a case study of material from the body of works by Tomlin to illustrate the concepts set forth in regard to a phenomenological approach to the presence of affordances, as experienced in embedded cognition (Temperley & de Clercq 2013). Music specifically composed and performed by Tomlin is laden with chord structures and changes that take advantage of the perception-action cycle and how the affordances embedded in the structures simplify the chord change process.

While the concept of affordances deals primarily with the phenomenology of perception and cognition, there is still the essential need for determining various factors about the actual chord structures that are represented in the music of Chris Tomlin. Arriving at those factors involves the study of fingering patterns and chord

structures and utilizing work by such researchers as Samir Sayegh and Daniele Radicioni, among others, gives a firm foundation and framework for fingering efficiency patterns. Researchers have incorporated business models such as the Optimum Path Paradigm (OPP) (Sayegh 1989) and computer models using light emitting diode (LED) technology (Heijink & Meulenbroek 2002) to study various guitar fingering patterns. Technological advances have allowed for a variety of evaluation methods to be employed in the study of fingering solo and chordal passages for a variety of instruments, including the guitar (Radicioni et al 2004, Radisavljevic & Driessen 2004).

This chapter began with the introductory remarks and research framework and will now move into the exploration of two primary areas. The first area to be explored is an overview of the affordances concept, beginning with the roots of cognition, perception psychology, and affordances study and moving to the specific connections between music and affordances. The second area examines the literature on guitar fingering and chord structures, starting briefly with early examples of fingering patterns developed by guitarist Fernando Sor and moving to modern, computer-driven methods such as the use of light-emitting diodes used in the study of fingering pattern efficiency models.

2.3.3 Cognitive science and affordances

The nature of this research is to explore chord fingering patterns and structures in terms of affordances and embedded cognition, and there were some specific questions laid out in the first chapter that speak to this exploration. The primary question of the research is “Are there specific chord fingering patterns and structures that afford ease of transitions from one chord to another more than other fingering patterns and

structures?” The question regarding music chord transitions has been addressed in terms of affordances, but from the framework of harmonic progressions rather than chord transitions (Yim 2011). Yim addressed the idea that some guitar chords were better suited to harmonic progressions, which he labelled affordant chord progressions, and contrasted them with functional chord progressions. However, by his own admission, Yim essentially answered the wrong question, and would have done better to focus on action science and the performance difficulty of actual chord changes rather than exploring the chord progressions (ibid.). This study addresses the action science of chord transitions, peering through the lens of current studies in cognitive science and affordances, using interpretative phenomenological analysis.

Contemporary understandings about cognition have moved from Gibson’s direct perception to embrace a broader idea of perceiver-environment engagements (Heft 2003) or coupled dynamical systems (Chemero 2009), coupled in the sense that animals and environments are linked through active perception from an environment rich with information (Chemero 2009). Through his research and discussion of radical embodied cognitive science, Chemero built the case that affordances exist in the action that takes place between the individual and the environment. Affordances, although present, are latent until the individual interacts with the environment. Once the individual interacts with the object in the environment in a given fashion, the effect of the affordances comes into play, and one can then say that the individual has appropriated the action possibilities, or affordances (Gibson 1979/1986, Withagen & Chemero 2012) and has the potential to build on the action, even to the point of finding or creating new affordances (Magnini & Bardone 2010).

In the case of the guitar chords that will be explored, one can hold a specific chord for an indeterminate amount of time, but no properties of affordances appear, or are realised, until the player shifts to a different chord. It is the approach of this research that certain chord structures offer affordances that create greater ease for changing chords than other chord structures offer,⁹ thereby creating the opportunity for offloading the chord-changing onto the structure within the chordal environment. The chords used by Tomlin provide the greatest illustration of performance difficulty in light of these affordances as understood in the context of radical embodied cognitive science, and more specifically, embedded cognition (Rowlands 2010).

In order to demonstrate this, it is important to understand some basic theories of cognition to provide a scaffolding for the discussion of affordances and how the understanding of affordances has evolved over the past three decades. It is also easy to get side-tracked into the areas of psychology, design, cognition, and any number of other rabbit holes, to borrow the idiom from “Alice in Wonderland”, that lead to strange and unexpected places, especially for a musician, so this section will only scratch the surface of cognitive psychology and perception, and spend a little more time with some of the current scholarship in cognition and affordances, transitioning finally to the application of affordances to the discipline of music.

2.3.4 Basic cognition processes

Cognition is considered to be that range of processes that take place in the sensory acquisition, storage and manipulation, and retrieval of information. Studies in

⁹ Somewhat similar to the research done by Yim on what he called affordant harmonic structures, in which he explored the idea that modern, rock music-based harmonic progressions might be built on structures unlike functional harmony; basically, he was hoping to demonstrate that some chord progressions provided more affordances for changes than functional harmony progressions from historic compositional practices (2011).

cognitive science have evolved throughout the centuries from the ancient Aristotelian writings (Heft 1989/2007), through Descartes, the Reformation and Renaissance, and into a complex field of empirical and phenomenological research (Rowlands 2010). Contemporary theorists (Chemero, Heft, Rowlands, Clark, Chalmers) generally agree that there are at least two different ways of thinking about perception and cognition, with one way being centred in the organism's mind and the other way offloading part of the cognition process onto the environment of the organism. It is in this offloading that the theory of affordances finds application in contemporary psychological study, most recently in the realm of 4E cognition championed by Rowlands (2010), Newen et al (2018), Schiavio et al (2017) and others.

It is important to set up an understanding of cognition before moving on to affordances so that the idea of affordances is supported in an "intentional analysis of perception" (Heft 1989/2007:1). We make sense of something through the mental processes that interpret the sensory input, and that sense-making constitutes the learning process, or cognition. Cognition, then, is essentially thinking, processing, and building on that perception-action cycle to come to a new perception or understanding; cognition takes on forms like the sensory input interpretation or the compiling of experiences. Learning is the result of progressively assimilating more complex cognitive processes and making sense of them in progressively greater contexts, or scaffolding them, and eventually building a storehouse of information usable by the cognising organism.

2.3.5 Aristotelian causality, or pre-Renaissance notions of cognition

Leading his readers to an understanding of how perception happens, Heft takes a phenomenological approach, unpacking early ideas about cognition, perception, and the relationships between organisms and their environments. He provides a brief

history showing Aristotle's development of a framework of causality that includes at least four possible causes. This Aristotelian causality, which was predominant through the early Renaissance time, embraces the idea of material character (material cause), structural character (formal cause), origins (efficient cause) and immanent or teleological cause (final cause) (Heft 1989/2007).

The first sense of cause is the material, or "that out of which a thing comes to be and which persists" (ibid.[sp]¹⁰). To this point, Aristotle used the illustration of the "bronze of the statue, the silver of the bowl" as the materials from which those items were formed. The second sense is "the form or the archetype, i.e., the statement of the essence" (ibid.[sp]), which is known as the formal cause, which Andrea Falcon called "the account of what-it-is-to-be", e.g., the shape of a statue (Falcon 2019 [sp]), drawing on Aristotle's Physics Book II 3 expansion. Unpacking that, Falcon went on to rephrase Aristotle's comments, saying

Note that the bronze is not only the material out of which the statue is made; it is also the subject of change, that is, the thing that undergoes the change and results in a statue. The bronze is melted and poured in order to acquire a new shape, the shape of the statue. This shape enters in the explanation of the production for the statue as *the formal cause*. However, an adequate explanation of the production of a statue requires also a reference to *the efficient cause* or of the principle that produces the statue. For Aristotle, this principle is the art of bronze-casting the statue (Falcon 2019, paraphrasing Aristotle Physics II 3 and Metaphysics V 2 [sp]).

Quoting Aristotle more directly regarding the third cause, Falcon writes "Again the primary source of the change or coming to rest: e.g., the man who gave advice is a cause...what makes of what is made and what causes change of what is changed"

¹⁰ Aristotle addressed the theory of causality in Metaphysics book V as well, spelling out some of the same information regarding the four principles of causation in V.2 (Hutchins 1952:533).

(ibid.[sp]). Falcon's later expansion makes it clear that Aristotle is referring to the agent of change as the third principle of causality.

The fourth principle gets to grasping the why of something. Labelled the final cause (Stacey et al 2000, Falcon 2019), Aristotle described it as "in the sense of end or 'that for the sake of which' a thing is done, e.g., health is the cause of walking about." (Hutchins 1952:271) Tucked away a few pages later, in Physics Book II 8, after Aristotle had been discussing various actions, or series of actions, and how they unfold, he threw in this thought: "...where a series has a completion, all the preceding steps are for the sake of that." (ibid. 276) On plants, for example, leaves "provide shade for fruit" while roots go down into the soil to provide nourishment for the plant. In part, Aristotle completed his idea that there are different principles of causation that feed into the final causality, which is the answer to the why question. At the same time, however, while there are four basic principles of causation, not all four are present in every situation.

Essentially, the chief end of Aristotelian causality is that final cause, which explains why something happens. Edwin Holt, borrowing from physics, likened this to what he called the bead theory as he used the theory of causation; "...the course of a falling body was described as a series of states (a, b, c, d, etc.), each one of which was the effect of the state preceding, and cause of the one next following." (Holt 1915/1973:157) This was his attempt to explain early understandings of behaviour as influenced by the four causes theory. For Holt, the shift that needed to take place in the psychological sciences was one that went away from the bead theory and answering the why questions, to the approach happening in the physical sciences that strove to address the question "What are the objects doing?" (ibid.:159).

As Holt was one of Gibson's mentors (Withagen et al 2012), this thinking surely influenced much of the work that gave rise to our modern understanding of perception and cognition, and consequently, affordances. It also helps frame the shift that took place around the time of the Renaissance, a shift that moved from the question of why and Aristotelian causality to the question of "what is it doing" and the idea of cause and effect, or a mechanistic cause.¹¹ Heft characterises the post-renaissance view of causality as mechanistic, saying "Mechanistic causal explanation, often in combination with materialism, seeks to reduce the diversity of natural things to a common mode of description, if not a common level of analysis." (Heft 1989/2007:7) This understanding of the mechanistic causality becomes clearer as Heft contrasts dualistic organism-environment interaction with relational organism-environment interaction and discusses affordances from that perspective.

2.3.6 Cartesian Notions of Cognition

This shift from an Aristotelian-cause framework to a mechanistic framework meshes nicely with the rise of Cartesian cognition (Rowlands 2010). Rowlands' discussion surrounding the ideas of René Descartes and early understandings of cognitive science provide a clear and concise account of the topic, illustrating that Descartes essentially equated mental processes with brain processes; for Descartes, cognitive processes all take place within the confines of our brain, from perception stimulus to an action or output. The organism doing the cognising has the stimulus input, which is interpreted in the brain through specific processes that include memory association and other aspects. However, the item in the environment that is being perceived is not a

¹¹ To be sure, Withagen and fellow researchers were not asserting that Holt or Gibson were on board with the idea of mechanistic causation. However, based on the use of the bead theory analogy in their article, it seems that Withagen et al might have a slightly different understanding of Holt's writings than other researchers.

participant in the cognition beyond stimulating the perceiving organ such as the eye or the ear. This internal in-the-brain processing results in mental representations of the stimulant, allowing the organism to name that which is observed, and is known as dualism, described earlier and represented by the Vertical Sandwich Model.

George Berkeley's¹² age old question "if a tree falls in the forest and no one is around to hear it, does it make a sound?" can be helpful in understanding the core of Cartesian cognition. One would think that a tree falling would make a noise, regardless of whether someone is there to hear it; that would have been my answer a year ago. The tree falls, and in the midst of that fall branches from the tree crash into branches from neighbouring trees, bending and in some cases breaking the limbs. The impact of limb on limb, or trunk against trunk, sets off a series of interruptions or anomalies in the surrounding air that we would refer to as sound waves.

If someone is standing within a reasonable distance of the event, those sound waves register on his ears as the noise of crashing tree parts, and he concludes that there is a noise being made. However, if sensory perception is based on a cognitive process that takes place entirely in the mind and there is no one in the area on which those sound wave pulses, which are a result of the tree falling and crashing through surrounding trees, can make their impact, then there is no sensory perception taking place. Hence the question of whether the tree makes a noise remains unanswerable to the human mind; if one does not experience it, or perceive it, did it really happen? Did the tree really make a noise?

¹² George Berkeley (1685-1753) is generally credited with the stated quotation as part of his defence that perception creates our reality and that reality is "a collection of sensations, perceptions, and interpretations" that God transforms into ideas (Christie 2019). Hence his classification as an Idealist philosopher.

In the case of Cartesian cognitive science, one might conclude that in fact there is no noise because no brain processes have happened, supported by Berkeley's supposition that it is our perceptions which comprise reality (Christie 2019). Our brains, in a sense, create the perception of sound using memories and representations, often filling in the gaps based on what we imagine or predict might happen, or on our history or memory with similar environments or circumstances, to complete the perception. This can be seen in the works of Wertheimer, Koffka and Kohler as they explored the ideas that developed into Gestalt psychology.

2.3.7 Gestalt theory and perception

Contemporary cognitive science has some affinities with earlier Gestalt theory, and while including a comprehensive study of Gestalt psychology in this work would be well beyond the scope of the literature review, it will be helpful to look at some fundamental aspects that gave rise to later studies in affordances. One of the key drivers for Gestalt theorists such as Wertheimer, Koffka, and Kohler is the idea that all objects and scenes have the potential to be visually observed in their simplest forms and meaning can be derived from that simplest form (Borchers 2010).

Ultimately there have been many laws arising from these studies, and two of those laws help illustrate the idea that meaning can be derived from observing something in a simple form. The law of closure, or reification, suggests that when presented with an object such as a circle with some parts missing (the simplest form), we fill in the gaps to make a whole circle. Due to the law of reification, an artist is able to draw part of a face and the observer will unconsciously fill in the remaining space to form the face. The illustration in figure 2.3.1 is essentially a group of ink blots arranged in a specific pattern but with some parts missing: through reification, one can perceive a

panda bear in the blots. Meaning for the simple blots is derived from seeing them being so arranged. This is an application of reification as pertains to visual perception; reification occurs when one thinks of or treats something abstract as a physical thing such as the connection of particular musical pieces to certain emotional responses; an example cited by Lewis is the playing of Beethoven's Ninth Symphony just days after the events of September 11, 2001. (Lewis 2014, 2016).



Figure 2.3.1 Reification

Another guiding principle of Gestalt theory is the idea that the whole of an object is more significant than the individual parts of that object; the law of proximity (Figure 2.3.2). In this case the elements that are close to each other seem to be grouped together when looking at the whole picture; one is more likely to see three groups of circles rather than 22 individual circles. It's a sticky little point, and the idea of proximity carries more pertinence to this work than reification, but essentially for the Gestalt theorist, the seeing of how things are is in the mind, not in the eye, of the beholder (Borchers 2010). It is not the visual perception that determines what is seen, so much as how the mind interprets what it is seeing - Cartesian cognition, *tout court*. Affordances, which do not stem from the discipline of Cartesian cognition but actually appeared in studies pushing cognition science in a different direction, might be applied to this understanding of perception as those structures or features that push the mind, if you will, to see in a certain way, opening up action



Figure 2.3.2 Proximity

possibilities for the beholder. If so applied, the affordances would be acting upon mental representations within the organism's brain.

2.3.8 Gestalt principles applied

Norman, building on the work of Gibson, incorporates affordance theory into his architectural designs (Norman 1988). For Norman, the layout of design elements, which he calls mapping, could serve to push a user to know intuitively how to manipulate the design, whether that be to push on a door handle or to pull to open it, or which light switch to use in turning a specific lighting zone on or off (*ibid.*). The application of affordances for graphic user interface (GUI) is to design the user interface in such a way that through certain features embedded in the interface, the user can be pushed to intuitively choose a specific action in order to achieve a desired result. Designing a "next" button and placing it in the most proximate position to gain attention (Borchers 2010) or mapping a pull-down menu for a phone application in a way that not only makes understanding quick and easy but also invites the user to take the next step (Keereepart 2018) are both examples of GUI design incorporating Gestalt principles through the paradigm of affordances theory.

As part of her work in software platform development, Thaniya Keereepart also made extensive use of heuristics as presented by Daniel Kahneman (2011), and referred to in a roundabout way by Kenneth Grant in discussing the work of Michael Polanyi (Grant 2007).¹³ Heuristics is the idea that a simple procedure can be devised or designed in such a way that the answers to difficult questions can easily be attained,

¹³ Grant's work is essentially an exposé on researchers not actually reading material that they present, masked as research on interpretation/misinterpretation of a popular quote by Polanyi. I have to confess that upon reading Grant's article, I revisited my own references in an effort to understand the original intent of each bit of information more fully.

and even though they might be imperfect, these answers might prove to be adequate for the intended application (Kahneman 2011).

The title of Kahneman's book "Thinking, Fast and Slow" provides a sample for arriving at a basic understanding of heuristics. The underlying premise of the book is that our minds process information, and in that processing of information our minds look for the easiest way to find a solution to whatever the situation is. Some tasks are then offloaded to a portion of our mind that makes quick (fast thinking) decisions based on previous experience and current, available information, leaving the larger portion of our mind to deal with things that require more processing (slow thinking). Keerepart utilized heuristics in such a way that although the individual using the TED app might not have all the information that could be available, or might not have made a clear decision, he could be presented with options that would simplify the decision process and make the path to a final decision easier. In her design, she broke the components down into categories and subcategories, offering the user the chance to progressively narrow his selection without undue work until he arrived, within three to four choices, at his final choice (Keerepart 2018).

Affordances play a role in the heuristics process in that they provide subtle cues for action possibilities that our brains pick up, and we can quickly determine a general risk in taking a chance on that action (Magnini & Bardone 2010). As we process through the perception-action cycle, we have the opportunity to create, in a sense, new affordances based on previous experiences and memories resulting in an upgraded or enhanced environment due to this cognitive niche construction (ibid.). For heuristics, the brain takes advantage of these higher-level constructions as a way to offload simple decision-making processes and invest itself in more complex cognitive efforts.

The TED app designed by Keereepart serves as a perfect example of this principle; as the user scrolls over different parts of the screen, that section “pops out” or is enlarged, allowing the user to quickly select that section, if that is the desired choice (fast thinking) or to read the available information more easily (slow thinking) if necessary (Keereepart 2018). As a guide for her design philosophy, Keereepart was combining the Kahneman principles of heuristics with Norman’s first four (of seven) principles of good design, based on Gibsonian affordances. The first principle, that one should use knowledge that is both from the world and in the head, suggests to the designer that information should be readily available to the user (Norman 1988). And the process for making things available is to simplify task structures, make things visible, and use good mapping techniques. These design principles fit hand in glove with Kahneman’s fast thinking ideas.

2.3.9 Heuristics and Haptics

The popping out of a pull-down menu and the incorporation of a finger, finger-shaped pointer, or other selection device not only to activate the popping out but also to make the selection serves to illustrate the idea of heuristics, and at the same time gives opportunity to introduce another sensory organ into the mix. Up to this point, discussion has revolved around visual perception and the eye as a sensory organ (the eye plus its internal parts, i.e. retina, optic nerve, and so on), but perception is not limited only to the optic array and light sensations. Gibson delved into the study of haptics (1962) and the idea of active touch; he did not ascribe the idea of performatory movements to haptics in his work, indicating that when an object is relocated or a tool wielded, perception becomes subsidiary to the action taking place (1962). He did, however, address the combination of touch and vision acting together, and this

combination of the two senses acting in tandem serves as a driver in the GUI popping up example; using active touch serves to highlight the pop-up menu item, the user sees the item and makes a decision, then acts on that decision with more active touch - either by selection resulting from pressing, or moving on to the next item (Keereepart 2018).

Modern scientific techniques for studying brain structures, patterns and processes have given us an entirely new language for dealing with cognitive processes, and include information related to brain patterns, circuits, canonical neurons, neural pathways and neuromodulators. Twenty-first century researchers (Chemero, Rowlands, Menin, Schiavio, Reybrouck to name a few) have expanded the lexicon of cognition science while pushing the boundaries of our perception way out from the physical structural framework of our minds.

2.3.10 Embodied, embedded, enacted, extended cognitive sciences

Distilling information from almost three chapters of Chemero (2009) into one paragraph hardly does his work justice, but identifying a few key points provides help in understanding his contributions as related to this research. Establishing his framework for radical embodied cognition, Chemero builds on the idea that cognitive science falls broadly into two different categories, representational and eliminative. Both involve sensory perception and are dependent on brain circuits and neuromodulators to aid the processing, as in Cartesian cognition, but the primary difference lies in the processing of that information.

Essentially, the representationalist claims that when something is perceived in the environment, neurons in the brain call upon imagery located in the brain to interpret what is perceived (mental representations); that imagery may very possibly originate

from memories derived from previous experience. Unlike the optic array as Gibson described it in setting up his research, one can look at a tomato straight on, and the eye, the sensory organ for vision, will perceive the two-dimensional, seemingly flat surface of the tomato; by moving one's body slightly to one side, the observer will perceive a sense of the depth of the tomato. However, this sense that a tomato is, in fact, roundish, builds on the represented experiences within the brain of the perceiver and is not due to the position of the tomato, the movement of the observer, or other environmental factors.

The eliminativist, on the other hand, (again, very generally) takes into consideration the idea that one's environment is richly laden with information, and cognition is constituted of an interaction between the perceiving sensory organism and clues contained within the affordances of the environment. Neurons within the brain take those clues and process them through a series of possibilities to arrive at an action response.

Chemero built on the structural differences between the representationalist and the eliminativist conceptions to support the concept of radical embodied cognition, which serves to reduce internal computations involved in cognition (Chemero 2009, 2013). Embodied cognition emerges in the actions of organisms that are situated in a specific environment (Reybrouck 2001, Van Dijk 2009) and happens in the embodiment of an actor or organism and a specific context of activity (Reybrouck 2001, 2012). The cognitive activity is structured by the body (to be expanded shortly) and that action takes place when a body is embedded in a specific environment; the environment shapes the experience (ibid.).

According to Embodied Embedded Cognition, the physical structure of the body, the physical and social structure of the world, and the internal milieu of the organism's body, all provide important constraints that govern behavioral interactions. (Haselager et al 2008:275)

The structure of the environment contains action possibilities, and the design of the organism's body offers constraints which, within the specific environment, limit the action options available to the organism (Haselager et al 2008). This Embodied Embedded Cognition (EEC) happens with an organism immersed in a specific environment, or Umwelt (von Uexküll 2010/1934, Reybrouck 2001), which places the notion of embedded as the situatedness of the organism in that specific environment. The object is immersed in the environment.

Rowlands and other 4E cognition scientists hold a slightly different version of embeddedness - for the 4E cognitionist the object takes advantage of the particulars in a situated environment (Clark 2001, Malinin 2016). The 4E'ers embrace the basics of embodied and embedded cognition and add enacted and extended cognition.

Following an introduction to basic cognitive science history, Rowlands develops his breakdown of cognitive processes into four conceptually different elements: embodied, extended, embedded, and enacted cognition. Each element approaches the process of cognition in relation to the function in the brain, combined with how the brain behaves in interaction with the environment. Others (Menin & Schiavio 2012, Chemero 2009, 2013, Ryan & Schiavio 2019) have used some or all of the same language regarding cognition, and the breakdown of the cognition process gets into the neurosciences with brain mapping, neurons and canonical neurons, and other concepts that go far beyond the scope of this thesis.

Menin and Schiavio have contributed to the embodied cognition discussion with research on canonical neurons, a concept not unique to them. They describe these

neurons as selective; in the case of visuo-motor neurons they are triggered by seeing an object that “offers an actionable structure” (Menin & Schiavio 2012:203). Seeing a cup, for example, triggers a set of neurons associated with grip-response. These canonical neurons are “a set of neurons which discharges when an individual *simply observes an object* without performing any movement, as well as when he or she grasps that object” (italics mine) (ibid.).

Rowlands’ case for 4E and non-Cartesian cognitive science rests in opposition to that of Cartesian cognitive science, in that for Rowlands and following Chemero, cognitive processes are *not* confined to the mind (Rowlands 2010). The story that he uses to illustrate this discussion is an example of the African Envoy and the Peruvian Kvinu and the different ways in which they carry and convey their messages. The African Envoy uses a process of word for word conveyance of his message, so he receives the message, memorizes it word for word, travels to the receiver and delivers his message, relying on that memorization of the text. For the Envoy, his ability to deliver a message of substantial length is directly related to his ability to memorize the entire message. In contrast, the Peruvian Kvinu uses a system of knots to aid in the recall of the message. The Kvinu learns a code represented by the knots that allows access to information embedded in the knots. All the Kvinu has to do is memorize a few knots to convey any information. For Rowlands, the knots represent an “appropriate environmental structure” (ibid.:15) that aids the cognitive process. He likens the knots to the Barking Dog principle that he learned; if there is some barking to be done, and you have a dog that will do some of it, then you have less barking to do. One can offload the barking onto an aspect of the environment, in this case the dog (ibid.).

Both the illustration of the Envoy and Kvinu communicating messages and the Barking Dog principle are ways that Rowlands substantiates his cognition delegation concept, in which he asserts that cognitive processes are not confined to the mind. To be sure, he is not the first to hold this opinion, but his writing provides some of the more accessible material on cognition and affordances. Affordances, then, are those ways in which our environment and the things within this environment offer themselves in usable ways. Therefore, when we have thinking, or cognition that has to take place, we can perceive it and think about it when we have to, but if the environment or thing allows for it, we can delegate the thinking when we can, essentially offloading it to the environment. The four ways this happens are embodied cognition, extended cognition, embedded cognition, and enacted cognition.

2.3.10.a Embodied Cognition

Rowlands describes embodied cognition as inclusive of more than mere connections of representations in the brain; embodied cognition is “partly constituted by, partly made up of, wider bodily structures and processes.” (2010:3) Unpacking the concept of cognition delegation in this way brings together the understanding that cognitive processes take place in both the mental processes of the brain and in the structures present in the environment. Rowlands points out the difference between his embodied mind concept and one of the main ways of thinking, the separability thesis. In separability thesis, similar to computational representations, the mind processes comprise the totality of cognition, and function apart from the bodies that contain the mind.

