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Melodic intonation in **Σολζοθα** '*Golgotha*' as evidence of
Ancient Egyptian and Arabic influence in Coptic music

MINA SALAMA

A thesis submitted to the University of Huddersfield in partial fulfilment
of the requirements for the degree of Masters by Research

The University of Huddersfield

July 2021

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Abstract

Successive civilisations in Egypt created the current Egyptian culture. This started with the ancient Egyptian civilisation, which lasted for thousands of years, then the Coptic, which began in the first century AD, and this was followed by the Arab civilisation, which began in the 7th century. This succession influenced Coptic music in particular, as some liturgical hymns derived from the ancient Egyptians. Current Coptic music sounds Arab-influenced today; however, the Copts lived in Egypt about seven centuries before the arrival of the Arabs in Egypt. This research investigates this triple connection using two approaches. The first is the *ney*, an instrument found since the time of the ancient Egyptians and a witness to their music system. It is still used in Egypt within the Arabic music system. The second is a melodic intonation study of the Coptic hymn $\Sigma\lambda\gamma\theta\theta\alpha$ 'Golgotha', believed to be derived from the ancient Egyptian era and used as a funerary hymn.

The research analysis and results illustrate the relationship between the Pythagorean and the ancient Egyptian music systems and indicate to what extent Coptic music can be used to obtain more knowledge of ancient Egyptian music.

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Chapter 1 General Introduction to The Research

1.1 Introduction

The aim of this research project is to understand the changes over time between ancient Egyptian and Coptic music. Moreover, to understand the influence that Arabic music has had on Coptic music. Although we know a great deal about ancient Egyptian civilisation in general, we have very little information about the music of this era. One of the open questions is, how did the instruments associated with these traditions actually sound? Also, what scales and music systems connected and united the different players and vocalists?

Archaeologists have uncovered the foundations of answers to these questions; ancient instruments have been found at various places in Egypt. The *nay*, an ancient woodwind instrument, is one of these instruments. Museums in Cairo hold original examples of this instrument; they can potentially serve as a guide to the musical traditions of the ancient Egyptian era. These ancient examples preserve the tuning systems from thousands of years ago. Due to their fragility, the originals are not playable, but replicas have been made of them, and we can obtain valuable information about ancient Egyptian scales and tunings from them. Another guide to the music of this era is the Coptic hymn repertoire, still used within the Coptic Orthodox Church of Alexandria and containing elements believed by some scholars to derive from ancient Egyptian music.

It must be considered that Egyptians are genetically not Arabs, and Arabic music has nevertheless influenced Coptic music, as from the perspective of cultural anthropology, culture is not a matter of genetics.

1.2 Research questions

Several research questions are raised in this study. Firstly, when and how did Coptic music emerge from ancient Egyptian music? Secondly, how can we verify the authenticity of a model ancient Egyptian *nay*, and how can we determine that a given copy is a faithful representation of the original? Thirdly, how much of ancient Coptic music comes from ancient Egyptian music, and how much comes from Arabic music?

On the first of these questions, there is also a need to explain how the identity of ancient Egyptian history changed from its character to others like Coptic and Arabic. Invasions and settlements by foreign peoples such as the Greeks, Romans, and Arabs have led to a mix of cultural influences. Then there comes the importance of the Coptic civilisation, including its music, because it retains original features of Egyptian culture; Malaty regards the Copts as the modern face of the original Egyptian authentic strain (1993, p. 8).

By using *nay* replicas, another query is raised about verifying the authenticity of ancient Egyptian *nays* found on temples and tombs. Consequently, can we determine that a given copy is a faithful representation of the original?

Regarding the use of Coptic hymnology as a guide to Ancient Egyptian Music, how much of ancient Coptic music comes from ancient Egyptian music, and what is the relationship between them? Accordingly, if there are some signs that Coptic music was influenced by Arabic music, how much of the Coptic hymnology comes from Arabic music?

1.3 Methodology

Following the findings of a study by Effat, Saleh and Gribbs (Effat et al., 2000) on the preserved ancient Egyptian *nays* in the Egyptian Museum and the acquisition of a replica of the same model through a *nay* maker called Adel Fouad who was assistant to this research group, practice-based research will explore what can be learned from the *nay* replicas, and will include performances on the instruments and recordings of these performances. The practice-based methodology is similar in how it uses technology in its approach, to other studies focused on European instruments, for example the work of Bonamini (2012) and Bissinger (2003) relating to instrument restoration and archaeology. In addition, several software programmes will be utilized to analyse note frequencies, comparing them with the modern Arabic *nay* (a somewhat different instrument to its ancient Egyptian cousin).