For example, hearing is a type of cognition that takes place in the mind, and the parts of the ear merely provide the vehicle of conveyance for auditory signals to travel to

the space in the mind that recognizes the sound, generally through representations in the mind. Because of this separateness, the ear itself is not necessary for hearing since hearing takes place in the mind. Rowlands, not the first in this field to do so (see Menin & Schiavio 2012, Chemero 2009), suggests that in the cognition process the mind incorporates, or reflects, the body that houses the mind. Menin and Schiavio, citing Esther Thelen et al, describe embodied cognition as that which

...arises from the bodily interactions with the environment depending on “the kinds of experiences that come from having a body with particular perceptual and motor capacities that are inseparably linked and that together form the matrix within which memory, emotion, language, and all other aspects of life are meshed. (Menin and Schiavio 2012; 203, Thelen et al 2001:XX)

An understanding of the cognitive process in terms of embodiment is not possible without understanding the wider bodily functions that surround the mind. As an example, Rowlands illustrates his point using the structure of the human head, with two ears placed one on either side of the head. As an embodied cognitive property, the interaction between the sound waves being processed through the two spatially separated ears and the brain allows the individual to ascertain the direction from which a sound comes. Placement of the ears is an integral part of auditory cognition - with its directionality a constituent part of cognition. In the cognition of hearing, placement of the ears, or the environment in which the sound happens, is key to determining the direction of the sound - the cognition process is the hearing of the sound and knowing from where the sound comes (Rowlands 2012).

2.3.10.b Extended cognition

If embodied cognition relies on the structural features of the organism to be a constituent in the cognition process, as the placement of ears on opposite sides of the head aids sound orientation, extended cognition relies on processes that are not

necessarily recognized as part of the cognising organism's structure. The processes that comprise such cognition extend into the environment surrounding the organism, and incorporate processes already present in the environment (ibid.).

In describing cognitive processes of the extended mind, Rowlands states that "the actions that the organism performs on the world around it are ones of manipulating, exploiting, and or transforming external structures" (Rowlands 2010:58). Specifically inserting music into the role of the item in the environment, Krueger claims that music provides a resource to the listener for doing things as a part of the auditory cognition event (2014). He illustrates that as a subject listens to certain types of music, the music guides certain sensorimotor responses of the listener, and these responses are considered by Krueger to be affordances of the music. Whereas in traditional cognition the music would trigger representations of emotions for the listener, which would be a process that takes place in the listener's mind, in extended mind cognition the music guides the emotions, or sensorimotor responsiveness. In this way the process of guiding the response is offloaded from being the responsibility of the listener's mind to being the responsibility of the music.

Windsor and de Bezenac (2012) refer to this as the capacity of music for advancing behaviour; music is able to "grant access to kinds of experiences" for the listener by integrating the brain-body-music into a system. In this way, for Windsor and de Bezenac, music provides an external resource that can access a different cognitive function for the listener, an action that would not be available to the listener without the presence of the music. Windsor and de Bezenac and Krueger all point to the offloading of mood moderation by listening to specific types of music (not specifically in those terms) as part of the extended mind cognition process. A slightly

different approach to the extended mind is presented by Kahneman using the concept of systems thinking. Kahneman differentiates between systems one and two as fast and slow, where certain cognitions are intuitive, innate and automatic and offloaded to the event or environment or situation (system 1, fast thinking) and other cognitions require a deeper level of processing, requiring slightly more time in the process (system 2, slow thinking) (Kahneman 2011).

2.3.10.c *Enacted cognition*

In the case of enacted cognition, the processes involved are not just neural, or confined to the mind and how it sits in its space, but also include things that the organism *does*, or how an organism acts on the world and how the world acts back (*italics mine*) (Rowlands 2010). Specific environmental cues are engaged when the mind performs certain actions - the world is an external store of information. Rowlands draws his support for the idea of enacted cognition from work using Mackay's enactive approach (*ibid.*).

This enactive approach is based on the illustration of a blind person holding a bottle, and the perception of it being a bottle based on the brain being tuned to certain potentialities, such as the shape of the bottle neck tapering as the hand goes one way or widening to the container part in the other direction (*ibid.*). In this instance, the perception is haptic in nature, and Rowlands calls this a haptic representation, wherein the brain constructs the perception based on certain potentialities of the bottle. The blind person is able to determine those potentialities through haptic exploration. Those features of the bottle are the environmental cues, the affordances (latent clues) at that point. Given this circumstance, the hand, moving along the bottle surface and discovering the environmental cues that are present, is similar to Gibson's optic array

and the movement or repositioning of the head to see a slightly different perspective, thereby opening up the ocular action that exposes the affordances.

The ocular action perception is introduced with the illustration of one experiencing a tomato, partially obscured by an obstacle. In Rowland's enacted cognition, even with obscured vision the perceiver experiences the tomato not as individual constituent parts, but as a whole tomato. According to Rowlands, the traditional view of cognition would assume the construction of a visual representation of the tomato; the tomato is a result of one's brain's cues. Enacted cognition, on the other hand, would say that there is an implicit understanding (or even an expectation) that the left/right movement of one's body will bring further parts of the tomato into view, thereby completing the cognition (Rowlands 2010).

In either the case of haptic perception and the bottle or ocular perception and the tomato there is action, and that action takes place between the cognising entity and the environment. Enacted cognition relies on the presence of expectations and the ability we have to act within the environment. As we perceive, the experience fills in; we expect the tomato to be roundish, and we expect to have the next section of surface unfold as we shift our eyeline, or we expect the bottle to widen as we move our hand down the surface of the bottle neck.

Embodied cognition relies on the wider bodily structures and processes of the organism interacting with the environment. In extended cognition, the processes are not exclusively in the organism, but extend into the environment and are composed of actions performed by or between the organism and its environment. As we have just seen, enacted cognition is constituted of processes that involve the organism engaging the environment through some manipulation or action. For embedded

cognition, the external structures have specific features or characteristics that are relevant and necessary to the interaction and accomplishment of a given cognitive task (Rowlands 2010).

2.3.10.d Embedded cognition

Rowlands illustrates the concept of embedded cognition, in which mental processes function only in tandem with a certain environment that lies outside the brain of the subject, by considering pieces of a jigsaw puzzle. The worker of the puzzle can pick up the piece and rotate it, comparing it to other pieces, to available slots in the puzzle, or to other factors, including shape and colour. Because the puzzle piece carries certain information, the cognition is embedded in the interaction between object and environment; without that environmental scaffolding, the mental processes do not perform ideally. “[A] given cognitive process is defined by its functional role” (Rowlands 2010:68) and is dependent on the environmental structure; the process acts or functions in tandem with those structures, and without the structures, the cognition cannot take place.

A benefit of embedded cognition is that the complexity of a process in getting from A to B can be reduced by using an external structure. Without the information present in the puzzle piece and the interaction between the puzzle worker and the object, the process of identifying the correct puzzle piece would take forever!

2.3.10.e Rowlands’ embedded cognition

According to Rowlands’ embedded cognition, “in accomplishing cognitive tasks, an organism can utilize structures in its environment in such a way that the amount of internal processing it must perform is reduced” (Rowlands 2010:68-69). This is the point at which exists the possibility that certain guitar chord structures contribute to

the reduction of processing that the organism must perform to transition from one chord structure to another. Embedded cognitive processes are dependent on the environmental structures and are designed to function in tandem with those structures (ibid.). Whereas standard guitar chord structures are constructed independently, and many chord changes require shifting several fingers in different directions, the chord changes used by Chris Tomlin have specific chord structures embedded that work with a minimum of shifting fingers, and they work within that embedded framework.

The theory, study, and practice of 4E cognition principles have grown steadily over the past few years, and include extensive articles on specific “E’s”, as referenced throughout this chapter, garnering an Oxford Handbook of its own (Newen et al 2018), and several websites, the most prominent among them being the 4E Cognition Group¹⁴, a compendium of presentations, publications, research and news about all things embodied, embedded, extended, and enactive in cognition science.

One of the most concise frameworks for the 4 E’s is presented by Kevin Ryan and Andrea Schiavio (2019) in the introduction to their work. As they explore the nature of musical experience at the intersection of music and cognitive science, they hold the position that 4E cognition is embodied, embedded, enactive, and extended and “(i) cannot be taken as separate from particular facts of the bodies we have, (ii) is scaffolded by the environment, (iii) is geared towards action in the world with a continuum between life and mind, and (iv) extends outside the skull-skin boundary to loop into the world” (Ryan & Schiavio 2019:8). These processes rely on the relationship of interactions that occur both inside the mind and in the organism’s

¹⁴ The 4E Cognition Group can be found at this Wordpress website <https://4ecognitiongroup.wordpress.com>

environment. These processes are enabled, in large part, by characteristics or conditions within the environment that suggest certain responses or actions; I now turn to examine more closely those characteristics or conditions in terms of the affordances in the environment.

2.3.11 Ecological psychology, abduction, action-perception cycles

The idea of affordances stems from the development of a concept pioneered in ecological psychology by James J. Gibson, who coined the term affordances to name those aspects of an environment that “it *provides* or *furnishes*, either for good or ill” to a subject, in his case an animal (author’s italics) (Gibson 1979/1986:127). Ecological psychology approaches stimulus information as being part of a conceptual framework used to explain how we perceive (Heft 2003), and incorporates elements of the environment, the Umwelt of the cognising organism (von Uexküll 2010/1934) as part of the perception process. Therefore, perception is a direct process (Gibson 1979/1986, Chemero 2009, Rowlands 2010).

Perception, then, is non-inferential and non-computational; information is present in the environment (Chemero 2009, Reybrouck 2012) and that information contains meaning for the organism in that environment (von Uexküll 2010/1934, Reybrouck 2001, 2012, Chemero 2003, Withagen et al 2012). Active exploration of one’s environment provides the information, so perception guides the actions of the organism (Gibson 1979/1986, Greeno 1994, Chemero 2009, Withagen et al 2012).

Recalling the chair example from chapter one (see p. 10), an adult would see the flat surface, and recognize (have the cognition) that it would probably be large enough, solid enough, and, with proper supports, sturdy enough for sitting on. The same characteristics might be available in a rock ledge along a sidewalk, and be perceived

by an adult to afford sitting, as well. Early in his chapter on affordances, Gibson differentiates between the idea of habitat and niche in talking about environments of subjects. He sets the niche apart as referring “more to *how* an animal lives than to *where* it lives. I suggest that a niche is a set of affordances” (author’s italics) (Gibson 1979/1986:128). The habitat, or the general environment, has a host of characteristics and nuances that are available to the animal world, but only specific characteristics and nuances are recognized by certain species as having a purpose or value to that species, into which that species can fit.¹⁵

Gibson’s approach to affordances was fully developed by 1979, and Norman followed up with his own writing in 1988. According to Gibson, affordances are relative to the inherent action capabilities of an object. For Norman, the design of an object suggests various possible uses; affordances are user-observable and based on both actual and perceived properties (Soegaard 2014). Norman writes from the discipline of design psychology and advocates the use of affordance mapping and identified constraints to design with ease of use for the object (Norman 1988). Harking back to Gibson, Norman agrees that “affordances provide strong clues to the operations of things” (1988:9) and develops his writing around the use of those clues in design.

In his work, Gibson refers to Gestalt psychology as part of his journey to affordances, in part as a way to move into optical information and the optic array system and its part in perceiving action possibilities in the environment (Gibson 1979/1986). Norman incorporates countless examples of good and bad design to help explain such components as mapping, execution and evaluation, affordances, and constraints, but

¹⁵ It is helpful and necessary to remember that Gibson is specifically addressing affordances in the context of visual perception. However, in the absence of light the flat surface, strong support, and solidity of the chair do not change; the aspect of affordances is not dependent on the subject’s ability to see the chair but is inherent in the structure of the chair.

seems to have assumed that a certain knowledge of psychology would already have been in the language of the reader. Norman's book has been used as a text for Professor Jan Borchers' "Designing Interactive Systems" at the Rheinisch-Westfälische Technische Hochschule (RWTH)¹⁶ in Aachen, Germany (see link in footnote), and Borchers spent the entire two hour and twenty-minute class time of the second session introducing Gestalt psychology and laws as a precursor to Norman's "The Design of Everyday Things".

2.3.12 Norman and mapping

Among several aspects of design psychology introduced by Norman and expanded by Borchers is the idea of mapping, which is using natural relationships or physical similarities among objects to create an ease of flow or obvious pattern of execution (Norman 1988). He suggests the possibility of at least four different types of mapping; spatial, cultural, biological, and perceptual, and gives illustrations of how each feature might be used as a design element to aid the user in completing an action.

Spatial mapping can occur, for example, when the design of an array of light switches is configured to match, as closely as possible, the location of each light controlled by the switch. The ideal layout, according to Norman, is to have the switch plate on a horizontal plane, with each switch located on that plane in a small facsimile of the room. While the protruding switch plate may present a problem by being an obstacle to walk around, it provides the purest spatial representation for the light controls.

¹⁶ Borchers has produced a variety of podcasts under the "Designing Interactive Systems" label through the past several years. This link is to one specific episode from the 2010/11 series: <https://itunes.apple.com/us/podcast/designing-interactive-systems-i-10/id390393723?mt=2&i=1000411344813>

My wife and I experienced this form of spatial mapping in the construction of our new home; the standard for electricians in new home construction in the United States is to put the switch that controls the overhead light fixture first in the line, so that when one enters the room, he or she can tap the first switch and get the main light. In several locations throughout the house, we have switch plates with two or three different switches, and in almost every case, the switch closest to the door as one enters is the switch that will turn on a light in the room. This simple example of the application of spatial mapping illustrates the use of affordances in electrical design engineering to reduce the thinking required to execute a task, building efficiency into the product through design.

2.3.13 Mapping and chord structures

Mapping provides a way to utilise the affordances of an object or environment more efficiently, and a well-designed feature will almost naturally guide the user in how it is to be used. In this research, there is an underlying assumption that mapping plays a large part in how affordances inherent in specific chord structures are promoted or put into action using spatial mapping, possibly even biological mapping. The intent is to show that Tomlin's chord structures draw from the Gestalt law of proximity and Norman's spatial mapping by keeping certain fingers in close relationship with each other, minimizing motion required by the guitarist to execute the chord changes in question. The law of common region is the Gestalt principle that humans group elements based on their direction and proximity, another feature of Tomlin's chord structures and one that uses biological mapping. A case could even be made for cultural mapping if one allows for the collective identity of contemporary evangelical

Christians to be characterized as a culture. That idea, however, is beyond the scope of this research.¹⁷

Bringing the discussion back to the second of the original examples, observing the placement of a door handle on a door as one approaches it, one can see Norman's design concepts in full display - physical positioning of the handle is a constraint that suggests an affordance through location; the handle is typically placed on the side of the door that opens, and not on the side that is hinged, so one knows to which side he will pass through. The vertical handle suggests an ability to grasp the upright handle with one's hand, almost like shaking hands with someone, which is logical. Both instances provide signals (visual cues as to how to position one's hand) and messages, or affordances, as to the appropriate action to be taken ("push me" for a horizontal bar, "pull me" for the vertical bar).

2.4 MUSIC, COGNITION, AFFORDANCES

Chapter One laid out a preliminary argument for the incorporation of affordances study within music scholarship, and the section immediately above provided a quick glimpse at the new directions of current scholarship regarding cognition and affordances. Bridging the gulf between early affordance theory and current studies includes researchers such as Rowlands, Chemero, and Heft, with help from scholars like Mark Reybrouck, to complete the crossover into the world of music. Recent studies show how the language of affordances has evolved to embrace more current thinking and models of perception (Krueger, Windsor, Yim, Reybrouck, et al.).

¹⁷ Norman adds other ideas into the world of design, concepts like the Gulf of Execution and Gulf of Evaluation, constraints and a feedback loop, but exploring all of the relationships available through Gestalt theory and Norman's understanding of affordances is the stuff of later research and could fill several large volumes. It is important, though, to grasp Norman's idea that good design sparks memory (1988).

2.4.1 Steps in time, or transitions

Early concepts of affordances came out of Gibson's work, which deals mostly with visual perception; his studies in perception involve what he describes as the optical array, discussed earlier in this chapter. Norman offers a way to incorporate the idea of affordances into the world of architectural design, but that design is generally about visual representation; he does, however, offer evaluative structures such as mapping and feedback loops in addition to design concepts. Heft, among others, builds a framework for sense-making as regarding the mental processes that take place as one interprets a sensory input with respect to seeing the features of an object (or phenomenon) according to the functional usefulness of the object.

The last century saw a move to study music in cultural settings, or ethnomusicology, recognising commonalities of behaviour as related to music, and to the sound itself. This conceptualising about music went beyond the basic discussions of theory (in the musical sense...harmony, melody) and history, and research began to look at music as sound (Solis 2012). Researchers extended musical study to include the psychological frameworks, creating tools for interpretive study. "Theory and analysis are interpretive endeavours that move well beyond the statistical description" as basic music theory is integrated into ethnomusicology (ibid.: 533).

Research for this project began by exploring music theory, or more specifically the lack thereof, involved in the chords of Chris Tomlin. As the research progressed, there was a shift to mixing music theory and cognitive development in terms of affordances in chord structures. Finally, as a case study of the music of Tomlin, there is an element of a specific Christian subculture that surrounds his music in terms of sonorities, text, and context of the performance. It is beyond the scope of this paper to address the

subculture in any depth other than to recognise that an analysis of the music reveals its individuality and at the same time its commonality: the uniqueness of Tomlin within the Contemporary Christian Music subculture and the commonality of his songs as a body of work.

As the study of music intersects with the study of cognition and affordances, it is helpful to recognise that music is a powerful tool for guiding cognitive processes in that it can elicit certain emotional or behavioural responses, that it involves sense-making and reactive behaviour, and that it is grounded in biology and our cognitive abilities (Reybrouck 2012, Reybrouck & Eerola 2017). Music takes advantage of the ecological approach to perception in that when viewed as a sound environment, it provides information for the cognising organism (Windsor & de Bezenac 2012). A cognitive approach to psychology focuses on the internal processes and mechanisms that process sensory information, and an ecological approach prioritises the relational qualities in music perception and action, highlighting the active nature of musical participation and interpretation. This relationship stems from the interactions that occur in the sounding environment, interactions between the musicians, various instruments, the environment of the sounding, and the listeners (ibid.).

The ecological approach, in opposition to Cartesian cognition, contends that perception uses information contained within the environment. Luke Kersten differentiates between wide and narrow computational systems in much the same way. Narrow computational systems hold that the totality of the processing takes place in the head (the traditional, Cartesian view) while wide computational systems include the environment (Kersten 2014). Considering the wide computational system, the

organism is embedded in an information-rich environment and the computations extend beyond the head.

Ecological perception has primarily been studied as regards visual stimuli, as in Gibson's optic array (Gibson 1979/1986, Reybrouck 2012), and music perception involves the detection of musical invariants within the acoustic array, much like detecting invariants in the optic array. The acoustic events constitute sonic environments, and the interaction between the auditory system and the musical invariants takes place in the context of a wide computational system; music perception, therefore, is extended (Kersten 2014).

Wide computational systems are yet another way of discussing the elements of cognition, incorporating the Umwelt or niche of the organism. Reybrouck establishes the sounding environment as an Umwelt in the music world (2001, 2005) showing that organisms or animals perceive the environment and the objects of the environment as affording something for the doing of a particular behaviour, not for their objective perceptual qualities (Reybrouck 2005, Lopez Cano 2006) but filled with subjective meaning (Reybrouck 2001). There are functional relations between the human and the sounding environment, relations that are significant for action possibilities.

These functional relations (Reybrouck 2012) are musical affordances that have a productive aspect that goes beyond the hearing level to a motor intention level. This contrasts with a motor behaviour, where the organism responds or reacts to the sound. In a functional relationship, objects are experienced in terms of their functional significance, demonstrated as a "for + verb" equation, or activity signature, as in "a surface is for sitting on". Motor behaviour related to specific actions helps, then, to

define that action more clearly (Reybrouck 2001, von Uexküll 2010/1936). The affordances derive value from the associated functions (Windsor 2004), and these functions move the organism toward specific action consequences because of the relationship and interaction between the organism and the environment (Clark 2005).

There were a few challenges faced by early researchers attempting to tie cognition and affordances to the discipline of music, one of which was the vast array of possibilities regarding affordances. Reviewing material from Andy Clark, Reybrouck, and Windsor, Ruben Lopez Cano (2006) offers several examples of the application of affordances language, such as Clark's "music affords dancing, worship, coordinated working..." and charges both Clark and Windsor with not only not specifying what a musical affordance is, but also not clarifying what it is not. "In effect, therefore, the said authors consider that any action can be deemed an affordance of music" (Lopez Cano 2006:3). Also, music holds the position of being a noun, as in a piece of paper with notation to be evaluated, or the auditory object of one's listening attention. Therefore, music needs to take on the nature of a verb and encompass the idea of the performance; hence the introduction of the word (and concept) of "musicking" (Small 1998, Krueger 2011a, Ryan & Schiavio 2019). Christopher Small outlines five ways that humans are involved in the acts of musicking, including performing, listening, rehearsing or practicing, composing, and dancing (Small 1998). Affordances could be described, therefore, as being related to the sonic aspects of the music...how we listen, or musicking (Lopez Cano 2006).

The application of affordances to music has in practice taken a variety of directions. Early on Eric Clarke, referencing Gibson, makes the case that music affords activities of a tangible sort (Clarke 2005). These activities are the result of interpretations that

were borne out of the affordances in the music, and these interpretations serve to make music perceptual and cognitive. For Clarke, the notion of affordances is essentially reduced to the action of evoking or eliciting a certain activity from the listener (Clarke 2005, Menin & Schiavio 2012). Reybrouck touches on this when speaking about experiential realism, explaining that cognitive activity is in the embodiment of the actor and a specific context of activity, making the sensory and motor processes inseparable (2012)

2.4.2 Reybrouck and Krueger

In much the same way that this chapter has included an inordinate amount of information generally suited to psychology, it is necessary for Reybrouck to put forth a basic understanding of cognition and affordances to set the stage for his main effort

to apply this conceptual framework to the process of musical sense-making which involves the realisation of systemic cognition in the context of epistemic interactions that are grounded in our biology and possibilities for adaptive control. (Reybrouck 2012:391)

Reybrouck and Krueger both recognise the application of affordances as having been administered specifically in the realm of the visual sensorimotor apparatus and address their different works toward expanding the affordances debate to embrace aural perception. For his part, Reybrouck situates the observer/listener in what he identifies as experiential realism, where the activity of cognition takes place as an interaction between the actor and the specific context of the activity, or environment (Reybrouck 2005, 2012). In this case, the actions of the sensory processes are inseparable from those of the motor processes; he assigns an attribute of inductive power to the actual music, but in the sense that it involves the observer/listener's sense-making and reacting. This power is "grounded in ... biology and our cognitive abilities" (Reybrouck 2012:392). Musical affordances, those affordances that are

based in the hearing and perceiving of the sounds of music, are productive aspects that can shape the motor intentions of the listener, rather than merely directing motor behaviour (Reybrouck 2012).

The essential arguments of Krueger, Reybrouck and others who would seek to move the concept of musical affordances into the arena of aural sense-making do have their places in the discussion. And if this research was attempting to enlarge the understanding of what makes the sound of open chords as used by Lake, Baloche, Tomlin and many other artists so popular in the aural spectrum of today's musical sound, these authors would provide substantial theoretical and empirical support. However, this research is designed to specifically explore chord structure affordances in a physical, touch-sensory oriented capacity, and to that end the early part of Reybrouck's work is most relevant.

In his introductory material, Reybrouck brings together several disciplines of cognitive theory to lay the groundwork for his thesis: experiential realism and embodied cognition, and circularity from the field of cybernetics are two of those disciplines. Circularity is the idea that perception and action are linked in a process that involves sense-making and interaction with the environment (Reybrouck 2005, 2012). Much like Norman's feedback loop, circularity has the basic constructs of adaptive behaviour as the sensing agent, or observer, interacts with the environment. Those four basic constructs identified by Reybrouck as central to that adaptation are perceptual input, effector output, central processing, and feedback (ibid.).

Applied to the process of learning a series of guitar chord structures, the observer, or in this case the guitar player, learns the structure of the chord, learns the structure of the next chord, then implements the transition between the two chords. Affordances

within the structures of the chords can factor into the release or inhibition of the transition process, depending on the complexity of the chord structures involved. This research hopes to show that the Tomlin chord structures offer quick, short circularity in the cognition process (the chords are easy to connect), whereas the cognition processes involved when using standard chord structures have characteristics that inhibit quick transitions.

Krueger develops his discussions of affordances as being related to the sonic world (Krueger 2011a), which as a musical environment had the capacity to be comfortable or stressful. Although he does not invoke experiential realism in his research, Krueger works with the concept that music interacts with the listener and can guide, or push, the listener to certain behaviours. He maintains the ontological assumption that the music/perceiver relationship is interactional, and both the quality of the music as environment and the actions of the perceiver work together to provide the affordances for specific actions (Krueger 2011a, 2011b), creating an activity repertoire (Krueger 2011b). This puts affordances as pertaining to musicking in the physical realm, i.e., a guitar neck is viewed as grip-able, and the related fingering goes beyond the concept of grip-ability.

Support for his notion comes through the evaluation of research regarding deep listening, or “listening in a voluntary mode of sustained perceptual focus and affective sensitivity” (Krueger 2011a:67), as well as the observations of responses by neonatal infants to sounds, and specifically music (Krueger 2011b), where specific qualities about the sounds or music that the listener is hearing are discerned in the relational, auditory actions between the sounds and the listener. In other words, the environment is considered to be the quality of a piece, and the perceiver brings certain abilities or

skills to the musicking process (ibid.). Another example of how the music can push a crowd directionally, so to speak, is his reference to crowds of concertgoers hearing the opening strands of a song and responding with enthusiasm in anticipation of the song to be heard (2011a).

Expanding this concept of extended cognition, that “vehicles of cognition need not be confined to the head” (Krueger 2014:5) but that musical affordances can be considered structural information in the environment, Krueger embraces the idea of affective synchrony to arrive at musical offloading. In the first chapter it was established that research shows the power of music to be able to elicit certain behaviours through various neural processes, and Krueger draws the circle bigger by suggesting that individuals can exhibit features of affective synchrony by, for example, combining in synchronized movement, moving as a group with the music: “we feel certain movements to be more contextually appropriate than others” (ibid.:4). He suggests, too, that the responsibility of affective synchrony can be offloaded onto the music through musicking entrainment (musicking is Krueger’s way of expressing the action of listening to and being involved with music). This offloading is a way of exploiting the environment of the observer/listener/musicker to reduce the cognition workload. In this way, too, the organism is exploiting the environment for the purpose of advancing behaviours (ibid.:3).

Music functions in tandem with the musicker in a way that has the capacity to regulate reactive behaviour. The circular process, extended in experiential realism, provides feedback - the listener can respond to what is being heard and can regulate a behaviour accordingly. This provides an external regulative function, as it were, that is present in the music. “Rhythmic structures...keep time for the listeners and contour the shape

of musically induced bodily expressions and movement patterns that propel them through strenuous activity” (Krueger 2014:6). The musical affordances invite different forms of musical engagement and are action possibilities in an organism’s environment that are specified relationally (Krueger 2011b, 2014). These affordances are 1) structural features of the musical environment, and 2) extended to the sensorimotor capacity of the perceiver/listener for detecting and responding to these features. Musical experiences are enactive and multimodal, and they integrate perception and action in performance settings, including the listening setting (ibid.).

This very brief distillation of both Reybrouck and Krueger is intended to illustrate the application of the concept of affordances to the sonic aspects of music and its attendant aural perception and cognition. The notion of musical affordances being active within the context of the sonic environment is not without its detractors. There is a sense that the commonplace view for musical affordances is that music can move emotions and bodies (Windsor & de Bezenac 2012, Lopez Cano 2006). These body activities under consideration as affordances of music (Lopez Cano 2006) fall into two broad categories.

The first category encompasses the manifestation of motor activity; the visible, external movements “that each segment of music allows us to execute along with it while we listen” (ibid.:6), with those movements connected to the audiation of the music. The second broad category involves the non-visible corporal activities referred to as covered motor activity (ibid.) in which virtual motor and kinetic reactions (to the music) appear as real motor activity. These activities, via corporal extension, are experienced beyond our space into imaginary space via the sonic environment.

Various actions attributed to music affordances include mood modification (DeNora 2000, Sloboda & O’Neil 2001, Windsor & de Bezenac 2012), action readiness, including combat, erotic encounters, dining out, studying (see above, plus Krueger 2014), and affective synchrony or entrainment, where two independent processes synchronise, adjusting and locking into a common phase (Clayton et al 2005, Will & Turrow 2011). By allowing the rhythms of a certain piece of performed music to draw certain felt responses out of the listener, he or she is participating in musicking, and the performer allows the offloading of entrainment onto the musical environment (Krueger 2014).

In the preceding examples, the question of affordances in music focuses on the role of the body and its motor knowledge, and the organism engaging in the process of perceiving the music and giving sense and meaning to that perception. Affordances, Menin and Schiavio proposed, are “propert(ies) [sic] of the intentional relationship between musical subjects and objects” manifested in music as pertaining to the motor repertoire of the listener (Menin & Schiavio 2012:209). The sensory motor process of putting the hand to the strings highlights the musical affordance, which is a “sub-cognitive, pre-linguistic, intrinsically motor form of intentionality” (ibid.:210).

A skilled guitarist might be unable to say where to put her/his finger to perform a solo, but s/he can use the motor knowledge of the fingers to reconstruct the actual set of notes played, by just putting the hand on the strings. (Menin & Schiavio 2012:210)

Affordances are not fixed, however, but are manifested in the mutuality of the organism acting in the environment, creating an agency relationship between the two (Windsor & de Bezenac 2012). Music, through affordances, can regulate reactive behaviour, working through a feedback loop, as in the way one uses intense workout music as an external function regulator (Krueger 2014). At the same time the identical

musical structure may elicit different responses from various organisms, and those responses may be based on the environment of the organism.

In the workout music illustration, the person essentially offloads onto the musical/rhythmic structure the management of time (or tempo), allowing the music and rhythm to “keep time for the listener and contour the shape of musically induced bodily expressions and movement patterns that propel them through strenuous activity” (ibid.: 6). In this research, the physical structure of the chord is considered to act in the offloading of responsibility for facilitating swift chord changes to the positions of the fingers in the chord construction.

Gibson holds that affordances are what we perceive, not events or objects (1979/1986). Later development of the cognitive processes frame affordances as properties of “an event or object, relative to an organism, which represents its potential for action” (Windsor & de Bezenac 2012:203) through the pick-up of structural information, with the discovery of this structural information coming through active exploration of the object.

Extended cognition, as it pertains to the musical/sonic environment, is developed in the relationship with devices and environments that come together to create musical behaviours (Schiavio et al 2017). These relationships are not confined to processes in the head (Krueger 2014) but are a function of integrating biological capabilities with the external resources available in the environment. This extends our function to interact with the sonic environment. Some structures of music make the sonic environment an event that elicit specific forms of interaction and motor entrainment, with some movements or actions that are more appropriate to specific contexts than

other movements or actions; all part of Krueger's hypothesis of extended cognition (see above, and Krueger 2014).

An embodied approach to music cognition considers musical objects as entities that are constituted within the intentional motor-based relation that defines a musical context (Menin & Schiavio 2012). In this musical context there is a situatedness of musical affordances. These affordances are embodied in the interactions between the body, the brain, and the world (Schiavio et al 2017); they arise from the bodily interactions with the environment (Menin & Schiavio 2012). Recall that embodied cognition relies on certain features of the body interacting with the environment to enable cognition, i.e., the spatial distance and placement of human ears on either side of the head affords directional awareness and location of sounds. The directional sound experience comes from particular perceptual and motor capacities that are inseparably linked. For embodied music cognition, the bodily features form a framework for scaffolding meaning, or emotion, or other aspects that are part of the sonic environment (ibid.). Huron and Berc used the language of idiomaticity in ways that reflect the principle of embodiment.

2.4.3 Huron and Berc

In their work on applying affordances to the music field, Huron and Berc (2009) frame the concept of affordances as a reshaping of idiomaticity by comparing the fingering patterns of compositions written for trumpet from a variety of angles. At the root of their work is the assumption that certain instruments are designed in ways that make them especially suited for specific sounds. Examples they use are of the trumpet making the sound of a neighing horse in Anderson's 'Sleigh Ride' and the smooth

glissando afforded by a trombone slide as opposed to a valved instrument or piano glissando.

Essentially, Huron and Berec consider musical patterns in a variety of compositions with respect to the fingering on the trumpet necessary to accomplish specific passages and attempt to discern if there are some passages that have built-in affordances that allow for easier execution of the passage. Their findings show that some passages written by composers who play the trumpet do, in fact, offer easier paths to being played than compositions written by non-trumpet players. They also found that playing learning exercises written by trumpet players provides a scaffolding for later learning of passages within compositions written by the trumpeter (in this case, Herbert Clarke, a trumpet player with the John Philip Sousa band).

As a result, they were able to determine that there are properties of musical instruments that suggest certain modes of interaction, or that encourage certain musical functions (Huron & Berec 2009). These properties, or instrument capabilities, can be viewed first as opportunities to the performer, and second as limiters (for example pitch and range are fixed for the trumpet, and the performer cannot play beyond a certain range). The aim of their research is to study the physical and kinematic aspects of an instrumental performance as it relates to the organisation of specific musical works (ibid.). It is further shown that the ability to play specific patterns related to that idiomaticity are related to the specific upbringing or experience of the individual player (Gjerdingen 2009).

Krueger relates the performer-instrument relation as framed in idiomaticity to the listener-music relation, as the two systems (performer-instrument or listener-music) allow for the development of agency within the integrated system (Krueger 2014).

Agency can be heightened in the performer as he or she is learning to play a particular instrument, learning passages, fingerings and note sequences (Pacherie 2013) and the perceptual experience increases through having and using those body skills (Ryan & Schiavio 2019).

Embedded cognition is understood within the context of the environment (Schiavio et al 2017). Affordances in the music environment have a relationship with behaviours that comes from fittedness and compatibility (Heft 1989/2007).

2.4.4 Gjerdingen

The idea of connecting writing on affordances with writing that capitalizes on the idiomatics of an instrument has merit, but also presents some other challenges in its construction. Gjerdingen (2009), responding to the Huron and Bercé piece, suggests that in addition to the actual affordances in the construction of the composition, there is value in having familiarity with the object on some level. Someone who studied the trumpet, and more specifically studied exercises written by a trumpet player-turned-composer, would recognize, or have access to, information already stored in his or her repertoire of capabilities.

This previous exposure could be construed as having paid a price, so to speak, to gain those specific affordances, and as he expands this thinking, Gjerdingen postulates that there might be what he calls first order and second order affordances. As an application of Gjerdingen's concept, for someone like me, a hack trumpeter who only plays simple melodies without written music, the affordances may be in the piece, but not too obviously. If I were to spend a year studying the exercises of a master like Herbert Clarke, then the composition might just roll off my fingertips due to their second order nature.

Applying the idea of first and second order affordances as a guitarist, if the student has not encountered a specific chord change, playing the chord change for the first time would be a first order process. However, once the player has obtained a certain level of proficiency in certain chord changes, interpolating those changes into another chord progression is a simpler matter.

The first sub-question in this research asks, “do the chord fingering patterns in Tomlin’s music reflect the use of a wide array of chords?”, implying that there is a possibility that is not the case. As someone learns a given set of chord progression changes, those changes move from being new to the player to being a stock part of the player’s available repertoire of actions. In the case of music written by the comparison artist Paul Baloche, his chord progressions changed over the years, showing a development process and expansion of his chord fingering configurations; Tomlin’s progressions do not show the same propensity for different structures. To gain the second order affordances present in the music of Baloche, one would have to learn some new chords and structures.

2.4.5 Yim

Referencing some of the work done by Huron and Berc, Yim applies the idea of perceived affordances in his work on guitar chord transitions. His idea is that there are specific physical attributes of the guitar that lead to an easier rendition of what he calls affordant harmony as compared to functional harmony. Yim theorizes that affordant harmony is more prevalent in a chosen corpus of songs than functional harmony, and that this prevalence is due to an ease of chord transitions from one chord to another.

He holds the opinion that certain factors allow for this disparity; structures of both the instrument and the chord configurations offer certain constraints to chord changes, and some changes are easy to make on a guitar due to the instrument's topology, making those chords predominant in usage (Yim 2011). Also, there are various barriers to playing easily that get in the way.

Among those barriers identified by Yim are things such as the use of a barre chord vs. an open chord or chord in first position, the position on the neck where the chord is fingered, the training of the performer (Yim cites the work by Gjerdingen on first and second order affordances in support of this point but does not discuss second order affordances in his work), the model and condition of the guitar, whether the guitarist is plucking the string or strumming, and whether the guitar is tuned in standard tuning or alternate tuning. It was hoped that the work done by Yim might offer some helpful constructs for this research, and there were some things that proved helpful, such as the factors in determining difficulty in chord production and performance, just not any help regarding the ease of transitions.

One of those helpful processes from Yim is his identification and use of a specific body of work to analyse. He utilizes a corpus study process introduced by de Clercq and Temperley (2011) that focused on a group of songs identified as the top songs in a specific genre of music, albeit through not a particularly scholarly process created by Rolling Stone Magazine. De Clercq and Temperley's work is a study done on aggregated chords and chord transitions, and it serves to point out various symmetries in most of the songs in their study. Yim narrowed their corpus of works from around 500 to a little less than 200, specifically those works written by guitarists.

It is important to note that the work of Yim deals generally with numbers, chord patterns, and theory, rather than the specific chords involved in playing the guitar.

Early on, he sets up the chord discussion with this thought:

“Affordant chord transitions” are those chord sequences which may be influenced by the fact that certain chords are easier to play relative to other chords, and certain chord transitions are easier to play relative to other chord transitions. (Yim 2011:3)

Yim immediately follows that statement by offering the chord structures that he is using for his study - the standard fingering for first position C major, G7 major, G major and D7 major chords, played with standard tuning. Later analysing his work, Yim suggests that it might be a useful tool for someone to develop a study of the actual performance difficulty for chords, possibly by constructing a model that would be used to determine the performance difficulty of a chord sequence, and then solicit guitarists to rate the degree of difficulty for each transition (2011). This process is not dissimilar to that of Huron and Berc in setting up their work on trumpet fingering and affordances, and provided a starting point for this research on the guitar fingerings of Greg Lake, Paul Baloché, David Gungor, and specifically, Chris Tomlin.

2.4.5.a Yim's Four Studies

The focus of Yim's research lays in the contrast between what he labels functional chord transitions and affordant chord transitions. Comparing the two, he distinguishes functional chord transitions as those based on tonic-directed motion, relative to a specific key, and containing transitions that are specific to the basic harmonic functions of the chords. For these, he adopted the Roman Numeral Encoding (RNE) process. Yim incorporated Letter Name Encoding (LNE) for the affordant chord transitions, primarily because the LNE is generally specific to specific chord structures corresponding to chords on a guitar with standard tuning. It is his

assumption that the use of specific chord progressions minimizes the technical difficulty of chord changes for the guitarist (Yim 2011).

As the driving force for his work, Yim asks the following question: “What is the relationship between the affordant and functional factors that affect chord transitions in popular music?” (ibid.:10) He then breaks the work down into four studies. Study one is a comparison of contributions of affordant as opposed to functional chord transitions, and in this regard Yim does not find sufficient statistical differences between the usage of one type of chord transition over the other to warrant any conclusion. In study two, Yim applies random transpositions to the songs, re-evaluating his chords. This results in a higher unpredictability for his data set, primarily because the transpositions impact the LNE associated with the songs, but not the RNE (there is no mention that he accounts for the transpositions on the guitar using a capo, which I believe would have negated the effect of the transposition process) (ibid.). Yim’s third study is a comparison of the harmony usage in RNE vs. LNE over time. This study demonstrates that there is, in fact, a significant increase in affordant harmony usage over the period of seventy years represented by the songs in the study (ibid.). Finally, for the fourth study the corpus is reduced from the original 200 songs to 98 works specifically identified as songs having been written by guitarists. The data on these songs indicates that there is a slight increase in the influence of affordant chords, but not a statistically significant one (ibid.).

2.4.5.b Conclusions from Yim

Processing his work, Yim identifies some areas that might have contributed to the results and offers suggestions for further research and development of this area. One of those that particularly struck a chord with me is the observation that if someone is

attempting a chord change study, when the actual chord progression up for examination is specified, that has the potential for bias in the results (Yim 2011). A second area suggested by Yim is the performance difficulty for specific chord changes (ibid.). As previously mentioned, exploring the difficulty of chord structures and chord transitions on a physical level allows a different perspective on the affordances within the chord structures; the perspective that forms the essence of this body of research on the Tomlin chords - looking at the specific performance difficulty of a chord sequence and identifying various aspects of affordances in those chord structures and sequences.

2.4.6 Menin and Schiavio

Recognising the ambiguous definition of affordances, both as introduced by Gibson in its original form and in its various permutations since its introduction in the late 1970s, Menin and Schiavio integrate research from the discipline of neuroscience pertaining to canonical neurons to re-evaluate the actual role of affordances in music (Menin & Schiavio 2012). Recall that canonical neurons are defined as “a set of neurons which discharges when an individual simply observes an object without performing any movement, as well as when he/she grasps that object” (ibid.:203). Menin and Schiavio hold that the relationship should include a consideration of the goal-directedness of an act, and not simply rely on the *possible* interactions that might take place. They argue, in fact, that a given musical affordance serves to “constitute a property of the intentional relationship between musical subjects and objects” (ibid.:209).

This intentional relationship is considered as an acquisition of motor knowledge over a period of experimentations, demonstrated in the sense-making of sounds that a child

experiences in exploring its sonic environment (ibid.), and serves as the “only plausible scenario where musical affordances can be observed in infancy” (ibid.:210). The exploration of these sounds provides structure and a scaffolding to develop a musical context for responding to the sounds. In this sense, the music itself does not offer affordances, per se, but over time the aural qualities become imbued with meaning and consequent actions.

In summary, the original notion of affordances developed from Gibson’s work in ecological psychology and has roots in his work with visual perception and the optic array. Follow-up work by Norman also focused on visual perception and how design interacts with our brains to promote certain activities. Huron and Berc incorporate idiomatic expression from certain instruments to ascribe affordances to musical passages, and Yim attempts to draw connections between the notion of affordances and harmonic progressions. In all those examples, the objects could be ascribed with static qualities, processed as interactions between a subject and its environment, or a subject and object.

More recently, scholarly work combining music and affordances has gravitated to the aural perception of sounds as represented in music, attempting to tie together feeling, mood, behaviour, and sound in a variety of configurations, some of which might be construed as affordances, some may just be representative of the modernisation of what philosophers, theologians, musicians, and charlatans alike have known for centuries - music moves us.

This research does not attempt to keep step with the modern workings of music and affordances but takes a step back to the essential roots and seeks to tie the design of

the chord structures to the ease at which those chords can be transitioned from one to another.

2.5 OPEN CHORD STRUCTURES

The modern classical guitar is said to have been developed by Antonio de Torres Juardo (1817-1892), a luthier active in Seville, Spain during the middle 1800s. The five courses¹⁸ of the chitarra battente from the 1500's were tuned to the notes A2 D3 G3 B3 and E4, totalling five notes using ten strings, two strings sounding each note; the five notes of the chitarra battente coincide with the upper¹⁹ five strings of the modern guitar. Juardo added a lower sixth string E (sounding E2), continuing "the arrangement of perfect fourths" of the chitarra battente three lower sounding notes, and removed one string from each of the courses. Thus, the modern guitar has six strings, tuned to E2 A2 D3 G3 B3 and E4.

For the last century, serious students of the guitar embraced and performed the works of Fernando Sor (1778-1839), regularly performing them on recitals.²⁰ Familiar with violin and piano as well as harmony, Sor composed dozens of pieces for guitar, including his *Studies* which features nearly a hundred different studies dealing with tremolo, staccato, playing in thirds and arpeggios; these studies serve as foundational exercises for the enterprising guitar student, and as such Sor was careful to put in fingerings that were to be used by the student in learning and performing the pieces.

¹⁸ A Course is a set of two strings sounding the same note, placed side by side on the instrument. A modern example would be the 12-string guitar, which has the standard six strings and an additional string beside each of the original; another example is the mandolin, with four courses, or eight strings, two each tuned to the same note.

¹⁹ This is a quick reminder that 'upper' applies to pitch designation; when holding the guitar in a proper position for a right-handed player, the strings actually ascend in pitch as they descend on the guitar neck.

²⁰ <http://www.musicweb-international.com/sor/>

In the late 1900's, an interdisciplinary approach was taken to study the common fingering practices used by guitarists. Following up on research for the violin by Yampolsky in the 1960's, Samir Sayegh (1989) applied a computational modelling approach to determining the best fingering for certain guitar passages. Using the Optimum Path Paradigm²¹ (OPP), Sayegh developed a four-step approach featuring the Viterbi Network system to analyse potential fingering patterns and choose the most efficient path. One of the chief challenges for the process was assessing values of difficulty in playing certain notes; Sayegh created a list of elements including duration, rhythm, dynamics and interpretation as well as location on the fingerboard and the chosen fingering. He also felt that the determination for note selection must consider the harmonic content of the fundamental pitch (Sayegh 1989).

The four-step approach used by Sayegh included 1) the formulation of a problem and how to value the different weights, or list of elements, 2) the application of a Rules Approach, or the Expert System Approach outlining rules for optimum fingering (the first class of rules revolved around ease of execution, i.e. having the hand in the same position and maintaining that position, while the second class of rules was to insure the homogeneity of sound), then 3) the use of the Optimization Approach featuring the Viterbi Network, whereby each transition “is assigned a weight based on the combined difficulty/uniformity of the transition” (Sayegh 1989:77). Following the weighting process, the path of least resistance is determined using the Dijkstra algorithm. Sayegh's article offers two observations about the process. One is that it is possible “to a large extent to capture the essence of good fingering through assignment of the cost transition from one finger to the next, and then seek the global minimum

²¹ The OPP comes from the business world of operations management and is concerned with finding the most efficient process for completing a task, from product manufacturing to distribution paths.

path” (ibid.:78). The other is “transition costs from one fingering to another need not be given individually...” (ibid.). The fourth and final step in Sayegh’s process is the Learning Phase, in which the fingerings are to be learned and applied, and then transferred to other guitar works (Sayegh 1989).

Over a decade later, researchers at the Nijmegen Institute for Cognition and Information added to the understanding of complexity in developing fingering patterns, focusing research on the biomechanics from a motor-skills approach. Hank Heijink and Ruud Meulenbroek (2002) incorporated the use of Infrared Light Emitting Diode IRED technology to trace specific parameters of fingering and its biomechanical complexities. Several variables were identified, including the hand position with three levels of differentiation, hand repositioning with two levels, finger span with 2 levels and the note number with 6 levels. Using a pre-test and post-test in addition to recording the actual IRED tests, Heijink and Meulenbroek determined that participants tended to avoid large finger spans and hand repositioning, and generally used the lower end or left side of the guitar neck when possible. An explanation for their findings is present in the beginning remarks of their paper, that “the results demonstrated that keeping the joints in the middle of their range is an important principle in guitar playing, and players exploit the available tolerance in timing and placement of the left-hand fingers to control the acoustic output variability” (Heijink & Meulenbroek 2002:339).

These research projects of Sayegh, Heijink and Meulenbroek and others conducted since, tend to focus on specific fingering patterns that involve having the subject play one note at a time and an attempt to determine the best path of note choice to play

those notes. Occasionally a researcher might hit upon two simultaneously played notes, but the idea of evaluating chords is not part of this early research.

A short time later, Radicioni and colleagues presented further research on the fingering path question. Building on the work of Heijink and Meulenbroek, Radicioni et al (2004) sought to provide a computational model for fingering based on input of the score, taking into consideration the shortest path (Sayegh's OPP) and segmentation into meaningful phrases (as in Heijink and Meulenbroek) and adding the human element of ergonomics. The researchers recognized that the process is complex, involving philological²² analysis, the physical constraints of the instrument and the biomechanical constraints of the performer. In tests comparing the computational model results with fingering patterns submitted by a professional guitarist, Radicioni and colleagues were able to present the model as a way for guitarists to determine fingering patterns quickly and efficiently for guitar music.

Seeking to refine the computational model even further, Aleksander Radisavljevic and Peter Driessen (2004) introduced the notion of Path Difference Learning into the discussion and provided fingerings by expert guitarists on seven selected pieces. Using a 6-step learning algorithm, they were able to tweak the computational model to achieve fingerings like the expert fingering patterns with a very small margin of error. Their research demonstrated that a computational model could be modified to reflect specific styles of guitar playing (folk, country, Classic) and individual styles (Radisavljevic & Driessen 2004).

²² According to the Merriam-Webster online dictionary, Philology is specifically the study of literary texts and written records, the establishment of authenticity and original forms, and a determination of meaning (Merriam-Webster [Sa]). As applied in this study, philological analysis interprets the sequence of notes according to structural features.

Vladimir Grozman and Christopher Norman drew on a similar algorithm for determining the optimum path and added what they called soft constraints to the cost function determination. Soliciting input from a guitar teacher, Grozman and Norman structured a cost/function set of guidelines designed to compare the difficulty of performing particular fingerings to accomplish certain passages and weighted to produce fingerings that would be most useful for beginning guitarists as opposed to expert guitar players. Constraints included such basic functions as preferring lower frets, avoiding hand position changes and avoiding the use of “the same finger consecutively on two different strings” (Grozman & Norman 2013:12).

Enric Guaus and Josep Llus Arcos (2010) approached the process of determining fingerings from a completely opposite direction; using a capacitive sensor, they captured finger positions for specific composition passages, then collected data about the fingerings being used, hand positions, the pressing of strings and other parameters to determine a prototypical description of common fingerings using this finger movement detection system. They built models from the collected fingerings, then created a pattern for that fingering position based on the models. After analysis of the data, Guaus and Arcos determined that they were able to “detect the left-hand position, based on gesture information, using classification techniques.” With that data, they could analyse possible fingerings and articulations (Guaus & Arcos 2010: [sp]).

The studies cited above centre on the building of finger patterns of monophonic pieces; solo guitar work where one note follows another. Radicioni and Vincenzo Lombardo (2005a, 2005b) continued their research, incorporating a constraint satisfaction problem framework to shift from determining single note fingering to

computing chord finger charts. They introduced biomechanical constraints representative of what can actually be played; “one note per string”, “no overlaps”, “max spans over finger pairs” and the “Barre’ index”. In the application of their search strategy, Radicioni and Lombardo made several assumptions that imply a preference for the computer model to search for the most comfortable fingerings, or those that are easiest to achieve bio-mechanically. Finding that the computation was capable of mimicking with great accuracy what a professional guitarist would do, they then combined the two concepts, creating a model that could determine the best computed fingering for both single-note and chordal passages (Radicioni & Lombardo 2005b).

Using computational models, algorithms, cost constraints and fancy tracking gizmos are practices not specific to the study of guitar fingerings, insofar as musical instruments go. Richard Parncutt (2007) is one of several who have applied the same concepts to the piano, and Gaus has worked with a team from the Music Technology Group to apply computational modelling to the violin. Others (Fiebrink 2004, Huron & Berc 2009) have come up with performance models for assessing difficulty in works for other instruments. In a talk given at the International Symposium on Performance Science in 2011, presenters Eliot Handelman, Andie Sigler and Jean-Benoit Chasles outlined their work attempting to “develop a fully interactive program” using the short-path algorithm and combining it with “other ways of exploring performance possibilities for the string instruments” (Handelman et al 2011:1-2).

The work of researchers Handelman, Sigler and Chasles brings to mind the popular game Guitar Hero, in which the player holds a controller shaped like a guitar and manipulates a lever with the right hand while using the left hand to finger the fretboard

after patterns that appear on a screen attached to the game console, usually a consumer-grade television. Handelman et al have devised a program that suggests, on the computer screen, specific fingerings for designated passages of major violin works. In their presentation, they referenced Peter Williams' argument "that Bach's famous D minor Toccata was originally for violin based on transposition - in A minor it becomes violinistic" (ibid.:7). They follow that by citing Huron and Berec's work with trumpet music and composers writing either idiomatically or abstractly "rather than with an insight into the physicality of the performance" (ibid.).