The extant Coptic hymnology is a considerable body of music encompassing more than a millennium of Egyptian history. The study will explore what can be discovered from old recordings of respected cantors in the Coptic Orthodox Church, comparing these recordings with what is notated in the written Coptic hymn repertoire, and examining the works and productions of contemporary Coptic orchestras or musicians in order to find how Coptic music performance has changed over time. Those versions of hymns known to be modern will be

compared with those suggested to be ancient by various scholars, providing different types of content that can be performed on the ancient *nays*. This study will focus in particular on the Coptic hymn **Ⲭⲟⲗⲥⲟⲩⲁ** *Golgotha*.

1.4 Personal background

I am a Copt who was born in Egypt and grew up in the Coptic Orthodox Church. I am a deacon with an ordination degree called **ⲪⲗⲗⲐⲤⲈ** (Epsaltes), which means a deacon responsible for chanting the hymns during the liturgy and who should be able to read the Coptic language. I was an assistant conductor, choir director, composer, arranger and principal *nay* player in The Egyptian Opera House in Alexandria. In addition, I was a sound studio manager and sound engineer for recording, mixing and mastering many projects, productions and programmes for Coptic TV channels worldwide. I have also contributed as a co-author to similar studies and PhD research, some parts of which have been accepted to be published in musicological journals.

1.5 Historical and Anthropological background

The term *Coptic* (of *Copt*) (also **قبط** *Qibt* in Arabic) has been the subject of much speculation about its origin. One theory arises from the fact that there was a city in ancient times called Cophth (or *Qift*), sited on the east bank of the Nile 40 km north of Luxor. An Egyptian historian of the fifteenth century called Al-Maqrizi speculated that the name Cophth originated from the tribes who settled there after the Flood, who were called *Cophths* by one of *Mizraim*'s sons (*King James Bible*, 1769/2017, Genesis 10:6), *Cophtharim* (or *Caphtorim*), (*King James Bible*, 1769/2017, Genesis 10:14). *Mizraim* was a son of *Ham*, one of *Noah*'s sons (*King James Bible*, 1769/2017, Genesis 9:18) (Erian, 1986, p.24).

Another hypothesis of the origin of the word Copt is that it was a name used by the ancient Egyptians of *Memphis*, the capital of ancient Egypt, derived from the word *Hecoptah*, which means 'House of the Spirit of *Ptah*' (or *Phtah*). The Greeks later rendered this word *aegyptus*, meaning the House of *Gypt*, which the Arabs later changed to be *Gibt* after dropping 'ae' (which

means 'house'), and 'us' (which means 'the'). This theory, therefore, suggests that the word 'Egypt' derives from the term 'Copt' (Shenouda, 1962, p.6).

In modern times, the word 'Copt' is used to refer to Christians in Egypt; previously, it would have referred to all Egyptians. This is because the word *Misr* (which means 'boundaries' in the Semitic language, also perhaps deriving from *Mizraim*, son of *Ham*), has been used by the Arabs after their conquest of Egypt, which took place in the seventh century between 639 and 646 AD, to announce the arrival of the new conqueror of Egypt, and to limit the word *Copt* or قِبطي *Qibti* to the original occupants of the land. The latter refused to adopt Islam as a replacement for their Christianity which was founded in Egypt in the first century AD by Saint Mark the Evangelist, who first preached Christianity in Alexandria around 43-44 AD before he was martyred there. Therefore, the Coptic Church head's appellation is 'the Pope of Alexandria and the Patriarch of the See of St. Mark' (Gillespie, 1971, p.4). Moreover, a Biblical passage (*King James Bible*, 1769/2017, Matthew 2:13-15) describes the Holy Family taking refuge in Egypt even before the arrival of Saint Mark around 40 years later. Hence, the Copts still celebrate the memory of the entry of the Holy Family into Egypt as an annual event.