The work of Huron and Berec can be compared somewhat to that of Sayegh, Radicioni and others in that they were looking for relationships between compositions, fingerings, and playability. The idea that a musical instrument might have certain affordances leading to a more prominent use of specific usages, passages or genres was demonstrated by their research of several compositions, some by trumpeters and some by non-trumpet players. Handelman et al reconfigured the idea of affordances in music:

To put it in our terms: what effect do the physics of the instrument along with the physiology of the player have on the kind of music that gets written? For example, to what extent do the structure and possibilities of the body and instrument manifest themselves in the standard repertory of eighteenth and nineteenth century music? (Handelman et al 2011:7)

Much of the research regarding guitar fingering has been dependent on empirical research methods, and processes of devising algorithms and computational models have provided quantitative data for researchers exploring the complexities of finger spans, lateral and longitudinal movements, placement on the fretboard and other parameters of guitar fingering, both for monophonic passages and chord change structures. Introducing affordances, an area first explored by Norman in design

psychology, provides the opportunity to shift to a qualitative approach, studying the phenomenology of how a guitarist might perceive certain chord changes as being either easier or more difficult to accomplish. And, over the last century, guitarists have expanded the palette of available fingering possibilities for specific chords, adapting the fingerings to meet the demands presented by their specific performance styles. Three such artists are Greg Lake, Paul Baloché and Chris Tomlin, and Tomlin is the focus of the case study that follows.

CHAPTER 3: METHODOLOGY

3.1 INTRODUCTION

The previous chapter provided a literature review on cognition and related concepts arising from the study of affordances, specifically embedded affordances as they relate to music. This chapter details the methods and processes involved in formulating research geared toward understanding guitar chord affordances as used by the case study subject, Chris Tomlin. This research involves several concurrent processes, including a corpus analysis of Tomlin's music and a survey of select guitarists, to provide the best possible understanding regarding those connections between cognition, affordances, and guitar chords (Creswell 2009).

It is helpful to note that research happens in a specific context (*ibid.*), one alluded to in the first two chapters and throughout the work. Briefly, the context for this study derives from my surprise at the apparent lack of musical training found in students at a particular university. Although the returning students were enrolled in their third semester of Theory classes, their level of competence on the basics of the language of music was severely limited; guitar students, for example, could watch a YouTube video and mimic the guitar players they watched, but were unable to pick out a basic tune on their guitars. This research deals specifically with the little universe between the guitarist's head, fingers and fingerboard and the processes going on in that world, but does not extend to music theory, social context, or other broad categories. It is a small-scale study to determine if Gibsonian affordance theories are applicable to the guitar chord structures in question.

Questions were raised about possible reasons for this deficit in music theory language, and there began an effort to explore the possible causes. One reason, it was concluded,

was the simplicity to be found in the construction of music learned by students in their early training. The learning process for new music consisted of finding the desired song on YouTube or Vimeo and watching the musicians to learn the chord patterns. The primary references for the students were songs written by Chris Tomlin, Paul Baloche, Matt Redman, and Michael Gungor. Tomlin, Baloche and Redman all played a relatively limited number of chords and progressions in their music. As before, this research seeks to tie the relative ease of specific chord changes to affordances embedded in the chord structures of the music written by a few popular artists and used by many worship bands in today's contemporary Christian church.

The chapter is organised into four main sections. The introductory section reviews the main questions, the framework, and the research objectives of the study, and elaborates on the semiotics as pertains to chord structures and inline text. The next two sections detail the specifics of data collection for the corpus selection and phenomenology analysis. These sections present information regarding the subjects of surveys, contain the questions and instruments used in data collection, and describe the procedures for sharing data. The final section discusses validation and reliability strategies and outlines possible problems with the research such as missteps, biases and methodological issues.

3.1.1 The research questions

The purpose of this study is to explore chord structures and related affordances that may have contributed to the popularity of music written by Chris Tomlin, who gained widespread influence in the contemporary Christian music movement of the early 21st century. The study focuses on, and attempts to understand in this context, the phenomenology of perceptual factors as filtered through the concept of affordances

applied to chords and chord sequences found in Tomlin's music. As such, it is not a detailed musical analysis of his compositions in terms of Roman numeral harmonic analysis or Schenkerian analysis or any other of dozens of options for musical analysis. And although some beginning guitarists may experience quick results in chord cognition, the creation of a new method of pedagogy is not the intent of this study.

3.1.2 Research objectives

The primary research question is to explore affordance capabilities represented in specific guitar chord structures and fingering patterns. With that in mind, the first objective addressed the corpus and included two major sections: a) a survey of the works of the case study subject, Chris Tomlin, looking briefly at his history and the development of his chord progressions in order to select a representative body of works, and b) to analyse the specific chord fingering structures used by Tomlin in the performance of his music in order to determine whether he uses a basic set of three to four main chord structures, or if he uses a greater variety of fingering structures.

The second objective, designed to address the interpretive phenomenological question, was to ascertain whether there is a perception that Tomlin's fingering patterns offer ease of chording, more so than standard chord structures. This is answered through the chord difficulty survey, which sought to solicit opinions on relative chord change difficulty, as well as interviews with specific CCM artists and a GUI programmer.

3.1.3 Chords, chords and spans, chord changes, and semiotics

A fundamental introduction to chord structures and semiotics for the different chords was presented in the first chapter, which outlined a way of representing the chords

both through the chord chart and in the line of text, following the example of Yim (2011). Moving into the various aspects of methodology it will be helpful to recall some of the specific semiotics used for describing the chords and chord structures, addressing chords specific to the research at hand. Remember the layout of the guitar; with the neck to the left of the player, the lower sounding E string is on top of the others, and with the rest of the strings (strumming downward and in normal, standard tuning) are E, A, D, G, B, and E.

Using the system explained in the first chapter, the representation for fingering of a standard G chord in first position is 3R2M0003L²³. That rendering puts the left-hand ring finger (R) on the low sounding E string (top string) third fret, the middle finger (M) on the A string second fret, the D, G and B strings open, and the little finger (L) (sometimes referred to as the pinkie) is on the high-sounding E (bottom string) third fret. When the fingers are placed in these positions, the notes actually sounded²⁴ are 3R=G2, 2M=B2, 0₁=D3, 0₂=G3, 0₃=B3, and 3L=G4, and if it helps to think in names or scale tone numbers, then again from left to right: tonic (1st), mediant (3rd), dominant (5th), tonic (1st, one octave higher), mediant (3rd, one octave higher), and tonic (1st, two octaves higher).

Figure 3.1.1 shows the different fingering structures found in the chords as played in a standard position, in a Tomlin formulation, and using the Baloché fingerings (the F chord is not represented in this chart, nor is it used in the body of research).

²³ Many guitar chord books show two variations for the standard G formation, one of which is used here. The other configuration is 3M2I0003R. I find that to be an even more difficult and less useful variation than the standard formation used in this research.

²⁴ The sounding pitch of notes is frequently aligned with the piano keyboard, in which the middle C is labelled C4, the A to the left is A3. G2 is an octave and a half below middle C.

Chord	A	B	C	D	E	G
Standard	002I2M2R0	X2I4M4R4L2I	X3R2M01I0	X002I3R2M	02M2R1I00	3R2M0003L
Tomlin			X3M2I03R3L	X002I3R3L		3M2I003R3M
Baloche	07R7L6M00	09R9L8M00			02R2L1M00	

Figure 3.1.1 Fingerings for chords

Going forth, the chords will be represented by shorthand designating the person or style followed by the chord letter name. Therefore, the Tomlin structure for the C chord will be labelled TC, whereas the standard structure for C will be SC. Because Baloche starts with a “B”, and the B chord shows up in the research, his structure will be represented with a “P”, from his first name, Paul; hence, PA for the Baloche structure of an A chord. Note that there are only three variations of the Tomlin structures in this research, although he has occasionally used a variant of Em with fingering X2I2M03R3L. With that in mind, the different structures will be represented with:

Standard chords: SA, SB, SC, SD, SE, SG

Tomlin chords: TC, TD, TG

Baloche chords: PA, PB, PE

All the chord representations are shown in first position, with the chord structure in the first three frets, except for the Baloche chords, which also happen in frets six through nine. Research will show that Tomlin uses the same patterns and modifies his song keys by using a capo to effectively move the nut of the guitar neck to whatever position fits the key, then enlists the same patterns for his chords.

Characteristics of guitar chord fingerings and the changes that occur in the placement of fingers when making the switch between two chords are broken down into specific challenge sections or parameters, after the fashion of Huron and Berec in their trumpet fingering study (2009). The first parameter is the movement from one chord to another, or generally the speed and effort needed to make the change. Some chords are fairly close to each other on the fretboard, with the result that the movement from one chord to another is at a minimum.

On the other hand, some chord changes require several mechanical shifts to be made to move from one chord to the next, whether in finger positions or fret location. An example from the study is the change from the standard fingering for an “E” chord (SE), represented here as 02M2R1I00 (Figure 3.1.2), considered to be in first position, as it is played on the frets closest to the headstock. A shift to the standard “A” chord (SA), 002I2M2R0 (Figure 3.1.3) requires very little movement, as the two chords are both in first position and fingers land in places relatively close to where they started.

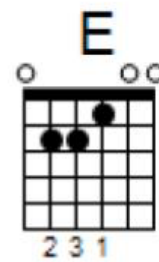


Figure 3.1.2 Standard E

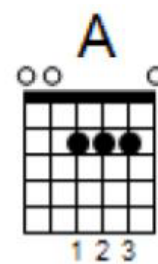


Figure 3.1.3 Standard A

However, shifting from the SE to an SB X2I4M4R4P2I (Figure 3.1.4) requires the hand to move up the string two frets to third position and adjust the fingers both laterally across the strings and longitudinally on the string. The movement from the SE chord to the SA chord requires essentially one shift (fingers, lateral) while the shift from SE to SB necessitates two shifts, the fingers (lateral) and the fret position

(longitudinal). It stands to reason that the second shift is more difficult to manoeuvre than the first. The first parameter, therefore, is a general assessment of the degree of difficulty in executing the chord change.

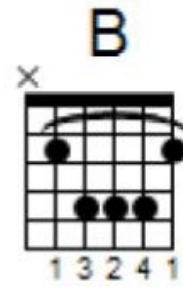


Figure 3.1.4 Standard B

The second parameter involves the action of shifting fingers laterally on the fretboard from one string to another. Lateral movement implies that a finger is placed on one string on a specific fret, then for the next chord moves to another string, whether on the same fret or not. This can be illustrated using the same chord shift as the previous parameter; playing the SE chord requires the M finger on the A string, second fret and the R finger on the D string, also second fret. Moving to the SA chord, the M finger shifts same fret, one string, to the D string, second fret, and the R finger moves from its position to the B string, second fret. These are both lateral movements that require the fingers to shift strings but maintain the same fret position.

In another example, an index finger placed on the second string, second fret (A2I) might move to the fifth string, first fret (B1I), skipping over two strings in the process. That would constitute a more difficult lateral move than shifting to the adjacent string with the same finger (D2I). And to the novice guitarist, the shift might also require visual tracking in the first case, whereas the second shift might come quickly to the student.

Included in the previous example is a shift for the index finger from the second fret to the first fret. That leads to the third parameter, the longitudinal, or horizontal, shifting of the left hand up or down the fretboard. Typically, chords played in a

constant position, as in first position, will not require much longitudinal shifting. An example of that would be moving the fingers from an SG chord in first position, 3R2M0003L to an SC chord in first position, X3R2M01I0, where all the chord is within the first three frets from the nut. In this case, the ring finger moves from E3 to A3 for no movement along the string whatsoever, only lateral movement. Chords requiring movement to a different position, such as the SE - SB shift described earlier, frequently include longitudinal movement and are perceived to be more difficult to execute. The movement of the ring finger in that shift is from D2 to G4, both lateral and longitudinal.

The above-mentioned parameters: 1) the degree of difficulty in executing chord changes including speed and effort, 2) the lateral movement of the change, and 3) the longitudinal movement of the change are part of the analysis process used when looking at the shifts in finger placement on fretboard by guitarists. Following the example of Huron and Berc (2009), the list of parameters was evaluated by guitar faculty and students, who rated each of the parameters on applicability to the chord change problem. It was determined that the parameters included enough mechanics in chord formulation to lead to significant evaluation of the difficulty involved in performing different chord structures.

Processing the compositions through various keys and tempos, Huron and Berc determined that there was a case for the idea that some compositions written for instruments work best at specific keys and tempos, and that composers who are familiar with an instrument might write music that is more idiomatically appropriate to that instrument, drawing on what could be considered the affordances embedded in the instrument fingering patterns (Huron & Berc 2009). This study also considers the

idiomatic aspects of the fingering patterns but narrows the scope of chord changes down to basic chord changes, focusing on the shifts between six total chords.

However, whereas Huron and Berec went through a process of having test subjects play the various compositions in different transpositions and at different tempos, this study uses a heuristic questionnaire instrument created to assess the ease of using progressions as structured by Tomlin as opposed to progressions using standard chord structures. For the questionnaire purposes, the chords are not identified as Tomlin fingering or standard fingering.

This chapter looks first at the procedure for determining the corpus for the case study, then moves to the phenomenologically evaluative instruments that build the relationships between music, chord structures, and affordances. It concludes with a brief examination of strategies for validation and reliability, as well as problems arising from various aspects of the research, data pool, and processes.

3.2 CORPUS SELECTION

This section describes the methodology used to arrive at the material for the corpus study, following corpus analysis after the fashion of Huron and Berec (2009). Yim (2011) borrowed from the corpus described by Huron and Berec, with modifications appropriate for his research. Normally, the subject of a survey is humans, but in this case, the sample surveyed is a particular body of work. The probability sampling process established a stratified sample (Creswell 2009) based on songs and specific artists associated with the Christian Copyright Licensing, Inc. (CCLI) company. The corpus selection includes a survey of a particular body of work, or corpus analysis (Creswell 2009) dealing with various documents, videos, and charts as the ‘subject’ (Rudestam & Newsom 2007), selected in support of specific purposive material.

3.2.1 Subjects

As the main licensing body for musical works generated for and performed in primarily Protestant and Evangelical Christian churches, CCLI is well-served with data indicating what songs have been used consistently over a period and how well particular artists' songs have performed in the church worship marketplace. Data is collected through the reporting activity of member churches and organizations; every two years, member organizations are required to submit a list of songs used over a six-month period through the CCLI Online Reporting software known as CCLI Copy Reports. Information gathered through these reports is primarily used to determine royalty payments to composers and is also compiled and reported on the companion SongSelect website, showing which songs are most used during that respective reporting time period. The website keeps a current list of both the top 100 worship songs being sung in churches throughout the United States over the past year, and a quick reference of the top 20 songs taken from the twice yearly CCLI Copy Reports. Various other formats of reports can be obtained from the customer service department of CCLI, and most of the same reports are available for international usage as well.

3.2.2 Instrumentation, measures

For the analysis of the works of Tomlin, Baloché and Gungor, the process evolved through several steps. Once the songs were identified, each was located on the CCLI website, which provides the bulk of information necessary for analysis,²⁵ and a lead

²⁵ The CCLI SongSelect program allows one, even if not a subscriber, to access pertinent information about songs; typing in the title of a song brings up the composers, the CCLI Song Number, the Original Key, and various videos of the performer, as well as copyright information. A subscriber has access to transposable chord charts, lead sheets, vocal harmonic sheets, and lyric pages, as well as the ability to print multiple copies for worship band purposes.

sheet for each song was downloaded in the original key from the CCLI companion website SongSelect, providing lyric content aligned with chords as identified by the appropriate alphabetic letter representation. This gave a benchmark for the song in order to compare and contrast the various chord progressions used by each of the three composers.

Information printed on the lead sheet includes not only the chords and lyrics but other pertinent information as well. Each lead sheet lists the title of the song, the composers, and, for many songs, the collaborators, the tempo marking and other musical information, the basic structure divisions (typically the song sections are labelled Verse, Pre-Chorus (when used), Chorus, Instrumental, Interlude, Bridge, and Coda or Ending, depending on its use in the song), the CCLI Song Number and the copyright and publisher information. An Excel chart was constructed for each of the three composers and selected music, with the following columns (headings and sample song):

	Jan 2018 position on CCLI chart	Song title	CCLI #	© and pub	Attr. to	Orig Key	Form	Chords used	Nashville System
2	19	Our God	5677416	2010 Said and Done	Redman, Myrin, Tomlin, Reeve	B	I, V1, V2, C1, V2, C1, Inst, B1	G#m, E, B, F#, C#m	6m, 4, 1, 5, 2m

Figure 3.2.1 Headings and sample from artist song analysis chart

In the above example (Figure 3.2.1) the first column shows the number of the song for research purposes and the second column represents the position of the song on the January 2018 CCLI Top 100 song chart. If a song was not on that chart, a notation

is made of the last appearance of the song on the year of the chart (i.e., ‘Lay Me Down’ was on the 2017 chart at number 91, so the column for that song says (2017 - 91). The third column lists the title of the song while the fourth has the song number assigned by CCLI for tracking purposes. The copyright date, when available, and the primary publisher²⁶ are listed in the fifth column, and the composer/collaborators is listed in the sixth. The seventh column shows the original key, while the eighth, the most complex, has the initial indicating the type of each section as identified on the lead sheet provided by CCLI. In this example, the form would be written out as Introduction, Verse One, Verse Two, Chorus One, Verse Two, Chorus One, Instrumental, Bridge One...etc. This song includes a second chorus and second bridge. The “Chords used” column (ninth) indicates the basic harmonic chords used in the song, without regard to modifications such as sevenths, major sevenths, inversions etc., and each chord is only listed once, although it typically appears multiple times throughout the song. This research limits the strict analysis of the chord shifts to the top five selected songs, and the data from that analysis is represented in a different chart.²⁷ The final column includes the chords used and transposed to the Nashville System.

3.2.3 Nashville Number System (NNS) and Letter Name Encoding (LNE)

Use of the Nashville Number System, or NNS for short, provides a uniform standard by which to evaluate the variety of chords used by the different composers (Bohlinger 2010). If the research were about the use of different keys by various composers, then

²⁶ Many of the songs on CCLI have multiple publishers, owners or copywriters as more and more songs are co-written by artists who are represented by different organizations.

²⁷ It would be in the scope of a different research project to structure a more comprehensive analysis of Tomlin’s chord progressions, like that done by Yim in his research, in order to determine the frequency of chord shifts between certain pairs of chords.

the Letter Name Encoding, or LNE, would show that all the artists use a variety of keys. For example, comparing the top three of Tomlin's songs, one is in the key of C, one in the key of F and one in Bb. The information from the chart for those three songs shows that, in total, the following chords are played: C, Am, F, G, Bb, Gm, G#m, E, B, F# and C#m. Again, with an analysis based purely on the lead sheet and LNE, it appears that Tomlin uses a wide variety of chords.

However, the sub-question of research is "do the chord fingering patterns in Tomlin's music reflect the use of a wide array of chords?" and is addressed through both the visual analysis of the lead sheets and the use of video analysis, as described in the next section. It was the initial premise of this researcher that the bulk of Tomlin's songs were written in a common key that allowed the use of specific chord structures and accommodated his vocal range. However, it was quickly discovered in this lead sheet analysis that the use of a common key was not part of his toolbox. It was during the video analysis the determination was made that he did, in fact, use similar chord structures, and modified the songs to various keys with the use of a capo. Therefore, reframing the chords that he used into the Nashville System allows the research to compare the chords apples to apples, as it were, among the different songs.

The Nashville Number System was created and used on stage and in the studios of Nashville, Tennessee to accommodate singers who would come into the studio with a lead chart in one key and might need to change the key. Numbers used in the Nashville system align with what classically trained musicians might think of as Roman Numeral Encoding (RNE), where the Roman numeral "I" represents the tonic chord, which in the Nashville system would be the Arabic number "1", the "IV" in

RNE would be the NNS “4” and “vi” in the RNE would be “6”.²⁸ As was mentioned earlier, in this phase of the research, identified chords are limited to the basic major or minor diatonic chord, eliminating the sevenths, major sevenths, suspensions and other musical additives that, while providing a certain element of interest, do not fundamentally add or detract from the quality of the basic chords. Therefore, with only a couple of exceptions, most of the chords fall into the scope of 1, 4, and 5, with the occasional 2 or 6 chords.

After narrowing the scope of research to the five songs of Tomlin, six songs of Baloché and three songs of Gungor, each of those songs was analysed regarding the chord changes that take place in the song. The number of times that a particular chord change was made was recorded and data collected and collated.

3.2.4 Procedures for determining the surveyed chord structures

There was need for an observational protocol for videos of the composers performing each of the songs in order to determine the chord structures utilised by the composers. This process addressed the second and third sub-questions of the research, namely “what are the chord structures that promote ease of transitions between chords?” and “what are the properties of those chord structures?”.

Multiple versions of each song were located in either YouTube or Vimeo formats for analysis. Each video was evaluated using variable speed playback and stop motion, with special attention given to observing the chord fingering patterns of the composer/performer. The resulting pattern formations were determined through

²⁸ While the NNS has been around for over half a century, there are some variations to the actual symbols used. In some cases, a minus (-) is placed before a number to indicate that it is a minor chord, while in other cases a lowercase “m” is put after the number. Because this research does not include very many of the variables available, only the Arabic numbers will be used.

repeated observation and recorded. The chord structures were noted with descriptions, as well as the key in which the song was performed, and whether the guitarist used a capo to modify the chord structure to match a particular key. Demographic information was included, such as in the cases of Tomlin and Baloché songs. There was typically a second guitarist, sometimes even a third, and it was noted whether the other guitarists were playing the same or alternative chord structures. In most cases, the latter was the case. The makeup of ensembles that play with David Gungor is configured with usually one guitarist, a pianist and string players, so there was only one guitarist to evaluate; frequently that was Gungor, but not always (Gungor 2015).

3.3 PHENOMENOLOGICAL ANALYSIS

Qualitative surveys are sometimes hampered by the use of certain language; referring to the process as a method tends to imply the procedure for data collection and might be better substituted with plan of inquiry, signifying “how one thinks about the question” (Rudestam & Newsom 2007:106). In fact, the qualitative survey in this research is designed to solicit attitudes and perceptions regarding chord change difficulty, asking for one to think about that question in depth.

3.3.1 Research approach

The primary qualitative survey questionnaire was administered through a purposive sampling process (Lunenburg & Irby, 2008) that included guitar instructors as well as guitar students of varying levels. The general approach reflects the work of Huron and Berec (2009) (see pages 21, 90-91) who explore idiomatic characteristics present to trumpet players as they perform work written by composers familiar with the trumpet as opposed to composers not familiar with the trumpet. Their process was to create an evaluation instrument based on identifiable parameters of trumpet fingering and

performance processes, then have selected passages evaluated by two trumpet players using that constructed evaluation tool. They concluded that certain compositions written by trumpet players seem to be easier to play due to the understanding of particular idiomatic characteristics of the trumpet. Huron and Bercé did not frame their work in the language of affordances, but certain aspects of the evaluation tool could have been structured in a way that speaks to affordances theory. Additionally, the trumpet plays one note at a time (generally speaking, ‘playing two notes at once’ on an aerophone entails singing one of the notes) whereas this research explores affordances embedded in the fingerings of chord structures and chord changes.

For his research, Yim (2011) (see pages 93ff) pulled from Huron and Bercé as the genesis for his research in functional versus affordant chord sequences. His driving opinion is that the design of the instrument and the configuration of chord sequences allow for some changes to be easier for guitarist than other changes. Yim deals specifically with Roman Numeral Encoding and chords in a music theory context, but he does not deal with either actual chord structures or perceptions related to performance factors of the chord sequences. Although this research may seem to address the same issue, it does in fact target perceptions of performance factors in chord structures and sequences.

This research specifically addresses the perception of select guitarists who are asked, through the survey process, to evaluate how they feel about the difficulty of changes between various chord combinations.

3.3.2 Research design

The study includes a case study approach to the corpus selection described in the previous section (3.2), and a phenomenological analysis in an inductive format for the

survey and interview interpretations (Smith 2003, Creswell 2009, Alase 2017). Details are explored with the intent to derive a general theme around the subject of affordances from the data resulting from a comprehensive analysis of the individual work of Tomlin. The qualitative research involves a survey designed to measure selected respondents' perceptions related to the degree of difficulty in executing certain chord progressions, as well as interviews with selected members of the Contemporary Christian Music movement. The surveys and interviews work together to bring understanding to the primary research questions and objectives.

The survey, titled Guitar Chord Difficulty Survey for the participant, and Affordance Perception Survey (APS) for internal use, was designed as a heuristic questionnaire (Lunenburg and Irby 2008) by the primary researcher, David Roman. It was initially distributed to a pilot group that included the guitar teacher, Brandon Maughan, and two students affiliated with a local private university, Southwestern Christian University (SCU). They were asked to take the survey and offer their evaluations regarding the ease of comprehension and understanding of process, and modifications were made to the survey based on their input. Following that revision the survey was given to the guitar teachers at the Maughan Guitar Studio for further evaluation. That group provided more input, and the instrument underwent some minor changes, resulting in what was determined to be the most comprehensive and understandable survey document. Based on the input, the questionnaire was constructed in four sections: a) Perceptions Part 1, b) Perceptions Part 2, c) Application, and d) Perceptions and Application.

3.3.3 Sample

Once the survey was revised according to the initial input (described below in section 3.3.4 Data collection tools), it was distributed electronically via email to professors at two other universities who distributed the survey to students involved in applied guitar lessons at some level. These surveys were completed by the individuals and returned to the researcher, via email, to be compiled and evaluated.

Participants from the two university programs, the applied guitar professor, and students at Oral Roberts University (ORU), and the applied guitar professors from the Academy of Contemporary Music, a division of the University of Central Oklahoma (ACM@UCO, hereafter ACM), were chosen for specific purposes (Rudestam & Newsom 2009). The ORU program was selected due to its familiarity and association with the contemporary Christian genre, and the broad base of students in the program. It was expected that the ORU students would also be familiar with the music and chord structures included in the study, those associated with Tomlin, as well as standard structures and the music of Baloché and Gungor. ACM provided a group of individuals generally unfamiliar with the genre or with the music of Tomlin, and the expectation was that they would be less likely to have any preconceived notions of the chords or how to play them. The final tally for participants included nine from ORU and three from ACM, for a total of 12. This falls within the parameters satisfying the criteria of adequacy for a homogeneous sampling, which can be as low as 5-6 participants (Rudestam & Newsom 2007). The guitar professors at the two schools served as gatekeepers (Creswell 2009), and received a digital version of the survey, administered the survey to the participants, then returned the completed surveys via

standard US postage. It was necessary for participants to have access to a guitar in order to check certain chord transitions and complete the survey.

In addition to the administration of surveys, the qualitative approach included interviews with certain individuals, some within the CCM community and some associated with local university populations. Subjects were chosen first based on having some level of acquaintance with the researcher, second on availability and internet communication capacity, and finally on having some degree of real or perceived credibility within the Christian worship community. Interview questions were based on a loose framework of central questions, but open-ended as to “what” or “how” elements, so as to allow divergences and perceptions to be uncovered (Creswell 2009). After a brief discussion about the influences and tastes of the interview subject, the main central question was asked, which took on some form of “what is your impression of the music, and specifically the guitar chords, used by CCM artist Chris Tomlin?” which frequently led to a second central question “how do you think it works with younger players?” or “...with less experienced players?”

Interview subjects were contacted through a variety of means - text, phone call, social media, email, etc - to determine willingness to participate. The proper permission and paperwork were transferred electronically for signatures and return, then the interviews were conducted through one of several video-chat formats. The predominate format was Skype, with Zoom and Facebook Chat used as well. Conversations were recorded and transcribed by the interviewer, checking and rechecking for accuracy, and notations were made regarding inflection and non-verbal cues that might have appeared during the conversation.

3.3.4 Data collection tools

The opening paragraph of the survey describes the intent of the survey by instructing the participant to “rate guitar chord changes on degree of difficulty” and then describes the parameters listed above as part of that degree of difficulty aspect. The specific wording is “When considering the difficulty of the changes, take into account the speed of the change, lateral movement of the fingers as well as horizontal shifting of the left hand, and shifts in the placement of fingers on the guitar fretboard for each chord.” The first two sections, PERCEPTIONS PART 1 and PERCEPTIONS PART 2 were completed without the use of a guitar, relying solely on the participant’s awareness and recollection of how the guitar chords are formed. The third section, APPLICATION, and the fourth, PERCEPTION AND APPLICATION, were to be completed using a guitar to strum the guitar and have that feel and sense in hand while making evaluations.

PERCEPTIONS PART 1 contains a total of seven different chord structures for the participant to evaluate. PERCEPTIONS PART 2 has ten different chord changes, as does the APPLICATION section. The PERCEPTION AND APPLICATION section is intended as an evaluation of the primary chord changes using a guitar to aid the evaluation and contains a total of nine different chord changes to play and rate. Scoring for the first three sections is based on a scale of one to ten, while the fourth section is a ranking process, with the chord changes ranked in order of difficulty from lowest to highest. The chord structures and changes are represented by just the basic name for the chord in order to eliminate any association with particular musicians; in this way, the survey is blind.

3.3.4.a PERCEPTIONS PART 1

In the first section, titled PERCEPTIONS PART 1, the respondent is provided with a series of seven chord changes using only the alphabetic symbol for each chord and asked to rate each of the guitar chord changes on a scale of one to ten, without any guidance on how to interpret or finger the chord structures. The instruction is to “Rate the following guitar chord changes on a scale of 1 to 10, based on the given chord symbols”. Chord changes listed are G-C, G-D, C-D, C-G, E-A, A-B and B-E. These are common chord changes, and by converting them to the Nashville Number System and assuming the key of G as tonic, for the first four the chord changes would be 1-4, 1-5, 4-5, 4-1; assuming a key of E for the last three the changes would be 1-4, 4-5 and 5-1.

The primary reason for choosing these particular chord structures and converting them, for the purpose of this research, to the NNS is that from the corpus study and video analysis, it was established that while Chris Tomlin did play in several different keys, he used a capo on his guitar so that, regardless of the key, his fingering patterns generally reflected the use of the Tomlin G, C, D and Em chords, and played in that which one could consider a “G as tonic” pattern. This first question is not about whether the guitarist used Tomlin chord structures or Standard structures, but rather allows the participant to make a judgement based on experience. The different fingering structures are introduced in the second question. In a similar fashion, Baloche’s use of the train track chording method is based on songs that use primarily E as the tonic; the NNS is not as important in this configuration, as Baloche typically plays a wider variety of chord structures than Tomlin.

3.3.4.b PERCEPTIONS PART 2

In the second section of the APS, PERCEPTIONS PART 2, a basic chord fingering chart was provided for each question, and the respondent was again asked to rate the changes, totalling ten, based on the visual representation of the chord, meaning that the question was accompanied by a small fingering chart as described earlier. The exact instruction was to “look at the following guitar chord changes based on the given chord charts and rate the difficulty of each change”, but no instruction had been given to use a guitar to check the fingering of the chords. This question was designed to move the respondent to a position of considering actual fingering patterns, rather than relying solely on memory of how a chord might be played.

By providing a simple chord chart, the participant was led to a particular fingering structure for each chord change and asked to rate the difficulty of the change based on the perception received by looking at the change. The first change was SG-SC (recall from earlier discussion that standard fingering is represented by the inclusion of ‘S’, Tomlin fingering has a ‘T’, and in some cases the change is either a standard change or a Baloché change (marked with a ‘P’ for Paul), which uses the E formation moving up the strings the appropriate number of frets (train tracks) to form the corresponding chord with open, ringing strings). The second change was SG-SD, followed by TG-TC, SC-SG, TC-TG, SE-PA, PA-PB, TD-TG, SE-SA and SB-SE.

The answer of this section was designed to gauge the participant’s perception of the difficulty in forming the chords, but without the use of a guitar to aid the respondent’s assessment. The assumption was that a guitarist might look at the chord symbols, even picture in his or her head what the fingering might feel like and how difficult it might be, but not really have a cognitive sense of the difficulty involved in the changes. In

terms of the embedded mind theory driving cognition and the role of affordances in the subject matter, this question represented a participant's thought process as a functionality, where thinking through the change involves visual representation and action in the mind, but not account for the situations presented in the environment by the use of chord changes that are alternatives to the standard chord formations.

It was expected that the changes based on the key of E and represented by the standard E, A and B chord formations as contrasted with the Baloché chord formations would seem somewhat easier, as the chord chart included indicators of open strings, and the mind can interpret them that way. As such, seeing the symbols is a semiotic representation readily assimilated into the analysis process. However, as shown on the chord chart but without the benefit of playing the chord on a guitar, figuring out the differences between the standard G, C and D chord formations and those of the Tomlin chord formations is not as obvious without some cognitive processing. That was the supposition behind the formulation of this question.

3.3.4.c APPLICATION

It is in the third section, APPLICATION, that the idea of exploring embedded affordances becomes a possibility. In this section, the participant was again asked for a rating in the difficulty of given chord changes and provided a chord chart for ten chord changes which mirrored the changes in the previous section; however, this time the respondent was asked to play the chords on a guitar before rating the difficulty of the change. The assumption behind this question was that by actually playing the chords on a guitar the participant would recognise a difference in the degree of difficulty in executing a standard chord progression as compared to a Tomlin or Baloché progression. The specific instruction given was to "Play the following chords

on a guitar using the given chord fingerings, then on a scale of 1 - 10 rate the difficulty of playing each chord change.”

Revisiting briefly the discussion on affordances and 4E cognition as set forth by Rowland, he suggests that the cognitive processes of an individual can use the environmental embedding of affordances in structures “in such a way that the amount of internal processing (the individual) must perform is reduced” (Rowland 2010: 69). The primary question of this research asks the question “are there specific chord fingering patterns and structures that afford ease of transition from one chord to another more than other fingering patterns and structures?” with the belief that, indeed, the structure of chords used by Tomlin allow the guitarist to execute the requested chord changes more easily than when using standard chord structures. It was hoped that by playing both the standard chord sequence and the Tomlin (or Baloché) chord sequence in the same set of chord changes, the participant would recognize that it is easier to move through the alternative chord changes than the standard changes. Chapter Five includes a detailed analysis and discussion of the findings regarding the structures of chords used by Tomlin, so suffice it to say that in the execution of a Tomlin chord change, the left-hand ring and little fingers generally stayed in the same position throughout the change, with no lateral or horizontal movement. The major tonal shifts for the chords came from the movement of the index and middle fingers.

A side benefit of the Tomlin structure was that in the learning process, a student had parts of one chord already set up, or embedded, from other chords, thus allowing a novice guitarist to grasp the chords quickly.

3.3.4.d PERCEPTION AND APPLICATION

In the final section, the respondent was asked again to rate the chord changes, a total of nine, but this time to rate them in descending order of difficulty, with the chord chart provided once more for reference. This section, titled PERCEPTION AND APPLICATION, was intended to measure the difficulty of each chord change against all the other chord changes, rather than simply to the perception of the individual chord change difficulty. Specifically, the participant was to “rate the changes 1 - 9 in order of difficulty of performance, with 1 being the easiest change and 9 being the hardest change.” The expected outcome was that individuals would conclude, based on the previous three exercises, that the Tomlin chords would be the easiest, the Baloché chords the middle and the standard chord structure changes would be ranked as the most difficult to perform.

3.3.5 Data analysis

While the instrument was being constructed, evaluated and edited for distribution, the university gate keepers were being contacted and given instruction on the instrument and procedure for delivery. Once the readied instrument was emailed, they were asked to administer the survey to individuals so that the participants would not share information but rely on their own judgements and perceptions. They were advised that the first two sessions were to be completed without reference to a guitar, but the third section necessitated that the student actually play the changes. The gate keepers then gathered the completed surveys and returned them to SCU, where they were evaluated and collated for presentation.

3.3.6 Ethical Clearance and annexure information

The University of South Africa requires that research projects include an application for ethical clearance of the proposals and research methods to be used in a study. This form is known as Annexure A and was submitted to the Ethics Review Committee of the Department of Art History, Visual Arts and Musicology. Approval was granted as part of the proposal process on 20 June 2016 and assigned reference number 2016_AVME_STUDENT_003.

Following are certain portions of the application pertaining specifically to the method and sampling procedures:

B6: Study Design - The design of the study falls into two broad categories. A quantitative survey will comprise the work of a corpus analysis on the music of Tomlin and will be generated from data derived from musical analysis of the most significant of his works. Simultaneously, a qualitative phenomenological study will be executed through a combination of interviews and surveys. The interviews will focus on contemporaries of Tomlin, as well as speaking with the author/composer. Surveys will be conducted on a specific cohort of individuals.

B7: Study Population and Sample - Interviews will be conducted with selected members of the Christian Contemporary Music community, as well as with selected participants from the local university population. The CCM community sample will be four top artists in the current CCLI list, and the university sample will be the guitar faculty and students.

B8: Data collection method(s) and procedure - Data to be used in answering the first set of objectives will be gathered through a corpus analysis of the music of Tomlin. The process of determining keys will begin with an evaluation of song charts to be downloaded from the SongSelect website, the division of Christian Copyright Licensing, Inc. responsible for providing the charts to churches world-wide. Although the charts are transposable, the default is the artist's original key. If the need arises, songs will be evaluated in a simple Roman Numeral Analysis that will result in an encoded version. The Roman Numeral Encoding (RNE) provides a numeric value for the song chords, and when compared to the original key of the song, can be translated into a Letter Name Encoding (LNE). Additionally, videos available through internet sites will be evaluated for hand positions and capo use. This process will provide the framework for constructing a coherent representation of the chords used in Tomlin's music.

A set of parameters identifying particular aspects of difficulty will be constructed, and the degree of difficulty will be assessed by individuals from the sample population. Results will be compiled and, using the Pearson coefficient of correlation, the degree of difficulty for each parameter will be rated. Following that, comparisons will be made between samples of Tomlin's songs and other selected CCM artists, and a degree of difficulty assigned for each of those songs, thereby ranking the songs.

Interviews will supply the data for the phenomenological study on affordances. The interviews will be conducted in person when possible, and

via Skype or Facetime when necessary; interviews will be recorded and transcribed. These interviews will include a discussion on the different selected songs and perceptions of performers as to the degree of difficulty, and results will be used to construct a conditional/consequential matrix illustrating the perceived degree of difficulty for the selected pieces relative to the chord structures in the composition of those pieces.

B9: Data analysis method - For the corpus analysis, once the information is gathered it will be compiled into a series of matrices which compare and contrast the chord progressions, as well as the fingering positions used in the execution of the chords.

Information gathered from the interviews will be categorised by content.

Survey results will be compiled, numerical portions will be charted, and prose sections will be analysed for content relative to the topic emphasis and illustrated in a conditional/consequential matrix.

Section B11 of the Annexure deals specifically with the ethical considerations of the study. Although participants share email and contact information with the researcher, there are no physical or mental implications for the subjects. Questions on the survey are related to feelings, perceptions, and experiences; the study is not designed to endanger or harm participants in any way. Nor is it designed in a way that participants would incur cost beyond printing the survey, and there is no provision for incentives or reimbursements.

3.4 VALIDATION, RELIABILITY, AND PROBLEMS

With any research undertaking there are opportunities for new insights to be uncovered and explored, and there is the potential that at any moment, with little provocation, things could go in a drastically different way from anticipated. Validating and reliability strategies are inserted into the process in an attempt to insure as much integrity as possible in the research, while issues and problems are recognized and identified.

3.4.1 Validating strategies

There are several different ways to validate strategies that researchers use in attempting to demonstrate integrity and transferability for the processes used (Rudestam & Newsome 2007, Creswell 2009). The use of multiple streams of data, or triangulation, is the intent of the use of two different qualitative instruments, the survey and interviews. Thick descriptions are intended to demonstrate the transferability of the information to other settings such as further explorations of later Tomlin music, or application to deeper research in the chords used by Paul Baloche, for example. Finally, an attempt has been made to provide an audit trail in the event that one would seek to replicate the processes for this research.

3.4.2 Reliability strategies

Qualitative research, which includes a variety of research tools and instruments that are not immediately recognizable as gathering empirical data, relies on the researcher, and in many cases, the reader, to arrive at plausible conclusions. Reliability strategies, both internal to the study and external to the scope of a discipline, are put into place to help show that approaches used by individual researchers are consistent with those of other researchers, i.e., the corpus analysis design of de Clercq and Temperley

(2011, 2013) as a template for this study. In addition to borrowing from and building on work from other researchers in musicology and affordances, transcriptions were carefully checked and rechecked for accuracy. Also, codes and tables were checked for drift by outside reviewers.

3.4.3 Problems

Chief among the potential problems is the bias brought by a researcher to the issue being studied. In this case, those biases and background have been on display from the first chapter; the music department in a university setting is a situation in which one would expect students to be at the very least acquainted with the barest essentials of the tools of the music trade. As the researcher, I was new to the university environment from a professor's perspective but had many years of experience playing music written by the people now highlighted in the case study. Therefore, I entered the research with a fair amount of confidence in the results to the questions, but questions of cognition and affordances (embedded affordances, 4E cognition, etc) were not part of my thinking at that time. One major result, discussed more thoroughly in a later chapter, is the reframing of teaching methods and chord cognition infused into my own teaching practices.

In his research Yim (2011) addressed as one of his problems the reality that not all the music used in his corpus of study was written for, or by, guitarists. Because he was exploring affordant harmonic progressions from the guitarist perspective, this caused discrepant information in his results. He addressed this by reconfiguring his corpus list, limiting it to songs known to be written by guitarists. Ultimately, the refining of his list did not make a difference in his findings regarding affordant vs. functional harmony (Yim 2011). Whereas Yim trimmed his corpus to focus on songs

by guitarists, according to his best ability to determine, this study focuses solely on music composed by guitarists.

One significant area that bears addressing is a methodological error in the dissemination process for the qualitative survey. Although it was believed that the gatekeepers understood the process for interpreting the questions, it was not sufficiently emphasised that the chord progressions in the survey should be carefully evaluated, rather than giving a first impression answer. Consequently, more advanced guitarists participating in the survey scored most of the changes in the first three sections closer together than they might have with a more detailed explanation. However, because the fourth section requested a comparison of chords against each other rather than independently, it provided sufficient data to interpret the perceptions of the participants adequately.

Finally, there is always the possibility that by specifying particular chord progressions to be examined there is potential for bias in the results (Yim 2011). However, because this study was specifically a case study in the chords and structures used by Chris Tomlin, it was determined not to be an issue.

CHAPTER 4: FINDINGS

4.1 INTRODUCTION

This case study and phenomenology analysis has been constructed to explore perceptions regarding the ease of chord transitions, specifically focusing on guitar chord structures found in selected contemporary worship music. The three sub-questions arising out of the primary question are addressed through the corpus analysis section of the research. The primary question and relevant research process is framed in the phenomenological study of embedded cognition theory and demonstrates how chord structures might offer affordances that increase the compatibility of a guitarist with the action capabilities of his or her Umwelt.

The study focuses on two main objectives. The first aim is to determine a corpus of work for analysis, and this has been carried out as a case study of the music of Chris Tomlin. The second aim is to determine if there might be a perception that the fingering patterns used by Tomlin offer easier chording structures than standard chord structures. This is accomplished through the administration of a focused survey and certain interviews, both seeking to gauge perceptions of the research subjects regarding the chord changes. This chapter presents a summary statement of the major findings from the research, with a discussion of the results to follow in the next chapter.

This chapter is organized in such a way that the results of the research are presented in the same order as the previous chapter: there is an exploration of the research sub-questions and results which represent findings regarding the corpus analysis and the video analysis. This is followed by an examination of the primary research question and results addressed through the phenomenological analysis and the survey. Finally,

there is a brief statement regarding the properties involved in the structures of these chords.

4.2 EXAMINATION AND RESULTS – CORPUS SELECTION

The sub-questions are addressed through research on the first of the two objectives. That aim is to survey the works of Chris Tomlin, focusing on the song structures and use of chords, and this study is carried out through a corpus analysis of Tomlin's works as well as an analysis of selected videos featuring the artist performing the songs. The results of those analyses follow below.

4.2.1 Selections for corpus analysis

The music of Chris Tomlin was initially selected because of its prevalent use by worship bands in church services and concert performances; tracking records from CCLI are detailed in Chapter Five and clearly chronicle his success in the CCM market. The specific songs selected for this analysis have been represented in the CCLI top 100 for over a decade. For example, the first song, 'How Great is Our God,' entered the CCLI top 25 in February of 2006 and was still in the top ten twelve years later. 'Forever,' number 46 in 2018, entered the top 25 in August of 2003 and remained in the top 24 through August of 2014. Overall, according to CCLI information the composition process for songs in CCM has shifted from single artists as composers to collaborations between several artists (detailed in Chapter Five) and Tomlin is no exception. Early in his career he wrote songs either by himself or with one or two collaborators. However, his later collaborations are with several different individuals. This mix of solo and collaborative compositional processes, coupled with his longevity on the CCLI charts, makes Tomlin's music a prime corpus for this analysis.

Regarding the other two composers and their corpora, Paul Baloche was involved in the worship music world a few years before Tomlin but did not appear on the charts until just a couple of years before him. Baloche wrote the bulk of his music individually or with one other collaborator. David Gungor performed on songs written and recorded by his brother Michael, but only recently has started composing and performing his own songs for church worship with his band The Brilliance. Musical compositions of The Brilliance are written, arranged, and recorded by David in collaboration with long-time friend and band member John Arndt, as well as family members Michael, Lisa, and David's wife Kate. Though his music provides a rich sonic variation when compared with Tomlin and Baloche, his songs have yet to find their way to the top 100 on the CCLI charts.

4.2.2 Corpus findings

The first of the sub-questions seeks to determine if the chord fingering patterns in Tomlin's music reflect the use of a wide array of chords. This is answered in a two-step process that includes an analysis of chord charts provided by CCLI and video analysis of the artists performing the specified songs.

Once the list of songs was set up that Tomlin either authored or was a collaborator (a list with over 300 different titles), the list was reduced to those songs that reached the CCLI top 100 at some point. A further reduction was made by selecting only those 14 songs that were on the top 100 list in January of 2018. Those songs, along with the analysis results, are shown on the following chart (Figure 4.2.1):

	Jan 2018 CCLI chart	Song Title:	CCLI #	attributed to	orig Key	Form	Chords used	Nashville System ²⁹
1	10	How Great is Our God	4348399	Tomlin, Reeve, Cash	C	V1, C, V2, C, B, B, C	C, Am, F, G	1, 6m, 4, 5
2	19	Our God	5677416	Redman, Myrin, Tomlin, Reeve	B	I V1, V2, C1, V2, C1, C1 Inst B1, C2, C2, B2, C2, C2	G#m, E, B, F#, C#m	6m, 4, 1, 5, 2m
3	14	Amazing Grace (Chains are...)	4768151	Newton, Tomlin, Giglio	F	V1, V2, C V3, C C V Tag	F, Bb, C, Gm	1, 4, 5, 2m
4	37	Jesus Messiah	5183443	Carson, Tomlin, Reeve, Cash	B	V1, C, V2, C, B, C, Tag	B, C#m7, B, E2, F#,	1, 2m, 4, 5
5	64	Whom Shall I Fear God of...	6440288	Tomlin, Cash, Cash	C	V1, C1a, V2, C1a, B B C1b, C1c	C, Dm, C/E, F, Am, G,	1, 2m, 4, 6m, 5
6	46	Forever	3148428	Tomlin	A	V1, V2, PC, C, V3, PC, C	A, D, E, F#m	1, 4, 5, 6m
7	62	Holy is the Lord	4158039	Tomlin, Giglio	A	V1, PC, C, V1, PC, C, B, B, PC, C, Coda	A, D, E, B, F#m	1, 4, 5, 2, 6m
8	79	The Wonderful Cross	3148435	Lowell Mason, Tomlin, Reeves	D	V1, V2, C, V3, C	D, G, A	1, 4, 5

²⁹ The chord numbers listed correspond in order with the chords used; therefore example two, "Our God" lists the chords in order of performance as G#m, E, B, F#, and C#m. The song is in the key of B, so the 1 chord is actually the third chord performed in the song.

9	94	I Will Follow	5806878	Tomlin, Ingram, Morgan	Bb	Intro, V1, C, Interlude, V2, C, Inter, Bridge, C, C, Ending	Gm, Eb, Bb, F	6m, 4, 1, 5
10	97	We Fall Down	2437367	Tomlin	E	V, C	E, B, C#m, A, F#m	1, 5, 6m, 4, 2m
11	38	At the Cross	7017786	Tomlin, Cash, Armstrong, Myrin, Redman	G	V1, C, V2, C, B, C, C, I, B, B, C	Em, D, G, C, Am	6m, 5, 1, 4, 2m
12	51	Because He Lives (Amen)	7027887	Tomlin, Carson, Cash, Bill and Gloria Gaither, Maher, Ingram	C	Intro, V1, C, V2, C, Bridge, C, C, End	Am, F, C, G	6m, 4, 1, 5
13	80	Jesus	7067249	Tomlin, Cash	A	V1, V2, C, V3, C, Bridge, C, C, Ending	A, D, Bm, F#m, E	1, 4, 2m, 6m, 5
14	90	Even So, Come	7036288	Tomlin, Ingram, Cates	Em	Intro, V1, V2, C, V3, C, Bridge, C, C, Inter, Inst, Bridge, C, C, Ending	Am, Em, G, D, C, Bm,	4m, 1m, 3, 7, 6, 5m
	CCLI position	Song Title	CCLI #	attributed to	orig Key	Form	Chords used	Nashville System

Figure 4.2.1 Tomlin song analysis

Tomlin's first song to grace the CCLI top charts was 'We Fall Down' at number 22 in August 2002. That same song was still on the charts at number 97 in 2018³⁰. 'Forever' entered the top 25 in August 2003 at number 19 and was 46th in 2018³¹. And arguably his most popular song 'How Great is Our God' was recorded at number 1 in February 2007 and was *still* in the top 10 in 2018³².

On the chart, the seventh column lists the original key for each song as recorded by CCLI, and the ninth column shows the chords used. Looking at the chart and the keys listed, Tomlin uses a wide variety of keys for his songs. Those keys include: A, Bb, B, C, D, Em, E, F and G, of which all but the F and Bb allow for chords that are easier to form. Column nine lists the chords in order of appearance in the song, as charted by CCLI and in the original key. The last column shows the numeric value of the chords for each song as they relate to the NNS of charting. For the selected songs of Tomlin, the Nashville system values are dominated by three chords; the 1, 4, and 5 chords (NNS), all three of which appear in each of the songs in some form. Ten of the fourteen listed songs incorporate a 6m chord, seven songs incorporate a 2m chord, one song includes a 2 major chord, and one song has a 6 major chord. The 14th song, 'Even So, Come' is the anomaly, having the following chords in the NNS: 1m, 3, 4m, 5m, 6 and 7. It is clear from the chart that if all the songs were played in a common key then the chords would be remarkably similar. In the key of G, i.e., the 1 chord is G, or in this case the TG. The 4 chord is TC, the 5 chord TD, etc. Transposing all the songs to the same key, then tabulating the number of different chords by adding the

³⁰ Song #10 on Chart 4.4 Tomlin Song Analysis

³¹ Song #6 on Chart 4.4 Tomlin Song Analysis

³² Song #1 on Chart 4.4 Tomlin Song Analysis

NNS numbers shows that Tomlin, in this set of songs, has used a total of 12 possible chords.³³

The sub-questions are answered through addressing the first objective, to analyse the music of Chris Tomlin. This was carried out, as shown above, by studying the charts for his songs as rendered through the CCLI, arriving at the common numerical values for the chords of the songs. The second part compiles the results of video analysis which dissects the chord structures of the top five songs as written and used by Tomlin in live performances captured and distributed across various video platforms such as YouTube and Vimeo (Figure 4.2.2).

As an illustration, for the song ‘How Great is Our God’ ten videos were evaluated. Of those videos, the earliest example is an instructional session for New Worship Cafe featuring Tomlin as he teaches the song to viewers. Uploaded to Youtube in January 2006, Tomlin used standard chord structures with no capo and the F chord played with an open lower E string. In a second example uploaded in October 2008, Tomlin played piano, and for another (April 2013) he only sang, but did not play an instrument. In the remaining videos that were analysed, Tomlin both played acoustic guitar and sang. He used a capo on the fifth fret of the guitar with the structures of chords in this study, the TG, TC, TD, in five of the videos. The remaining two videos show that he used the standard C chords, occasionally adding his little finger on the bottom string E3 to sound the high G. These analyses demonstrate that when performing this first song, Tomlin most frequently uses a capo on the fifth fret and plays with his unique fingerings.