Anthropology and archaeology contribute to the study of the ethnicity of the region to reinforce the lineage of the Copts from the ancient Egyptians. Georgy Sobhy, an Egyptian physician who made significant contributions to Egyptology and Coptology fields in the early twentieth century, undertook a thirty-year study on skulls which were found in Coptic cemeteries from earlier centuries in Egypt. He contrasted them with some ancient Egyptian skulls and stated that he found no difference. He also showed how modern Copts preserved some habits identical to those of the ancient Egyptians concerning some funerary rites, pregnancy and childbirth. Moreover, he stated that the Coptic language was basically the ancient Egyptian language written in Greek letters (Sobhy, 1936, pp. 34-63). Finally, he affirmed that:

[t]he Copts of the present day, considered from the ethnological, philological, and anthropological points of view, are not only the direct descendants of the ancient Egyptians but are the actual representatives of the ancient civilization. ... The Copts themselves believe that they are *genus Pharaonicus* (Pharouni genus) (1936, pp. 53, 64).

On the same subject, Leeder mentioned the Copts as 'the Modern sons of Pharaohs', and he means that the Copts are the descendants of the ancient Egyptians (Leeder, 1918). In the same context, Malaty said the Copts,

as the successors of the ancient Egyptians are defined as the modern sons of the Pharaohs. They played an essential role in the whole Christian world, especially during the first five centuries. ... they were genius in music, iconology, architecture, textiles, literature, astronomy etc. ... Copts inherited a very ancient musical tradition from their ancestors the Pharaohs (1993) pp. 8, 351, 353).

1.6 The value of Coptic music

Despite the attempts of some Arab rulers of Egypt to prevent the Copts from speaking or using the Coptic language, which was the dominant language in the country before the Arab colonialism of Egypt, the Coptic music preserved the Coptic language from extinction.

Drioton argued that 'The key to the mystery of Pharaonic Music will be found then in a good edition of Coptic ecclesiastical music in use in our days' (*Ragheb Moftah and Coptic Music / Library of Congress*, n.d.), and by 'Pharaonic Music' he refers to the musical culture of ancient Egypt's Pharaonic era, and not music related to a Pharaoh. Drioton wrote these words in a letter sent to Ragheb Moftah, who was among the first scholars to recognise Coptic music's liturgical value. Moftah was a wealthy Copt and devoted his life to recording and analysing Coptic music by cooperating with other scholars worldwide. As a summary of his long experience in the field of Coptic music scholarship, he stated that

[s]cientific research has proved that the music of the Coptic Church is the most ancient ecclesiastical music which exists, and it constitutes the oldest school of music which the world now possesses (in Malaty 1993, p. 353).

Moftah invited Ernest Newlandsmith, a professor at Oxford and London Universities who spent several years in Egypt (1927–1936), to notate Coptic hymns. Newlandsmith stated that 'Coptic music is a great music and may be called one of the seven wonders of the world' (in Malaty, 1993, p. 353). In the same context, Manniche mentioned the importance of Coptic musical liturgy and how it can be a guide to ancient Egyptian music as a residue from the earlier era. She stated that

we are greatly hampered by our lack of information ... It is difficult to find conclusive evidence from Egypt at such an early date. A more recent source is the liturgy of the Coptic Church. This originated in Egypt, where there was a Christian community from the second century AD, and the liturgical language is Coptic, a late form of the ancient Egyptian language (1991, pp. 11, 12).

Therefore, one can see the importance of following the history of Egypt, passing through the original inhabitants of the land, to Copts, then Arabs, and the present Egyptians, to understand

the changes in Egyptian music, especially in music instrumentation, music theory and the liturgical Christian music from the early ages of Christianity. Moreover, it is necessary to know more about the influence of ancient civilisations on those that followed.

1.7 Clarification

This research considers only Egyptian Coptic music, not Ethiopian Coptic music, even though the Ethiopian Orthodox Tewahedo Church emerged from the Egyptian Orthodox Church Of Alexandria. The Ethiopian branch has its own music which differs from that of the Egyptian Coptic and both kinds are unique folkloric musics related to their countries' heritage and history.

This study will focus on only one hymn, **Σολζοθα** '*Golgotha*', as a sample from the vast Coptic music repertoire. Moreover, it will study only the ancient Egyptian source of Coptic music and I will not consider Jewish, Byzantine, or Greek influences on Coptic music as this is beyond the scope of this thesis. Likewise, this research will use only replicas of one ancient instrument: the *nay* or ancient Egyptian flute. While the *nay* is commonplace, there are many other instruments related to the ancient Egyptian and Coptic eras.

Following this introductory chapter, Chapter 2 will review relevant literature, including that relating to the ancient Egyptian, Coptic, and Arabic civilisations and their music. Chapters 3 and 4 will study and analyse ancient Egyptian flute (*nays*) replicas, deducing some features of the ancient Egyptian music system. This will include video and audio recordings. Chapter 5 will use the results from Chapters 3 and 4 to compare the ancient Egyptian *nay* replicas and modern Arabic *nays* in order to understand Coptic music today and how it has changed from its original form, connecting the different versions of the *nays* with the Coptic music hymn **Σολζοθα** '*Golgotha*'. Finally, Chapter 6 will summarise the conclusions of the research.