³³ “Even So, Come”, the final song on Tomlin’s list, is the only song written in a minor key, so the Nashville numbers used could be translated to the relative major equivalent in which case the Bm chord becomes a 3m and the overall count drops to ten possible chords.

How Great is Our God				
Uploaded	Tomlin	Capo	Key/Chords	Comments
30 Jan 2006	Acoustic	no	C/standard	New Worship Cafe teaching video
28 Oct 2008	Piano	-	-	Official Tomlin video
8 Jul 2011	Acoustic	5th fret	C/Tomlin G	Springtime Festival
12 Apr 2013	Vocals	6th fret	C#/Tomlin G	World Edition Two acoustic players, second capo 1, standard fingering
25 Mar 2016	Acoustic	5th fret	C/Tomlin G	Official live video
23 Feb 2015	Acoustic	5th fret	C/Tomlin G	
12 Aug 2008	Acoustic	5th fret	C/Tomlin G	
31 Jul 2014	Acoustic	1st fret	C#/Tomlin G	Big Ticket Festival Lead played capo 5, Tomlin G chords
27 Mar 2015	Acoustic	no	C/standard	
2015	Acoustic	5th fret	C/Tomlin G	amateur video
Our God				
Uploaded	Tomlin	Capo	Key/Chords	Comments
29 Oct 2013	Acoustic	4th fret	B/Tomlin G	Official Tomlin video
29 Nov 2010	Acoustic	5th fret	C/Tomlin G	

8 Mar 2010	Acoustic	4th fret	B/Tomlin G	New Song Cafe Redman playing capo 2, A chords
23 Feb 2015	Acoustic			Late Night
13 Jun 2018	Acoustic	5th fret	C/Tomlin G	Texas Harvest America Festival

Amazing Grace (Chains are Gone)

Uploaded	Tomlin	Capo	Key/Chords	Comments
25 Mar 2016	Acoustic	3rd fret	F/standard D, Tomlin chords on chorus	Official live video
12 Dec 2006	Acoustic	no	G/standard G, shifts to Tomlin chords	
17 Feb 2007	Acoustic	3rd fret	F/standard D, Tomlin chords on chorus	Passion Conference
09 Jun 2016	Acoustic	3rd fret	F/standard D, Tomlin chords on chorus	New Song Cafe Capo 3rd fret, played in D, standard D, except with an open E string and sustains the D, ring finger second string; A chord keeps the ring finger D and open E
12 Aug 2012	Acoustic	1st fret	E/standard D	amateur recording
19 Feb 2016	Acoustic	3rd fret	F/standard D, Tomlin chords on chorus	

Jesus Messiah

Uploaded	Tomlin	Capo	Key/Chords	Comments
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12 Sept 2008	Acoustic	2nd fret	A/Tomlin G	SPIRIT 1053 studio
18 Jun 2016	Acoustic	3rd fret	Bb/Tomlin G	New Song Cafe
11 Jul 2014	Acoustic	3rd fret	Bb/Tomlin G	amateur video
Whom Shall I Fear God of Angels				
Uploaded	Tomlin	Capo	Key/Chords	Comments
25 Mar 2016	Acoustic	5th fret	C/Tomlin G	
8 Mar 2013	Acoustic	5th fret	C/Tomlin G	Passion VEVO
4 Jan 2013	Acoustic	5th fret	C/Tomlin G	K-LOVE studio
14 Apr 2016	Acoustic	5th fret	C/Tomlin G	New Song Cafe
10 Jan 2013	Acoustic	5th fret	C/Tomlin G	

Figure 4.2.2 Tomlin video analysis

Of the 29 videos featuring Tomlin that were analysed, one video has Tomlin playing piano, one has him singing only, and the remaining 27 include him both singing and playing acoustic guitar; Tomlin uses a capo in 24 of those 27 songs. Furthermore, in 19 of the videos, Tomlin is playing exclusively using his own chord structures with only 2 songs featuring standard chord structures (in the one video with Tomlin singing, the lead guitarist uses the Tomlin chord structures). Both of those video performances are in the key of C, and Tomlin plays the standard chords with no capo. The six videos of Amazing Grace (Chains are Gone) use standard chord structures for the key of D through the verse, although the use of a capo changes the key to E or F in different versions, depending on which fret the capo is situated. On the chorus (specifically the portion Tomlin added as a chorus) the chords used are the Tomlin structures.

Clearly Tomlin writes and performs a number of songs in a variety of keys. The videos illustrate, however, that when Tomlin is the performer, the chord structures that he uses are limited primarily to four main structures, shown here in a typical guitar chord chart:

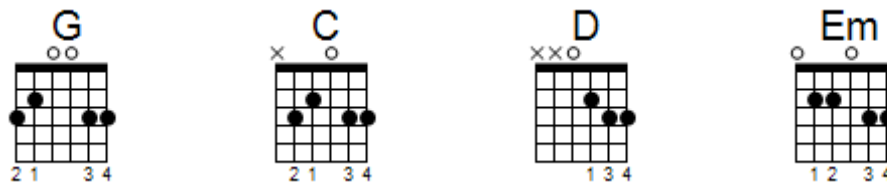


Figure 4.2.3 Tomlin chord configurations

Although other members of the band frequently play other chord structures, when there is a change of key, Tomlin uses his capo to transpose the chords to the proper frets for that key. The sub-question asks whether the chord fingering patterns reflect a wide array of chords. This question would be more precise if it were to specify Tomlin as the artist; as the chart and research show, strictly speaking, there is a wide array of chords. In fact, over just the first five songs Tomlin uses three keys - B Major, C Major, and F Major - and at least 12 different chords. Therefore, were a guitarist to play those five songs with open strings (no capo) and in their original keys, there would be a wide variety of chords. However, video analysis shows that Tomlin is inclined to use a capo and move his hand position to the appropriate key, thereby limiting to five the number of actual chord structures he plays. Those chords, represented in the NNS, are 1, 2m, 4, 5, and 6m.

4.2.3 Baloche

Unlike Tomlin, Paul Baloche grew up surrounded by music, and became a worship leader in 1989, recording his first live album in 1992. In 1995 he began recording a set of teaching videos, “The Worship Guitar Series”, close to the same time that he

joined the staff at Community Christian Fellowship in Lindale, Tx. “The Modern Worship Series,” a set of eight instructional DVD’s, was recorded between 2002 and 2006. Baloché made his first appearance in the CCLI Top 25 in August of 2000 with ‘Open the Eyes of My Heart’, which was still at number 44 in January of 2018. However, despite the longevity of both ‘Open the Eyes of My Heart’ and ‘Hosanna (Praise is rising),’ which was number 34 on the January 2018 list, these are the only two songs penned by Baloché that have stayed in the top 100 over time. Other songs may be familiar to the worshipping community, but they are not typically chosen for use in the church, at least by CCLI records. The chart showing songs by Baloché includes the two listed above as well as seven additional songs that have appeared on the top 100 chart.

	Jan 2018 CCLI chart	Song Title:	CCLI #	attributed to	orig Key	Form	Chords used	Nashville System
1	34	Hosanna (Praise is Rising)	4662491	Baloché, Brown	G	V1, PC, C, V2, PC, C, Inst., PC, PC, C, C, Coda	G, C, D, Em	1, 4, 5, 6m
	44	Open the Eyes of My Heart	2298355	Baloché	E	C, C, V, C, C, V, Bridge repeat	E, B, A, C#m, F#m	1, 5, 4, 6m, 2m
2	(2017, #83)	Your Name	4611679	Baloché, Packiam	Bb	V1, C1a, Inst, V2, C1a, Inst, C1b, C1b, Coda	Bb, Eb, F, Gm, Dm, C	1, 4, 5, 6m, 3m, 2

3	(2015, #76)	Today is the Day	5200924	Brewster, Baloche	D	Intro, V1, C, V2, C, Inst, B, C	D, Bm, A, G, Em	1, 6m, 5, 4, 2m
4	(2015, #97)	Our God Saves	4972837	Baloche, Brown	D	V, C	D, G, Bm, A	1, 4, 6m, 5
5	(2015, #71)	Above All	2672885	LeBlanc, Baloche	A	V1, V2, C	A, E, D, F#m, Bm, C#	1, 5, 4, 6m, 2m, 3
6	(2016, #32)	Kingdom of Heaven	5997804	Baloche, Ingram	F	V1, C, V2, C, Inst, Bridge, C	F, C, Dm, Bb	1, 5, 6m, 4
7		The Same Love	6180933	Baloche, Rossback	B	V1, C, V2, C, Inst, Bridge, C, Coda	B, E, G#m, D#m, F#	1, 4, 6m, 3m, 5
8		All The Earth	4037057	Baloche	F	C, Interlude, V, C, Inst, C, Coda	F, Bb, C, Dm	1, 4, 5, 6m

Figure 4.2.4 Baloche song analysis

The songs analysed in this research represent six different original keys and within those keys, twenty chords including the various iterations such as sharp (#), and minor. Adjusting to the NNS shows that Baloche's songs contain the following chords: 1, 2, 2m, 3, 3m, 4, 5, and 6m; within those nine songs a total of eight different possible chords are found.

Four songs featuring Baloche were analysed for a total of 18 different videos. In every video he is playing rhythm guitar and singing, and he is accompanied by at least two other musicians, whether those are guitarists, keyboard players or string players. For 'Hosanna (Praise is Rising)' and 'Open the Eyes of My Heart' Baloche does not use a capo but varies his use of chord structures. Two videos of 'Hosanna' have Baloche

playing standard chords in the key of G, while the other two videos show him playing, again in the key of G, Tomlin chords.

Five videos of ‘Open the Eyes of My Heart’ supply the evidence for the train tracks that Baloche speaks of in his training videos. In every one of these videos, he played acoustic guitar and sang the lead vocal, he used no capo, and the song was pitched in the key of E. This is the trademark key for Baloche’s chord structures that use an open E chord with fingering that allows the guitarist to slide the same structure from the first frets up to the A and B chords, keeping open E and B strings.

Hosanna (Praise is Rising)				
Uploaded	Baloche	Capo	Key/Chords	Comments
16 Apr 2011	electric rhythm/vocal	no	G/standard	few Baloche guitar chords to analyse
3 Jul 2015	electric rhythm/vocal	no	G/Tomlin G	final chorus shifts to standard chords
4 Nov 2008	acoustic/vocal	no	G/standard	
4 Jun 2017	acoustic/vocal	no	G/Tomlin G	mixes in standard occasionally, esp. Em
Open the Eyes of My Heart				
Uploaded	Baloche	Capo	Key/Chords	Comments
15 Feb 2018	acoustic	no	E/open, some Baloche	minimal amount of video on his hands

12 May 2017	acoustic	no	E/open, some Baloche	chord structures in 7th fret - Baloche train tracks
16 Oct 2008	acoustic	no	E/open, some Baloche	same 7th, 9th fret structures ...Song Story explains genesis of song
10 Jul 2010	acoustic	no	E/open, some Baloche	little to go on
28 Aug 2007	acoustic	no	E/open, some Baloche	again, with the 7th, 9th fret structures
Our God Saves				
Uploaded	Baloche	Capo	Key/Chords	Comments
4 Jun 2017	acoustic	7th fret	D/Tomlin G	limited shots, C configurations for 5 chord
19 May 2009	acoustic	7th fret	D/Tomlin G	standard fingering on Em chord
20 Nov 2007	acoustic	no	D/Tomlin chords	song demonstration video/open E string on Bm chord
6 Nov 2015	acoustic	2nd fret	C/standard	guitar tuned down whole step, using the capo brings the string pitch back to standard tuning
Above All				
Uploaded	Baloche	Capo	Key/Chords	Comments
4 Jun 2017	acoustic	2nd fret	A/standard G	
1 Feb 2018	acoustic	2nd fret	A/Tomlin G	Standard D chord

28 Aug 2007	acoustic	2nd fret	A/standard G	Tomlin chords on chorus
12 May 2017	acoustic	2nd fret	A/standard G	Tomlin chords on chorus, alternative fingering for the Am chord
13 Dec 2007	acoustic	2nd fret	A/standard G	Tomlin chords on chorus, teaching video showing fingerings and walking bass line

Figure 4.2.5 Baloche video analysis

Baloche’s various recordings of ‘Our God Saves’ exhibit the greatest variety in chords and structures. Four videos were analysed, three in the key of D and one in C. However, for two videos Baloche used a capo on the 7th fret and played using the Tomlin G chord structures. In his Leadworship video (2007) he did not use a capo but did play quite a few Tomlin structures, and this is a teaching video where he demonstrates his chord structures and strumming patterns. For the Song Tutorial video (2015) he placed a capo on the 2nd fret and used standard structures modified to supply a sustained G high note, but has his guitar tuned down a whole step so that he is actually playing in the key of C. This video demonstrates his technique and chords for the medley ‘Joy to the World/Our God Saves’ which incorporates the chorus from ‘Our God’ into ‘Joy’.

The structures used in the videos featuring his song ‘Above All’ alternate between standard and Tomlin chords in a G formation. A capo is used on the 2nd fret, so all videos are in the key of A, and Tomlin structures are used on the chorus, standard on the verse. As with ‘Our God Saves’ the Leadworship video (2007) is a demonstration

of how Baloché plays the song, including the addition of a walking bass pattern in the lower-sounding notes. Around three minutes into this video Baloché acknowledges that he is attempting to minimize wrist movement using specific structures. At this point he demonstrates the G structure predominant in the Tomlin series and pictured to the right.

Baloché and Tomlin both figure into the CCM movement as leaders in song writing and playability. However, the music of Baloché demonstrates a greater variety of chords and structures across songs, as well as versatility within the performance of specific songs. David Gungor, on the other hand, does not enjoy a similar visibility in the CCLI landscape, even though his participation in the CCM world is over a decade long and he has performed both as a solo artist with the band The Brilliance and with artists like Israel Houghton and Michael Gungor, his older brother.

4.2.4 Gungor

About the same time Paul Baloché was turning a quarter of a century old and Chris Tomlin wrote his first worship song, David Gungor (b. 1986) was figuring out how to walk as a toddler. His teen years were spent playing the bass for his oldest brother in the Michael Gungor Band, which gained national prominence as one of the main bands for the “Acquire the Fire” conferences. Relatively obscure on the CCLI charts, the elder Gungor made his first appearance with the song ‘Friend of God’ written by Michael Gungor and Israel Houghton. Peaking at #19 in 2007, ‘Friend of God’ was still in the top 100 at #88 in January 2018. The harmonic progression fits the basic pattern for worship music - 1, 6m, 2m, 5 and 4. Michael and Lisa Gungor’s ‘Beautiful Things’ is even more basic, using 4, 5, 1 and 6m.

The younger Gungor continued to play bass as ‘Beautiful Things’ entered the charts, peaking at #66 in 2014. Simultaneously, David was working with classically trained pianist John Arndt as The Brilliance, incorporating orchestrations that included strings, horns, and written parts. None of their songs have hit the top 100 on CCLI charts, but songs like ‘Brother’ and ‘Breathe’ have aired on secular radio and gained wide recognition on online platforms Spotify and Amazon Music.

One of his more popular songs, ‘Breathe’ serves as an example of the range of harmonic combinations, using the 1m, 6, 4m, 3, 7, b2 and 5 chords (Nashville system) and relying on a complex arrangement for cello and violin with extensive keyboard work - not typical church worship fare. ‘Lift Your Voice’ uses an equally diverse set of chords, with 1, 2m, 6m, 4, 5, 3 and 2 in its progression. ‘Prayers of the People’ fits what would be more typically used in a worship session - 1, 6m, 4 and 5.

	Jan 2018 CCLI chart	Song Title:	CCLI #	attributed to	orig Key	Form	Chords used	Nashville System
1	2014, #66	Beautiful Things	5665521	M. Gungor, L. Gungor	D	V1, V2, C1, V3, C1, C2, Inst, Bridge, C3, C4	G, A, D, Bm	4, 5, 1, 6m
2	2015, #88	Friend of God	3991651	M. Gungor, Houghton	E	V, C, Inst, V, C, Bridge, C, Coda	E, C#m, F#m, B, A	1, 6m, 2m, 5, 4
3		Breathe	7038507	Arndt, D. Gungor, M. Gungor, L. Gungor	Em	V1, C, V2, C, C, Coda	Em, C, Am, G, D, F, B	1m, 6, 4m, 3, 7, b2, 5

4	Lift Your Voice	7070301	Arndt, D. Gungor, K. Gungor	D	V1, C1, Turnaround, V2, C2, V3, C1, Inst, V4, C3	D, Em, Bm, G, A, F#, E	1, 2m, 6m, 4, 5, 3, 2
5	Prayers of the People	7039048	Arndt, D. Gungor, Cron, Kilgore, Wickham	D	V, C, Inst, repeat	D, Bm, G, A	1, 6m, 4, 5

Figure 4.2.6 Gungor song analysis

Analysing video proved to be a bit trickier for Gungor’s songs, as he does not play guitar very often, and when he does, the guitar features most frequently in a supporting role to the keyboard and strings.³⁴ Both ‘Breathe’ and ‘Prayers of the People’ are available in studio versions, and there are some unofficial recordings that are exceedingly difficult to decipher. ‘Lift Your Voice’ is only available as an audio file; no video performances are available for analysis. While Gungor plays acoustic guitar in one ‘Breathe’ and one ‘Prayers’ video, he is the lead vocalist on all the recordings, and his guitar playing is very minimal. When guitars are shown to be playing, the guitarist is either finger picking and playing single-note passages or playing standard chord configurations. Visually there are no examples of Tomlin structures in the guitar chords.

³⁴ The Brilliance consists of David Gungor (bass, acoustic, vocals) and John Arndt (piano), with Dave Campbell (cello) and Kate Gungor (violin, viola) as the two core string players. Additional strings and horns are hired for recordings and concerts.

Breathe				
Uploaded	Gungor	Capo	Key/Chords	Comments
20 Nov 2013	vocals	no	Em/arranged	Keyboard, cellos, violins, double bass, percussion
16 Apr 2015	vocals/bass	no	Em/arranged	piano, cello, bass, violin, lead guitar, trombone, percussion
11 Nov 2017	vocals/acoustic	no	Em/arranged	piano, cello, guitar is total instrumentation in this one
Prayers of the People				
Uploaded	Gungor	Capo	Key/Chords	Comments
25 Feb 2015	vocals	no	D/arranged	Studio "Takeaway Show" piano, cello, violins, viola, trombone, French horn; piano carries rhythmic motif
27 Mar 2015	vocals/acoustic	no	D/arranged standard guitar chords	cello, violin, trombone, percussion, electric guitar, piano, bgv
Lift Your Voice				
Uploaded	Gungor	Capo	Key/Chords	Comments
videos on internet are all audio only - no live video performances				

Figure 4.2.7 Gungor video analysis

4.3 EXAMINATION AND RESULTS – SURVEY ANALYSIS

The primary question, “are there specific chord fingering patterns and structures that afford ease of transition from one chord to another more than other fingering patterns and structures?” has been addressed through research on the second of the two objectives. That goal is to determine perceptions regarding guitar chord changes and whether some changes might be perceived to be easier to perform than others. This study is carried out through the administration of a survey to two select groups of guitarists.

4.3.1 The respondents

Two university guitar programmes were selected for participation in the survey. At ORU, the survey was administered by the primary guitar professor, with nine individuals completing the survey. The respondents varied in guitar-playing ability level, on a spectrum from beginner students to senior-level guitar students. The three responding students at the ACM@UCO were all advanced guitarists, and the survey was administered by the primary guitar professor for ACM@UCO.

4.3.2 The survey results

The Guitar Chord Difficulty Survey is divided into four separate sections, with a progression in the sections intended to increase the level of engagement by the guitarist with the physical performance of specific chord structures. Participants are instructed to rate chord changes based on the degree of difficulty in making the change, with consideration for lateral and horizontal movement of the chording hand, as well as movement of the fingers.

4.3.2.a PERCEPTIONS PART 1

The first section, titled “Perceptions Part 1”, includes seven different chord structures for evaluation; in this section, the respondent is asked to rate each chord change on a scale of one to ten. No guidance is provided as to the fingerings to be used, and without a guitar for reference the expectation is that responders would base assumptions of difficulty on remembered experiences with the guitar chord changes, or representations. Also, at this point there is no differentiation as to whether the chord changes reflect fingering structures of standard, Tomlin, or Baloché patterns. As can be seen on the chart (Figure 4.3.1), six respondents rate the E-A change as having a difficulty level, or degree of difficulty (DD), of one, while four respondents rate the G-D and C-G changes with a DD of one. Those changes with the widest variety of perceived degree of difficulty are the C-D, C-G, A-B and B-E. Of those, the B-E change ranks highest, with five respondents writing down a DD of seven or higher.

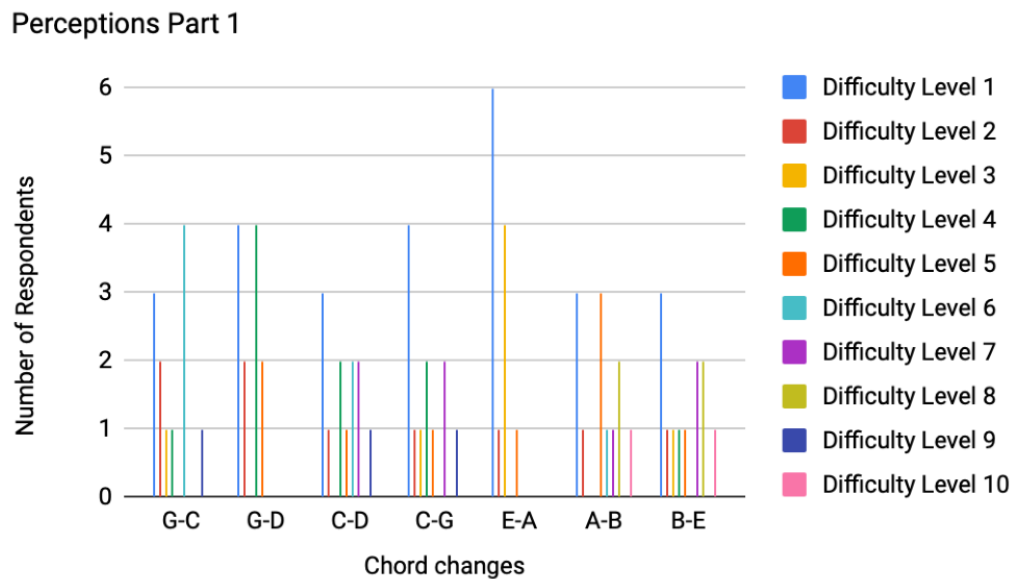


Figure 4.3.1 Perceived difficulty vs chord change (Perceptions Part 1)

4.3.2.b PERCEPTIONS PART 2

The second section, titled “Perceptions Part 2” includes a series of chord changes to be evaluated in terms of performance difficulty. However, these chords have the addition of a fingering diagram for the respondent to follow, although at this point that is the only reference available for comparing the chords; the chord diagrams offer no clues as to whether they are standard, Tomlin, or Baloché fingerings. Of the twelve participants, ten rated the TC to TG³⁵ chord change as having a degree of difficulty of one while nine rated the TG to TC as a DD one (Figure 4.3.2). The standard fingering for SG to SC received the widest variety of difficulty ratings, and the SB to SE scored a total of seven points as being a seven or higher in difficulty.

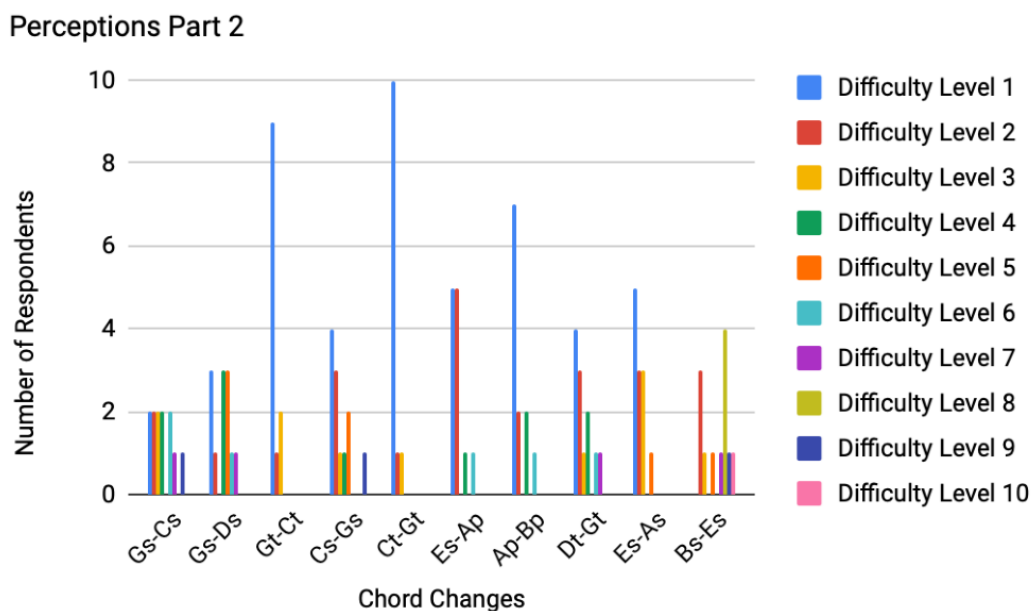


Figure 4.3.2 Perceived difficulty vs chord change (Perceptions Part 2)

The overall rankings for the second question show the TC to TG as the least difficult chord change to manage (10, 1), the TG to TC a close second (9, 1), and the Baloché

³⁵ Recall from the previous chapter the convention whereby chord structures are differentiated with an S for standard, a T for Tomlin, and a P for (Paul) Baloché fingerings.

PA to PB using the railroad track method as third least difficult (7, 2). The shift for the SE to the PA netted 10 respondents giving it a DD of 2 or less (5, 5).

The results of Parts 1 and 2 are based on the perceptions of the respondents rather than any practical finger placement on a guitar. Given a specific chord structure to be played (Part 2), the TG - TC chord change ranks easier than the SG - SC chord change, just as the TC - TG change is viewed as easier than the SC - SG change. Of the ten changes provided, the SB - SE is ranked overall as having the greatest difficulty level, with seven respondents giving that change a DD of 7 or greater.

4.3.2.c APPLICATION

When completing the third survey section, titled “Application,” the respondents are requested to play the actual chord changes on the guitar, supplying a tangible, experiential reference point. Chords and fingering diagrams are provided in the same sequence as Part 2, so the comparison is between perception (seeing the diagram but without playing the chord) and perception/performance (seeing the diagram and playing the chord on a guitar). Overall, there is not a notable change in the ranking in terms of difficulty level, although the shifts in DD from perception to performance on specific changes was interesting (Figure 4.3.3).

When the respondents performed the chords on the guitar, the TG to TC received the most rankings as easiest and the TC to TG received a slightly higher difficulty level ranking overall than in Part 2, with nine DD one and one each of levels two, four and five, as opposed to ten DD one and two each of levels two and three when just viewing the chords. This would indicate that the perceived degree of difficulty for playing the TC to TG is easier than the actual performance of that change. TD to TG also scored a significant difference, with the perception of the chord change viewed as more

difficult than the actual performance of the change. Four respondents rated the perception of DD for that change as four, three rated it as two; however, in actual performance seven gave it a one and one gave it a two.

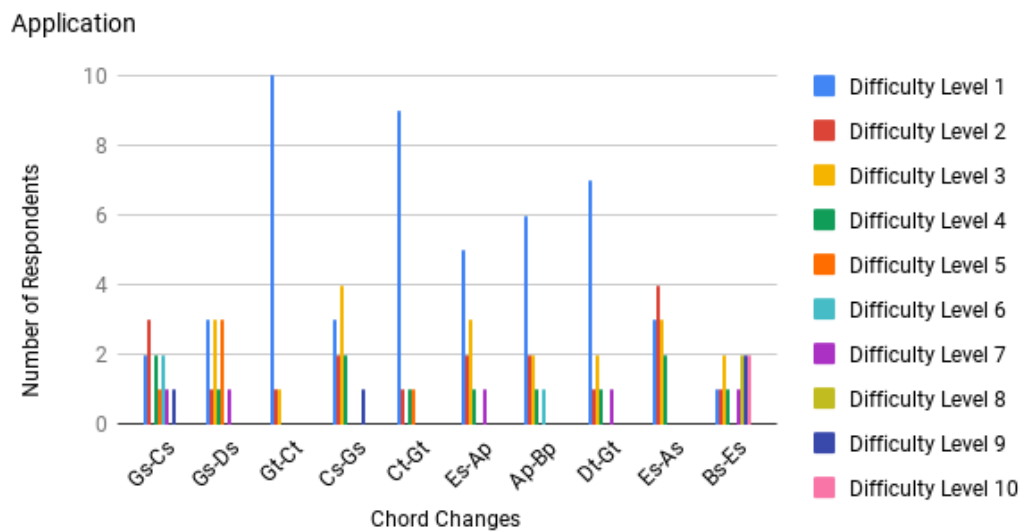


Figure 4.3.3 Perceived difficulty with chord changes (Application)

Of the standard chord changes, the SB to SE suffers the most by being played on the guitar - the perception of difficulty is evenly spread across levels two through ten with predominantly one person voting per degree level, four voting for level eight. In performance (Part 3), although the overall numbers are the same (five below DD 5 and seven above DD 7) there is an increased spread of rankings. In the perception section part 2 four respondents rate the DD as 8, one as 9 and one as 10, while in the performance section the rankings are two as DD 8, two as DD 9 and two receive DD 10.

A closer look at Parts 2 and 3 reveals another aspect of the study related to the overall perceptions of the players. Comparing the chord changes in terms of standard versus Tomlin fingerings shows that the SC to SG rate four ones and three twos for DD while the TC to TG difficulty is perceived as ten ones and one two. Adding the aspect of

performance, the SC to SG rates three ones, two twos and four threes, while the TC to TG received nine ones and one two rating. Similarly, the SG to SC is rated with two votes per DD levels one through four in Part 2, while adding the performance aspect shifts the DD ever so slightly. However, the TG to TC has nine DD one in Part 2 and ten DD one in Part 3. Clearly, the Tomlin versions of the chords are perceived as being easier to perform than the standard versions.

4.3.2.d PERCEPTIONS AND APPLICATION

The section of the survey marked Part 4, “Perceptions and Application”, proved to be an anomaly in the series, not because of the disparity of answers but due to the errors in answering the question. Respondents are instructed to rate the chord changes against each other, resulting in a numbering of the sequences from one to nine³⁶. However, of the 12 participants, eight rated the chord changes in terms of difficulty to perform against the 1 to 10 scale, rather than against the other chord changes. Only four participants rated the changes against each other, so the results of Part 4 were eliminated from the study. The findings were similar, though, with the TC to TG chord change ranked as the easiest to achieve and the TG to TC second. In comparison, the SC to SG change was ranked fifth and the SG to SC was third.

It is possible that the anomaly was due to the fact that participants were asked to rate the changes against the 1 - 10 scale for the three earlier parts, and so were not careful in reading the instructions. Another possibility is that the instructions could have been clearer in communicating the intent of Part 4, changing the difficulty of performance language, or adding stronger wording regarding the evaluation of the chords.

³⁶ The specific instructions were “Looking at the following chord transitions, rate the changes 1 – 9 in order of difficulty of performance, with 1 being the easiest change and 9 being the hardest change.”

4.4 CONCLUSION

The survey instrument supplied data showing clearly that there is a perception that the chords structured by Chris Tomlin offer an easier transition from one to another, over both standard and Baloché chord structures. Furthermore, the distinction is strengthened as the responder physically performs the chord changes on a guitar, not merely thinking about the changes. The analysis of songs, coupled with the video analysis, demonstrates the limited range of chords used by Tomlin. This is especially evident in the videos where he clearly relies on the use of a capo to change keys, allowing him to use four different chords for any song or key choice. Video analysis also supports the belief that those four chords make use of anchored and ring finger on the left hand, with motion to change the chord limited to shifting only the index and middle fingers, as diagrammed in these symbols, shown earlier (Figure 4.2.3, p. 147).

Regardless of the position of his capo (when used, the capo takes the place of the heavy line at the top of the symbol), these symbols represent the vast majority of structures used by Tomlin. Note that on each symbol the third and fourth fingers (3 - ring finger, 4 - little finger) are anchored in the third fret, while the first and second fingers (1 - index finger, 2 - middle finger) move laterally across the strings to create the different chords.

The next chapter will seek to tie these structures to embedded cognition and affordances of the structures, which allow the guitarist to pursue other actions while simultaneously performing these chord changes.

CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This research did not begin with affordances in music. Landing here was a serendipitous journey directed by my supervisor; the starting point was a sense of frustration at the lack of theoretical training of music students at the university where I had just started teaching. What I found, when I discussed the idea with my supervisor, was that there had not been sufficient research done on some of the aspects of the Contemporary Christian Music scene, the mainstay of the school. As I dug deeper into the ideas of affordances and psychology in music, corpus analysis and other areas of the research that I was doing, I found that there are a lot of things that can come out of studying this music. What started out as a negative attitude toward some of the students (with what I perceived as a great lack of theoretical background) turned into a sense of excitement about the potential for what could be done in terms of creating significant learning opportunities for students.

Chapter One lays out some foundational structures of cognition and affordances, as well as the main question and sub-questions for the research. Chapter Two provides the foundation for an understanding of the science of cognition and developments that have occurred in that discipline over the past few centuries. The framework for understanding the study at hand is also established in that chapter. The methodological approach is presented in Chapter Three, with results summarized in Chapter Four. This chapter revisits the questions and offers recommendations for future research. The first section approaches the findings of the study in light of the research and several implications of the study for current research are discussed. The second section examines findings that are not supportive to the research, addresses limitations

that might affect the validity or generality of the study, and offers recommendations for further research and implications for professional practices or applied settings, respectively.

5.1.1 Overview of the findings

The overarching question of this study centers on the question of affordances as applicable to chord structures for guitar players: “are there specific chord fingering patterns and structures that afford ease of transition from one chord to another more than the other fingering patterns and structures?” The objective associated with this question is to determine if the fingering patterns used by Chris Tomlin offer guitar chording structures that might be easier to navigate than standard chord structures. This question and objective are addressed through a phenomenological survey designed to engage perceptions of the participants regarding the structures of chords, and participants are asked to compare Tomlin structures to more generally used Standard structures for specific chords. The results of the second and third questions of the survey support the main idea that Tomlin structures are easier to perform than standard structures. This positive answer indicates that characteristics of the structures guiding chord change action and mobility may be considered action possibilities in the form of affordances.

Three subsequent questions are explored through the corpus study on Tomlin’s works as compared with two fellow contemporary Christian music writers. These questions are employed in addressing the second objective, which is to determine a corpus of work for analysis. This corpus has been determined by analysing the song usage records of CCLI, landing on one of the most prolific composers of CCM over the last two decades, Chris Tomlin.

The first sub-question asks if the chord fingering patterns in Tomlin's music reflect the use of a wide array of chords and is answered by careful analysis of song charts downloaded from CCLI's SongSelect program, which provides music charts based on the composer's original key and pattern. The results of these analyses indicate that at first glance Tomlin's music is composed with a variety of chords and keys, and on the surface this observation would appear to disqualify this question. However, following the addressing of the next questions it becomes clear that while the songs are composed with a variety of key signatures and using several different chords, Tomlin himself plays the chords with a very limited set of chord structures, choosing instead to change keys on his guitar by adding a capo. This allows him to use the same structures across numerous songs regardless of the key.

The second sub-question seeks to determine the chord structures that promote ease of transition between the chords. Video analysis supports the overall theory, demonstrating that Tomlin generally uses a set of four basic chord structures when he performs, and alters the key for his guitar by using a capo. The chord structures used by Tomlin have been addressed at length regarding their finger formations, and the charts for those chords are provided in Figure 4.2.3 (p. 147).

The final question seeks to determine the properties of these chord structures and is intended to provide a basis for comparison against standard chord structures. Those structures are represented using the following chord charts:



Figure 5.1.1 Standard chord configurations

A quick look at the charts would lead one to believe that standard chords might be easier than Tomlin chords to successfully produce, considering that the standard G³⁷, C, and Em chords require fewer fingers to construct the chord. However, the Gibsonian notion of affordances as action possibilities implies the anticipation of or possibility for action, and it is in the process of movement from one chord structure to another that the properties of the chords exhibit those action possibilities characteristic of affordances. For the Tomlin chords, the third and fourth fingers (ring and little) remain anchored throughout the four structures, while the fourth finger is not even represented in the standard structures. For the standard structures, the third finger is found on a different string in each of the four charts, indicating that lateral motion is required to perform each of the chord changes, regardless of which two chords are in action. Additionally, in the Tomlin chords G and C, the second and first fingers each have a very simple lateral shift of one string while maintaining their relative positions. The movement between standard G and C requires that the second finger move laterally two strings and longitudinally back one fret at the same time the first finger moves laterally three strings and longitudinally one fret: those two shifts occurring in tandem with the lateral shift of the third finger. The properties of the Tomlin chords are such that all four variations have the anchored third and fourth

³⁷ There are at least two variations found for standard guitar fingerings, and the structure in the chord chart is the second variation. The first uses the 2, 3, and 4 fingers rather than the 1, 2, and 3 fingers.

fingers and the first and second fingers have minimal lateral movement between chords. These findings support the framework and suppositions of the study.

5.1.2 Framework

This study explores the possible existence of affordances in certain guitar chord structures in light of current studies in the broad discipline of cognitive science and the interplay of mind and matter, specifically in the Gibsonian concept of affordances. This study focuses on the notion of affordances as it relates to the Tomlin chord structures versus standard chord structures, and the notion of action readiness within these structures. Gibson's ecological psychology asserts that the processes of the brain combine with the action processes that are present or implicit in the interactions of the subject with its environment, laying the groundwork for his concept of affordances. Briefly, the tenets of Gibson's approach are first that perception is direct, not computational or representative, second that perception is for the guidance of action, and third that all the information necessary for perception is already available in the environment.

This information, which offers environmental opportunities for guiding behavior, is what Gibson calls affordances. Rowlands more recently expands the concept, showing that people use specific features of the environment, features that are embedded in the environment, to achieve this cognition or cognitive action. A benefit, or side impact, or result of, the embedded cognition is that the complexity of a process in getting from A to B is reduced by using that external structure; "in accomplishing cognitive tasks, an organism can utilize structures in its environment in such a way that the amount of internal processing it must perform is reduced" (Rowlands 2010:68-69). The placement of the fingers in the Tomlin chords, coupled with the

minimal amount of attention necessary to complete a chord change, reduces the complexity of making the chord change, thereby allowing the guitarist to put more energy into other aspects of performance. This reduction in expended energy is directly a result of the affordances found in the structures of the Tomlin chords.

5.1.3 Findings in light of the research

The link between affordances and motor action possibilities is noted by embedded cognition theorists (Clark & Chalmers 1998, Rowlands 2010, Menin & Schiavio 2012), and there is a recognition that the design of an environment provides certain constraints that enable some possible behavioural interactions while at the same time limiting other possible actions (Haselager et al 2008). This study supports the perception that a guitarist interacts with the chord structures, including constraints and possibilities, and these interactions (opportunities) constitute affordances for the performance of the chord changes. Much like the jigsaw puzzle worker observing a puzzle piece, the guitarist finds that certain structures offer a quick path to the next structure in a change, while other structures offer constraints to the shifts required.

These findings are in line with the work of Heron and Berec in their study of idiomatic trumpet compositions, where certain passages were found to be easier to play due to the formation of the composition and the way certain fingerings of trumpet notes flowed better in combination with other fingerings in a passage. For the trumpeter and the guitarist, these structures provide action capabilities that promote an ease of movement from one chord to another. The trumpeter uses multiple finger combinations to move from one note to another, and some combinations make for easier playing of the passage. The guitarist who is using Tomlin chord structures has no movement of two fingers in transitions between the four chords studied, with

minimal movement of the other two fingers, and those fingers frequently move in tandem with each other. Only one finger in one chord change includes longitudinal movement (to play the Em chord, the second finger moves to the second fret). Phenomenologically speaking, the chord transition appears easier because of the structures of the chords.

Actions that are taken, whether in playing chords on a guitar or fingering the valves of a trumpet, present challenges as one moves through the processes necessary to complete those actions. However, certain structures provide opportunities for those actions to be more readily accomplished than might happen with different structures. This difference in performance capabilities is a perception that one has based on how one has experienced those actions. The study shows that for those taking the survey, the chord changes based on Tomlin structures were perceived to be easier to accomplish than the chord changes using standard structures. These chords feature certain fingering patterns that are embedded in the structure. The experienced guitarist will have several options available for executing various chords. The National Guitar Academy website, for example, shows four variations for fingering the C chord³⁸, three using the barre method. The guitarist has the ability and the option to select which chord structure best fits the musical passage sonically, or which structure might more easily lead to the next chord, and to make other decisions regarding chord structure choices. However, novice guitar students do not have those options readily available at the start. They must learn the chord structure, then apply this learning to the fretboard, and for the first several times they play the chords, must think about the position of their fingers for the next chord to be played.

³⁸ <https://nationalguitaracademy.com/lessons/c-guitar-chord/> (accessed?)

Of course, every possible chord structure has certain characteristics embedded in the chord. Likewise, every structure has action possibilities built into it. So too every puzzle piece has certain characteristics and action possibilities, just as every door handle has characteristics and possibilities. Not every puzzle piece will fit in every available position in the puzzle; in fact, there is only one possibility for that puzzle piece. And every door handle may function quite nicely to open or shut a door, but not every door handle screams “pull me” or “push me” as one approaches the door. The accomplished architect will take advantage of those affordances to guide the user even before he reaches the door, and the skilful songwriter will guide the guitarist to the best options for producing a particular accompaniment. However, the chords have attributes built into their structures that may provide an easier path to performance.

The survey provides a series of chord changes, soliciting a response as to the complexity of the chord changes and how difficult the changes are to accomplish, thereby addressing the action readiness of the guitarist. The second section of the survey (Perceived Difficulty vs. Chord Change) is intended to be completed with only a visual frame of reference in the chord chart and requires the participant to call upon his or her experiences in the past with the chords. In order to complete this task, the participant very likely relies on representations already available to him through previous experiences with these chords. Nine participants rated the Tomlin G-C change as very easy (with a degree of difficulty of 1), one participant rated the same change as slightly less easy (2), and two rated it as merely easy (3). The standard G-C change, however, was spread more evenly between several levels of perceived difficulty (no more than two votes for difficulty levels 1, 2, 3, 4, and 6, with 7 and 9 receiving one vote each). This indicates that the participants consider the Tomlin

change to be remarkably easier to perform than the standard change, but solely based on what is known or remembered about the chords.

The third section involves the guitarist executing the chord changes, and it is in this section that the guitarist has a haptic interaction with the fretboard, experiencing the sensations of motion and difficulty in the chord changes. With that tactile experience, the Tomlin change received ten votes at the difficulty level of 1 and one vote each at the difficulty levels 2 and 3. This indicates that two participants decided that the Tomlin chord change was easier by at least one degree of difficulty when played rather than merely thinking about the changes. Results for the standard chord change were only slightly different than Section Two, with one participant deciding the change was easier and one deciding it was harder after playing the changes. While there was not a significant change in the perception of difficulty between sections two and three, both sections show that there is a perception that the Tomlin chord changes are easier than the standard chord changes. Hence, the action possibilities, or affordances, of the Tomlin chords support the theory that those chord changes are easier for the guitarist to complete.

5.1.4 Implications of the study for current theory

This study focuses on the belief that affordances are embedded in structures, ready to be unveiled in an action process. Huron and Berc (2009) use the language of idiomatics in their work on trumpet fingerings and compositional practices, in which they structure an experiment for demonstrating performance difficulties in trumpet fingerings. The work of Huron and Berc stands apart from other attempts to associate music with affordances, tying the question of idiomaticities to the physical work of producing music. Menin and Schiavio (2012) suggest that affordances in music

pertain to the motor repertoire of the subject, allowing the focus to be placed on the action readiness of the performer to reconstruct a given passage of music using the motor knowledge of the fingers.

The focus of study in cognition and affordances on the action readiness of the musical performer as related to specific performance practices is relatively unexplored in research to this point. Beyond Huron and Berc, who do not even mention affordances per se, much of the research in affordances as related to music is centred on the sonic environment produced by musical sounds and explores the ways in which listeners experience and respond to the environment. This direction in music cognition and affordances is understandable, as references to music might generally be considered aural rather than haptic.

However, Chemero has opened the door to further development in the haptic application of affordances with reference to Heidegger's ready-to-hand and unready-to-hand as applied to interactions with tools (Chemero 2013). The hands and fingers of the guitarist fit very well into the role of a tool used to complete the performance, the structures of the chords dictating hand placement and mechanics necessary for chord changes. Heidegger's ready-to-hand interactions are those things done without requiring a great degree of concentration, such as riding a bicycle or, for Chemero, using a computer mouse. Once one learns to ride a bicycle, the mechanics of the bicycle recede into the background of experience and the cyclist pays more attention to the road, traffic, and other aspects of the surroundings. If something happens to disrupt the bicycle, such as brakes grabbing or the chain slipping, then the cycle comes to the forefront of our experience, as unready-to-hand.

The guitarist who is attempting to lead a worshipping congregation is immersed in a particular environment. DUBY (2020) makes the case that any band on stage might very well be considered a superorganism. Features of this Umwelt place many demands on the concentration of the leader; words must be recalled, communication with the band and technical support team must take place, the leader reads the room to gauge how to proceed in the worship setting. While playing a set of chords that are easily ready-at-hand, the guitarist can offload those thought processes related to guitar performance, freeing up the mind to fully engage in other activities. This study indicates that the Tomlin chord structures have affordances that more readily allow this offloading to occur.

This idea of offloading chord changes is addressed by Baloche in the use of his train track chords, especially in his video-taped teaching series. His use of train tracks is built on the standard E chord formation, and that formation is shifted from the first fret to the sixth fret position for the A chord and the eighth position for the B chord. For these chords, the E strings and B string remain open, sounding throughout the chord progression. Baloche's idea is that the guitar-playing worship leader only needs to glance occasionally at the location of his hand on the fretboard and is able instead to concentrate on other aspects of the worship experience.

In the Baloche fingerings the first finger is unused, and the chord is formed with the second, third and fourth fingers. Those three fingers have longitudinal movement of six frets but remain on the same strings so have no latitudinal movement. Also, three strings (E, B, and E) are played, but remain open throughout the chords. The B chord chart is similar in structure but shows the 8fr rather than the 6fr.

The chord structures of both Tomlin and Baloché provide the opportunity for offloading the energy of chord changing to the structures, rather than requiring attention from the worship-leading guitarist. The actions of the guitarist are specifically located in what could be considered an environment *within* an Umwelt. On a micro level, the hand is interacting with the fretboard to create the distinct chords that produce the peculiar sound, and the guitarist is paying attention to this particular action. On a macro level, the worship leader is not only participating in the worship event but is responsible for leading that event as well. For many Christian church groups worshipping in the contemporary style, this event has definite components which distinguish it from church groups using liturgically based structures, as well as from the experience³⁹ one might have at a concert.

Subtle differences exist between the band giving a rock concert and the worship band. For many churches this experience may feel the same, as both the rock concert and the worship setting are generally designed to carry the participant along with the band on a scripted journey, thereby calling the partaker to enter the Umwelt of the band. In the concert setting the skilled front man may engage with the audience in ways that invite spectators to share in the experience more fully. However, the front man is typically following a script, with certain songs placed at specific intervals, and a destination represented by a wild ovation followed by two or three encore numbers, also well scripted. The worship experience also benefits from a skilled front man, or worship leader, but the experienced worship leader will recognise an opportunity to

³⁹ Ginghamburg United Methodist Church in Tipp City, Ohio, is one congregation that actually labelled its gatherings as "experiences" rather than "services" based on the idea that to go to a service was to go do something for someone else, whereas gatherings were intended to be emotionally engaging and spiritually uplifting while immersing the worshipper in an environment designed to direct the worshipper on a journey from the time of entering the parking lot to exiting same parking lot.

“go off script” and repeat a chorus, or extend a phrase, or even introduce a different song than the planned next song. In this sense the worship experience presents a world all its own - a unique Umwelt. Within that setting it is a great advantage to the worship leader to have a set of chords with embedded affordances that can be played in some offloaded world of its own.

5.2 LIMITATIONS OF THE STUDY

There are several aspects of this research that will be beneficial to consider as research proceeds in this area. This section looks first at some of the problem areas and limitations with the research and concludes with some suggestions for future research areas and professional applications.

5.2.1 Findings that fail to support the main idea

The study is designed to explore the main idea that there are affordances in specific guitar chord structures, and evidence from the study supports that theory. However, the first of the sub-questions is centred on the music of Tomlin and asks if there is a wide array of chords used. The working concept behind the question is that Tomlin does not use a diversity of chord structures but relies instead on four or five basic structures. The evidence, however, indicates that in fact there is a variety of chords used in Tomlin’s music. The main idea is not, strictly speaking, supported by the evidence.

Instead, it would be more accurate for the purposes of this study to ask the question specifically about Tomlin as the guitarist and his personal performance practice while playing the music. The video evidence does support the intent behind the question, which is to determine if Tomlin himself uses a wide variety of chords. He does not. When Tomlin performs his own music, he typically plays the four structures presented

earlier. Therefore, to get at the intended meaning, the question might better be worded “Do the chord fingering patterns found in Tomlin’s own performance of his music reflect the use of a wide array of chords?” Asking the question in this way narrows the chord structures in question to those used specifically by Tomlin. If that were the question, the answer would absolutely be in line with the main theory of the researcher.

Other guitarists in the videos do, in fact, play a wide variety of chords and structures. Most of the analysed videos had at least one other guitar player besides Tomlin, and in almost every case, the other player used either standard chording or alternative structures. Some of the guitarists did not use a capo to play in different keys, while other guitarists used a capo in a different fret, allowing the chord to sound in a different register than Tomlin’s guitar. This is a very common arrangement in the videos analysed - one or two guitarists play the song in alternate chord structures to add depth through playing in different sonic registers.

Another aspect of the research pertains to the survey instrument itself. Sections two and three of the survey ask for and provide evidence that there is a perception that the Tomlin chord structures afford ease of transition from one chord to another. Participants drew upon representations to complete the second section and used the guitar to finger the chord changes for the third section, and every one of the participants rated the changes as instructed. Participants are asked to rate each chord change as to the difficulty of making that change and do so on a scale of one to ten, with one being easy and ten being difficult. Section one of the survey provides an entry into thinking about chord structures but is not designed to solicit information

that differentiates between standard and Tomlin chord structures. In that sense, the first section neither supports nor fails to support the main idea.

The fourth section is designed in a way that the subjects are asked to rank the difficulty of the chord changes against one another, rather than on a scale. When this is done correctly, the respondent ranks the nine chord changes and each change has a different number, 1 - 9. In this way the fourth section shows the perception of the chord change difficulty against the other chord changes. Whether due to the instructions on the survey or verbal instructions, or for some other reason, only four of the respondents completed the fourth section in the fashion that was intended. The other eight participants continued the pattern established in the previous sections and ranked each chord against itself in terms of degree of difficulty. Therefore, while the results of the four participants indicate clearly that the two Tomlin chord changes, C-G and G-D, are the easiest to perform, that is only one-third of the total respondents of the survey. Those four do support the theory, but section four must be omitted from the research results based on the failure to fully capture the necessary information regarding the ranking of the chord changes.

One other area of the study that fails to lend support to the main idea is the inclusion of a third artist in the song and video analysis leading up to the corpus analysis. The original intent was to provide two contrasting artist/songwriters to the Tomlin corpus in order to give examples of 1) a contemporary on equal footing (Baloche) and 2) an up-and-coming artist in the genre (Gungor). The Baloche music and videos provided contrast and in some cases validation of the theory. However, Gungor's music turned out to be so diverse in both instrumentation and orchestration as to be unusable as a contrast. His music is interesting and deeply spiritual while also being more musically

complex and certainly more heavily orchestrated. However, it did not provide useful information for the purposes of this study.