As indicated above, the written thesis is an accompaniment to a series of recordings and videos that are at the centre of this research project. This practice-based research is at the project's core and is the key means by which its research questions are answered.

Chapter 2 Literature Review

2.1 Ancient Egyptian Music Literature Review

Archaeology is an essential source for investigating music in ancient Egyptian and Coptic civilisations. Archaeologists have taken various approaches in different periods to decipher what has been discovered in ancient Egyptian tombs and temples, Coptic cemeteries, and ancient Coptic monasteries.

Discussing her study of ancient Egyptian music and musicians (1991), Manniche mentioned the importance of music archaeology in this field and points out that many ancient Egyptian monuments have been moved from Egypt and preserved in other countries. She notes that ‘[t]he most important collections of musical instruments are in Cairo, London, Paris, Berlin, Florence, Leiden and New York ... most of these objects were acquired during the course of the nineteenth century’ (Manniche, 1991, p. 11). Manniche mentioned the lack of information in this field and specified the Coptic liturgy as a guide which remains from the ancient Egyptian period, and which includes elements such as the derivation of the Coptic language from the ancient Egyptian language (Manniche, 1991, p. 12). Accordingly, this research will focus on the analysis and codification of Coptic liturgical music and related insights deriving from ancient Egyptian music.

Before Manniche, the German musicologist and archaeologist Hickmann contributed several studies of ancient Egyptian music (1949, 1951b, 1951a, 1956a, 1956b, 1958) and presented a comprehensive review and description of surviving instruments with the support of pictorial representations. Hickmann (1949) documented the surviving ancient Egyptian musical instruments preserved in the Egyptian Museum (previously known as the Cairo Museum). Hickmann (1956b, 1958) explained the chironomic signs on the ancient Egyptian music practice, including illustrations of the chironomists hands’ signals and its musical indication in addition to its similarity to the Coptic chanting these days. Chapter 4 in this research will give more details on the ancient Egyptian chironomic similarity to the Coptic one, as Hickmann explained it. Figures 2.1 and 2.2 below illustrate Hickmann description of ancient Egyptian music notation from iconographic analysis of an ancient Egyptian image which included chironomic signs. Hickmann produced several studies ‘A considerable amount of research has been carried out into the fragmentary remains of the musical culture of the ancient Egyptians. ... based on a scientific classification’ (1951a, p. 25). For instance, he demonstrated the

position that the musicians would take when playing the ancient instruments, exemplified by a description of the double clarinet player statuette shown in Figure 2.3; he accurately explained performance technique in a sketch of the statuette (Figure 2.4):

Later representations of players of the double clarinet appear to differ slightly from this one; if their dating and that of the one in the Cairo Museum is sound, this statuette must be one of the oldest representations of a musical subject in existence. The stone bears no traces of paint. The hair-style of the player follows the contours of the head very closely, in a most archaic fashion; it is not unlike the styles worn at a later date by musicians of, for instance, the Vth Dynasty (Hickmann, 1951a, p. 26)

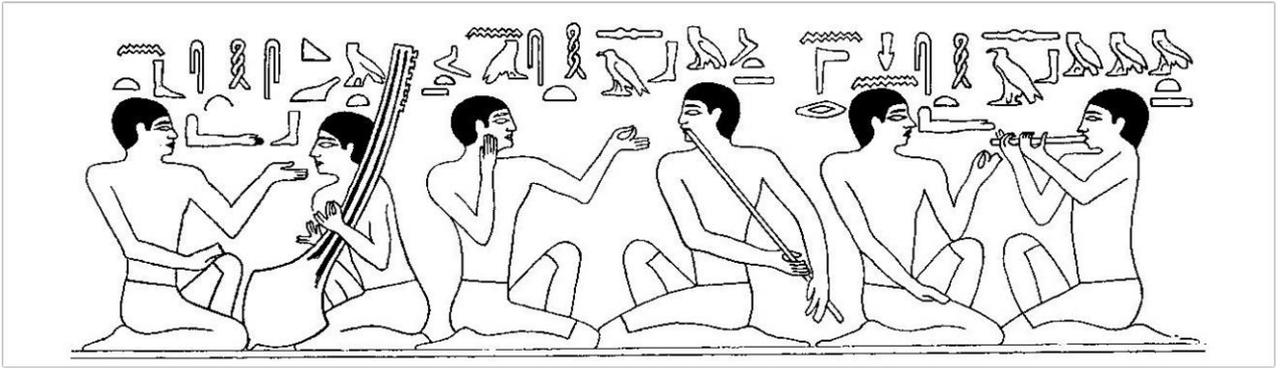


Figure 2. 1: A representation of an ancient Egyptian music ensemble, including instruments and symbols, discovered at Saqqara in the tombs of Nekauhor and Sekhem-Hathor¹ (Hickmann, 1956a, p. 19).