5.2.2 Limitations of the study

The choice of using the Christian Contemporary Music resources as a starting point for building a corpus for analysis is one that by its very nature limits the generality of the research. The CCM genre is functionally a vast Umwelt of its own, with radio stations and record stores exclusively devoted to that market. CCLI is an international agency dealing with the administration of intellectual property royalties and the associated businesses, but again functioning within the CCM framework. In the sense that this research focuses on that genre and market, it would be a stretch to claim that the results could be scalable to a larger body of work, for example the rock and roll genre as a whole. That is not to say chord structures in other genre do not have the same or similar affordances characteristics; Greg Lake, introduced in the first and second chapters, made use of a drop D tuning in order to have a sustained bass note that fit his chord structures. The guitarist who has a few power chords in his hand is able to easily play a number of different styles not at all related to CCM.

This study focuses on that CCM market and is not designed to encompass the entirety of the guitar-playing world. Even so, the CCM market and specifically the volume of churches and music associated with the CCLI licensing process is rather large, with over 300,000 different churches or organizations around the world reporting on the music used in worship services in various formats. For any number of private Christian higher educational institutions seeking to address the proliferation of the CCM music and style of worship (and the impact that has on the college music student), the music of Chris Tomlin has tremendous impact, and the results of this

study speak to one of the reasons his music is popular with worship bands - it is easy and pleasurable to perform.

Moreover, this research targets the corpus of work by one particular artist. There are numerous artists in the CCM world and most of them are represented at some level on the CCLI charts. It is not within the realm of this research to tackle the music of other artists either in chord structure frameworks or music theory content.

5.3 RECOMMENDATIONS FOR FURTHER RESEARCH

A whole chapter could be written on possible directions for future research based on the findings in this study. Further research could centre on questions such as the CCLI licensing practices, music and artist selection by licensing agents, compositional practices of artists as individuals or in collaboration with other artists, questions of affordances and how the worship leader uses music to guide a congregation to certain unified experiences, the link between affordances in music and entrainment through music, and the list could go on. One primary area that bears exploration in the community of cognitive researchers and musicologists focuses on the structure and direction of the study and ways that it could be developed to provide empirical evidence for the main idea of the research.

The type of research done in this study is a phenomenological study on perceptions about guitar chords, and the primary instrument of investigation is a survey completed by several guitarists of varying levels of ability. Perceptions are valuable to the research community in terms of understanding how individuals feel or think about a certain topic. However, perceptions are seldom indicators of empirical data; the compilation of numerous survey results may help the researcher understand how larger groups of people may think about things, but to draw mathematical conclusions

from emotional responses is a bit of a reach. Future research in the area of affordances in the chord structures and progressions could focus on asking and answering the question “what would an empirical data process look like that addresses the main question of this study”? It is one thing for respondents to give their impressions on a survey. It is entirely different to develop a way to quantify the results and obtain empirical data. Huron and Berc headed in that direction with their process of deriving a coefficient against which to measure degree of difficulty in fingering passages for the trumpet. With advances in neurological studies and computer-captured inputs and analysis, compiling empirical data should be just around the corner.

Research into affordances and the practice of playing guitar chords is just one of the many areas that might benefit from additional research. Practitioners would benefit from some of the implications of the research and what that could mean to the guitar performer. While this section explored one area of possible further research, the following section expands on how the professional would benefit from these findings.

5.3.1 Implications for professional practice or applied settings

This study is conducted using a corpus of work from Christian Contemporary Music as represented by CCLI. That body of works is one of the main sources for music in worship services throughout the world, and on any given Sunday songs from Chris Tomlin’s pen are being played and sung by millions of worshipping Christians. Tomlin’s songs, along with Baloché’s songs and thousands of other songs by hundreds of composers make up the over 200,000 possibilities from CCLI for the Sunday morning contemporary worshipping church. Most of those songs have seen their time in rotation come and go while a solid core of songwriters has dominated the church music marketplace. Both Tomlin and Baloché are members of that elite core

and have music that has been in the top 100 songs over the past nearly 20 years. The results of this study point to that being in part because the chords used by Tomlin, and to an extent those used by Baloché, are easier to manage and change between, and the worship leader can off-load attention to chord changes to the actual chord, freeing the leader to focus on other aspects of performance.

The guitar player responsible for leading worship while playing has to navigate through reading lyrics either from a chord chart in front of her, or projected on the screen on the back wall, meanwhile changing chords and paying attention to the response of the congregation to the Spirit at the moment. Simultaneously, she is communicating with band members about the direction of the song while feeding upcoming lyrics to the computer operator responsible for projection of said lyrics so that the congregation, who is trying to sing along, does not fall behind. However, now that the guitar playing worship leader has looked down to manipulate a particularly difficult chord change has forgotten to feed the lyrics to the computer operator, the words on the screen are from the end of the chorus and not on the beginning of the next verse and everyone, including the background vocal singers, is lagging behind on text. The band, unfortunately, is forging ahead on tune and the hapless guitar playing worship leader is now scrambling to bring the band back in line with the vocalists.

The last paragraph is confusing, and may seem somewhat of a stretch, but all too often it is a very real scenario in which the worship leader is called upon to perform a number of tasks simultaneously. Having a series of chord progressions that require little or no engagement from the guitarist allows her to focus on other aspects of the performance. With careful examination of the worship music, the leader could apply

the idea of the affordances in chord structures to create a music set which allows the continued off-loading of chord changes to the structures.

Regarding the worship experience and the sciences of cognition and affordances, it is important for the leader to be aware of other studies in the field, especially as related to matters of entrainment and psychology. Studies have been done in the area of collective identity in groups, specifically as applied to the performing music ensemble (Duby 2020), and it might be valuable for the worship leader to regard the church community as a system and the worship setting as a performance.

A second area addresses the possibility of an instructional outcome from this research.

Affordances built into the Tomlin and Baloché chord structures offer the guitar teacher the opportunity to develop a pedagogical system of instruction based on the Tomlin chords, and use that system to teach a student how to play the guitar in a limited number of sessions. Because the chords are easily constructed, and changes between chords are perceptually easier to accomplish, the teacher could construct a system teaching the Tomlin chords first. Then the teacher might add in other variations with similar affordances such as the Baloché or Lake songs. This system could be designed in a way that a student could attend one lesson and walk out of that lesson with the ability to play a simple song and the encouragement to return for another lesson.

That pedagogical system supposes that the student would learn a few chords quickly and feel a sense of accomplishment. The danger in such a possibility circles back to the original impetus for this research. Guitar players have numerous resources available through which they can learn songs and be able to perform them quite adequately. However, the guitar student in the university setting must be prepared to

play a variety of chords with a comprehension regarding the theoretical drivers of the chords as well as how to make the chords sound nice. It was this lack of a musical foundation both theoretically and practically that led to this project. Ideally, the pedagogic system will embrace the ease of playing Tomlin guitar chord structures and move the student into a deeper understanding of the music theory behind the pretty sounds.

5.4 CONCLUSION

The discussion of affordances introduced by Gibson in the last half of the last century brought a new element to the science of cognition, an engagement or interaction between the cognising organism and its environment. This relationship has been explored in several different fields that rely on visual perception as the vehicle of that relationship, and in the realm of music the interaction has primarily focused on the sonic environment. This research has shown that the study of affordances is applicable in a haptic sense for musicians as well. As Huron and Berec demonstrated the idiomatic nature of trumpet compositions by Herbert Clarke and trumpet fingering, it is evident that a similar relationship exists between the compositions and chord progressions of Chris Tomlin. His music uses chord structures that have embedded affordances which allow the guitarist to make the chord changes quickly and efficiently, simultaneously offloading thought processes onto the fingering and freeing his mind for the work at hand – guiding a group of worshippers through an interaction with God.

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APPENDICES

Following are two appendices for informational purposes. The first is a copy of the Survey Instrument that was distributed to participants. The instrument was originally formatted for distribution in the United States, so was done with 8 1/2 by 11 paper size, one-inch margins. It was distributed to the gatekeepers electronically, and they printed and distributed the documents. Upon completion of the survey by participants, the gatekeepers returned the surveys via the United States Postal Service.

The second appendix is a list of videos used in analysis. The list includes videos featuring each of the three artists and divided by artist, then song. The format for the entry begins with the title of the video, followed by the website for the video link, then a very brief note on the publisher and date of publication, followed by the access date.

The third appendix is a brief schedule of the interview questions. The interviews were conducted in an inductive format, beginning with general starter questions and follow-up questions coming from the context of the interview. This schedule represents the broad starter questions.

Appendix 1

Guitar Chord Survey

Measuring perceptions of chord production difficulty

A research project by

David Roman

In partial fulfillment for

PhD et Litt in Musicology

Dr. Marc Duby

UNISA

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GUITAR CHORD SURVEY

In the following exercises, you will be asked to rate guitar chord changes on degree of difficulty. When considering the difficulty of the changes, take into account the speed of the change, lateral movement of the fingers as well as horizontal shifting of the left hand, and shifts in the placement of fingers on the guitar fretboard for each chord.

PERCEPTIONS PART 1

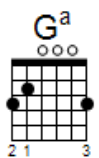
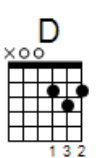
Rate the following guitar chord changes on a scale of 1 to 10, based on the given chord symbols:

- | | | | | | | | | | | |
|-----------|---|---|---|---|---|---|---|---|------|-----------|
| 1. G – C. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Very easy | | | | | | | | | very | difficult |
| 2. G – D | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Very easy | | | | | | | | | very | difficult |
| 3. C – D | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Very easy | | | | | | | | | very | difficult |
| 4. C – G | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Very easy | | | | | | | | | very | difficult |
| 5. E – A | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Very easy | | | | | | | | | very | difficult |
| 6. A – B | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Very easy | | | | | | | | | very | difficult |
| 7. B - E | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Very easy | | | | | | | | | very | difficult |

PERCEPTIONS PART 2

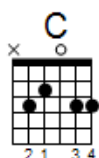
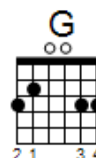
On a scale of 1-10, with 1 being very easy and 10 being very difficult, look at the following guitar chord changes based on the given chord charts and rate the difficulty of each change:

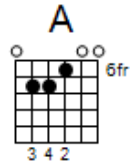
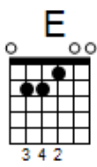
10.   1 2 3 4 5 6 7 8 9 10
 very easy very difficult

11.   1 2 3 4 5 6 7 8 9 10
 very easy very difficult

12.   1 2 3 4 5 6 7 8 9 10
 very easy very difficult

13.   1 2 3 4 5 6 7 8 9 10
 very easy very difficult

14.   1 2 3 4 5 6 7 8 9 10
 very easy very difficult

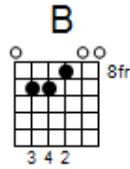
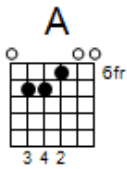


1 2 3 4 5 6 7 8 9 10

15.

very easy

very difficult

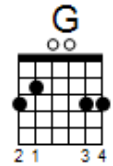
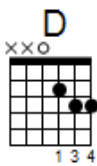


1 2 3 4 5 6 7 8 9 10

16.

very easy

very difficult

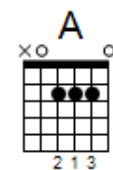
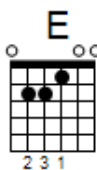


1 2 3 4 5 6 7 8 9 10

17.

very easy

very difficult

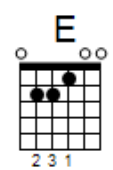
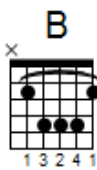


1 2 3 4 5 6 7 8 9 10

18.

very easy

very difficult



1 2 3 4 5 6 7 8 9 10

19.

very easy

very difficult

APPLICATION

Play the following chords on a guitar using the given chord fingerings, then on a scale of 1 - 10 rate the difficulty of playing each chord change:

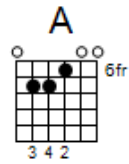
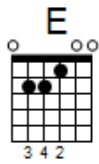
20.  1 2 3 4 5 6 7 8 9 10
 very easy very difficult

21.  1 2 3 4 5 6 7 8 9 10
 very easy very difficult

22.  1 2 3 4 5 6 7 8 9 10
 very easy very difficult

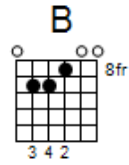
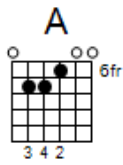
23.  1 2 3 4 5 6 7 8 9 10
 very easy very difficult

24.  1 2 3 4 5 6 7 8 9 10
 very easy very difficult



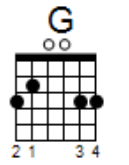
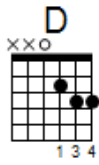
25.

1 2 3 4 5 6 7 8 9 10
 very easy very difficult



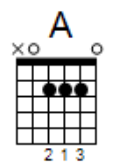
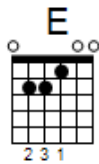
26.

1 2 3 4 5 6 7 8 9 10
 very easy very difficult



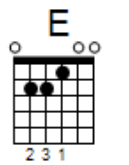
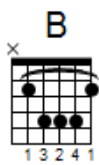
27.

1 2 3 4 5 6 7 8 9 10
 very easy very difficult



28.

1 2 3 4 5 6 7 8 9 10
 very easy very difficult

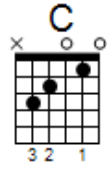
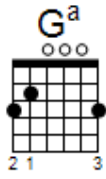


29.

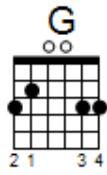
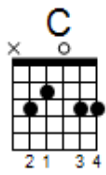
1 2 3 4 5 6 7 8 9 10
 very easy very difficult

PERCEPTIONS AND APPLICATION

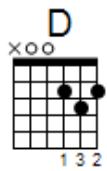
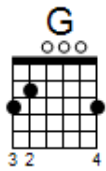
Looking at the following chord transitions, rate the changes 1 - 9 in order of difficulty of performance, with 1 being the easiest change and 9 being the hardest change:



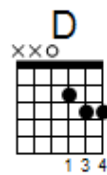
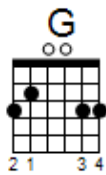
41. _____



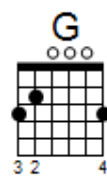
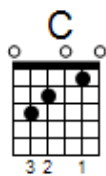
42. _____



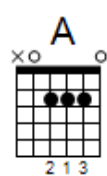
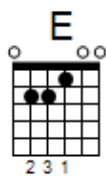
43. _____



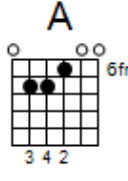
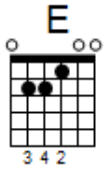
44. _____



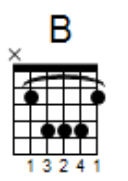
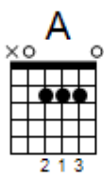
45. _____



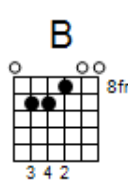
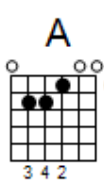
46. _____



47. _____



48. _____



49. _____

Appendix 2

Chris Tomlin videos:

Amazing Grace (My Chains Are Gone)

Chris Tomlin - Amazing Grace (My Chains Are Gone) (Live)

<https://www.youtube.com/watch?v=KKo3T0j9qqo> Official Live video published on March 25, 2016. Accessed May 4, 2018

Chris Tomlin Amazing Grace (My Chains Are Gone) -- Live

<https://www.youtube.com/watch?v=UeRdfnfCJwA> Live audience video published Dec. 12, 2006 by rayoflight67, recorded in Indiana

Passion 2007 Amazing Grace (My Chains Are Gone)

<https://www.youtube.com/watch?v=7goz3PWjJKs> published by 2Fine2DFine on Feb. 17, 2007, Passion Conference 2007, Atlanta, Georgia Jan 1-4.

Chris Tomlin // Amazing Grace (My Chains Are Gone) // New Song Cafe

<https://www.youtube.com/watch?v=BJi8MbEQBgc> Worship Together published June 9, 2016

Chris Tomlin - "Amazing Grace (My Chains Are Gone)" Live at Fandana Festival 2012 <https://www.youtube.com/watch?v=hAJCWOGj3JA> amateur recording Zack Sanders Aug. 12, 2012, recorded at Huntington University, Huntington, Indiana, Aug. 10, 2012.

Amazing Grace (My Chains Are Gone) by Chris Tomlin with Lyrics

<https://www.youtube.com/watch?v=RoeBFZes3ts> ice cing published Feb. 19, 2016

How Great is Our God

Chris Tomlin - how great is our god

https://www.youtube.com/watch?v=JpfKli_4LQ0 NewWorshipCafe with Quang

Vu, Tomlin talking about and teaching the song uploaded 30 Jan 2006

How Great Is Our God <https://www.youtube.com/watch?v=5pF11qnJ8rw>

Christominmusic, uploaded 28 Oct 2008 Chris and his piano, solo

CHRIS TOMLIN - how great is our god @ Springtime Festival 2011 (Live) HD

Uploaded 8 Jul 2011 <https://www.youtube.com/watch?v=1wWUaih7Uw>

How Great is Our God (World Edition)

<https://www.youtube.com/watch?v=vg5qDljEw7Q> Various worship artists singing in different languages, recorded 2012, published 12 Ap 2013

How Great Is Our God (Live) <https://www.youtube.com/watch?v=DpIcqoKOz2M>

Official Live video for “How Great Is Our God” by Chris Tomlin published 25 Mar 2016

09. Chris Tomlin - How Great Is Our God (S5)

<https://www.youtube.com/watch?v=2FoObcPWmGo> Published 23 Feb 2015 Tomlin on acoustic guitar leading worship.

Chris Tomlin - How great is our God

<https://www.youtube.com/watch?v=MWLiNrNjOZ8> From 1shotandamiss2, uploaded 12 Aug 2008

How Great is Our God & How Great Thou Art by Chris Tomlin

Chris Tomlin at Big Ticket Festival 2014

<https://www.youtube.com/watch?v=IN91D84Tptc> Outdoor venue, not professional recording, published 31 Jul 2014

Chris Tomlin - How Great is Our God (LIVE-HD) iPhone video Scottrade Center, St. Louis, 3-26-15 pub 27 Mar 2015

https://www.youtube.com/watch?v=zFn-c5nf_RU

Chris Tomlin - How great is our God uploaded by Will Job in 2015

<https://www.dailymotion.com/video/x362nfg>

Jesus Messiah

Chris Tomlin - Jesus Messiah - LIVE @ SPIRIT 105.3 FM

https://www.youtube.com/watch?v=Vz64E2y0_UI SPIRIT1053 published Sep 12, 2008, viewed Feb 28, 2019 Live in the studio

Chris Tomlin // Jesus Messiah // New Song Cafe

<https://www.youtube.com/watch?v=iHpHIotUzPA> Worship Together published Jun 18, 2016, viewed Feb. 28, 2019 Live at new Song Cafe

Chris Tomlin - Jesus Messiah

https://www.youtube.com/watch?v=L_onoJ5xCnM Matt Stephan published Jul. 11, 2014, viewed Mar 1, 2019 amateur video of live performance at World Pulse Fest, South Bend, In.

Our God

Chris Tomlin - Our God (Live) official Tomlin video

<https://www.youtube.com/watch?v=NJpt1hSYf2o> christomlinmusic published Oct. 29. 2013 recorded live

Passion 2010 w/ Chris Tomlin - Our God

<https://www.youtube.com/watch?v=l6YCrWhUdDs> rastakim16333 published Nov. 29, 2010

Chris Tomlin // Our God // New Song Cafe with Matt Redman

https://www.youtube.com/watch?v=zZXaWN_9Z1E Worship Together published Mar. 8, 2010 interview about the birth of the song, which was written for Passion 2010.

10. Chris Tomlin - Our God (Late Night) Acoustic version, very cool

<https://www.youtube.com/watch?v=MBYIyba7TWE> Adrian Grigoras published Feb. 23, 2015

Chris Tomlin Our God Live - Arlington, Texas Harvest America 2018

<https://www.youtube.com/watch?v=AFFX1-sppHw> Jesus Canal De Salvacion
published June 13, 2018

Whom Shall I Fear

Chris Tomlin - Whom Shall I Fear (God Of Angel Armies) (Live)

<https://www.youtube.com/watch?v=bwo7KT95iDg> christomlinmusic published
Mar. 25, 2016 viewed Feb 28, 2019 Recorded live

Passion - Whom Shall I Fear [God of Angel Armies] [feat. Chris Tomlin]

<https://www.youtube.com/watch?v=q24z4XcJxnM> PassionVEVO published Mar 8,
2013 viewed Feb 28, 2019 recorded live

K-LOVE - Chris Tomlin “Whom Shall I Fear” LIVE

<https://www.youtube.com/watch?v=cVyqmb189AE> K-LOVE published Jan 4,
2013, viewed Feb 28, 2019 recorded live in the K-LOVE studio

Chris Tomlin // Whom Shall I Fear (God of Angel Armies) // New Song Cafe

<https://www.youtube.com/watch?v=i6MVuUr352U> Worship Together published
Ap 14, 2016, viewed Feb 28, 2019 New Song Cafe with Matt Maher

Chris Tomlin - Whom Shall I Fear (Live Acoustic) 1/10/13

<https://www.youtube.com/watch?v=C-dgke8Eifg> MrDanielson published Jan 10,
2013, viewed Feb 28, 2019

Paul Baloche videos:

Above All

Paul Baloche - LIVE at Bethel Church

<https://www.youtube.com/watch?v=rdiAunjzmas> published on YouTube by Jonathan Martel Jun 4, 2017 accessed Jan 26, 2019.

Paul Baloche - Above All (Official Live Video)

https://www.youtube.com/watch?v=LtJK5oqAh_8 Integrity Music published Feb 1, 2018 viewed Mar 5, 2019 Studio production with live studio audience;

Above All - Paul Baloche

<https://www.youtube.com/watch?v=RbrMSEwDo8o> leadworshipdotcom published Aug 28, 2007, viewed Mar 5, 2019 Acoustic set

Paul Baloche: Above All (James Robison / LIFE Today)

<https://www.youtube.com/watch?v=nUt6sW6Npqq> published May 12, 2017, viewed Mar 5, 2019

Paul Baloche - How to play the song Above All

<https://www.youtube.com/watch?v=OT9a9ggcgd0> leadworshipdotcom published Dec 13, 2007 viewed Mar 5, 2019

Hosanna (Praise is Rising)

Paul Baloche - Hosanna Studio Video

<https://www.youtube.com/watch?v=3F1ADeQcIIU> published on YouTube's leadworshipdotcom on April 16, 2011.

Paul Baloche - Hosanna (Praise Is Rising)

https://www.youtube.com/watch?v=_6t53HBih1I published on YouTube's PaulBalocheVEVO Jul. 3, 2015.

Paul Baloche - Hosanna - Live in Korea

https://www.youtube.com/watch?v=tT_jngwVX3A published on YouTube's leadworshipdotcom Nov. 4, 2008

Paul Baloche - LIVE at Bethel Church

<https://www.youtube.com/watch?v=rdiAunjzmas> published on YouTube by Johathan Martel Jun 4, 2017 Accessed Jan 26, 2019

Open the Eyes of My Heart

Paul Baloche - Open the Eyes of My Heart (Official Live Video)

<https://www.youtube.com/watch?v=ViBNqNukgzE> live audience, published Feb 15, 2018 by Integrity Music

Paul Baloche: Open The Eyes Of My Heart (James Robison/LIFE Today)

<https://www.youtube.com/watch?v=R3rxO0ZJj4Y> tv studio performance, published May 12, 2017 by lifetodaytv Paul Baloche - Open The Eyes Of My Heart - Song Story

https://www.youtube.com/watch?v=XqE7_SQcbX8 published by Integrity Music Oct. 16, 2008

Open The Eyes Of My Heart - Paul Baloche - Ana Paula Valadao - Kari Jobe

<https://www.youtube.com/watch?v=8-84E26KEdI> published by Alessandro M on Jul. 10, 2010

Story of Open the Eyes of my Heart - Paul Baloche

<https://www.youtube.com/watch?v=gA9Tg2CK6ZA> published by leadworshipdotcom on Aug 28, 2007

Our God Saves

Paul Baloche - LIVE at Bethel Church

<https://www.youtube.com/watch?v=rdiAunjzmas> on YouTube by Jonathan Martel
Jun 4, 2017

Paul Baloche “Our God Saves” & Interview

<https://www.youtube.com/watch?v=W3INVZuruRE> 100huntley published May 19,
2009

Paul Baloche - How to play “Our God Saves”

<https://www.youtube.com/watch?v=mCTzf7IS9AE> leadworshipdotcom published
Nov 20, 2007

Joy to the World / Our God Saves - PAUL BALOCHE: Song Tutorial

<https://www.youtube.com/watch?v=7iuKJNf0TKc> WeAreWorshipMusic published
Nov 6, 2015 viewed Mar 1, 2019

David Gungor videos:

Breathe

Breathe | The Brilliance

<https://www.youtube.com/watch?v=OvRVFd2NmMY> published by The Brilliance on Nov. 20, 2013 studio recording “Road Recordings”

Breathe - The Brilliance

<https://www.youtube.com/watch?v=EdrOIbUZ1io> published by Hospital Church, a Florida SDA church, on Ap 16, 2015

The Brilliance - Breathe

<https://www.youtube.com/watch?v=45TJjVlmo5o> published by 6footSmurf on Nov. 11, 2017

Prayers of the People

The Brilliance || “Prayers of the People” Takeaway Show

https://www.youtube.com/watch?v=vcJf18cGAzY&list=PLEIWM9jjRtYDy2GRiA6ty4o3yCO_UtIPq&index=12 published Feb. 25, 2015 on The Brilliance site Studio take on the song

Prayers of the People by The Brilliance

<https://www.youtube.com/watch?v=Lez1cwI070> Richard Hickam published Mar 27, 2015

Appendix 3

Schedule of Interviews

David Gungor Oct 9 2015

- 1) Set a framework of Affordances
- 2) Would you say that you write CCM? Or what type of music do you write?
- 3) What do you look at as forming your musical tastes?
- 4) What are some of your current sources for inspiration in your song writing?
- 5) What do you think is the reason that you include a bridge in your music?
- 6) Do you gravitate toward specific chords for any reason, such as trying to solicit a response?

Tanya Keerepart Jul 25 2018

- 1) Set a framework of Affordances
- 2) Are you familiar with, or a member of, CHI (Computer Human Interaction)?
What is behavioral economics?
- 3) Can you describe some of your background, both educational and vocational, in CGI and your chosen field?
- 4) How have you used some of the information in your own work?
- 5) Are you familiar with Chemero and his work with affordances? What is your view on how his thoughts might apply to the field of music?
- 6) Recap some of your work experience in relation to our discussion