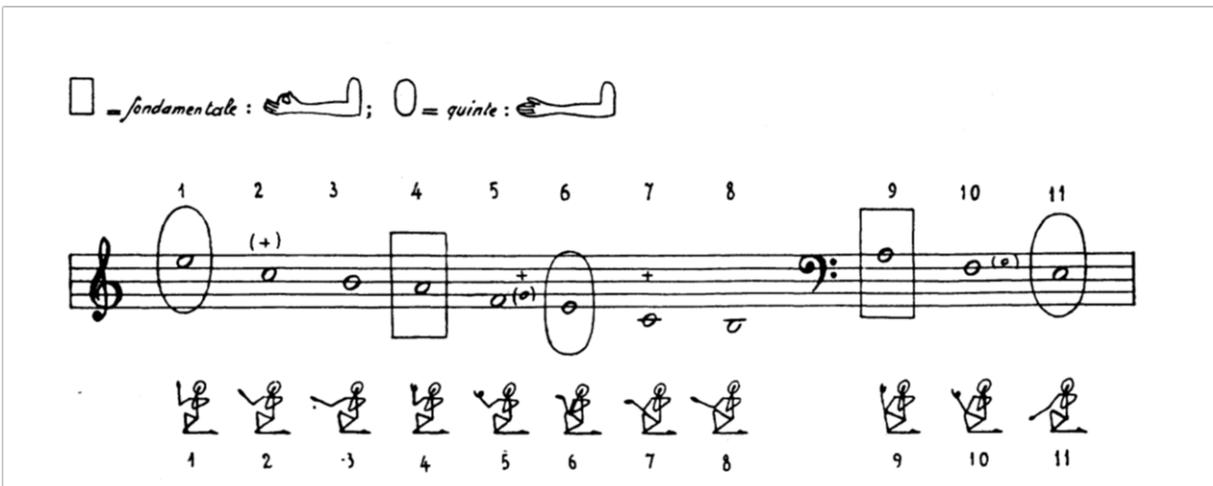


Figure 2. 2: Iconographic analysis of ancient Egyptian pictograms explain a prediction of pitches through the chironomist's (similar to music conductors) hand signals (Hickmann, 1956b, p. 27).

¹ The tombs of Nekauhor and Sekhem-Hathor dates from the 5th dynasty (2563-2423 BC); the part comprising the musical scene is now in the Metropolitan Museum of Art, New York (Hickmann, 1956a, p. 19).



Figure 2. 3: A double clarinet player statuette. (Hickmann, 1951b, facing p. 25).

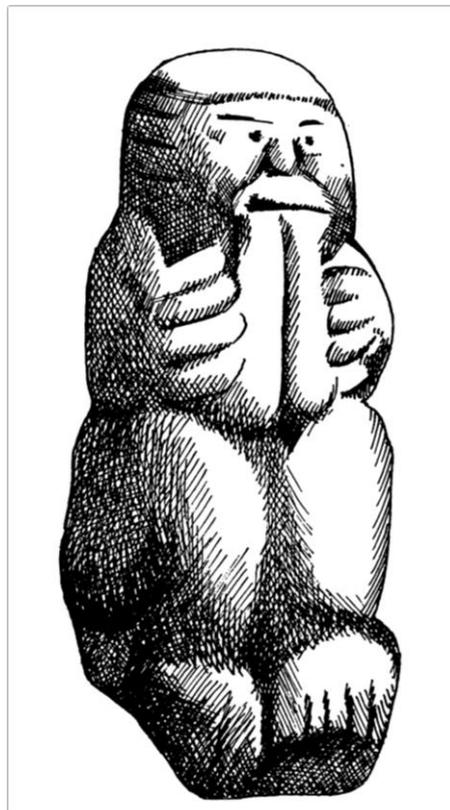


Figure 2. 4: A sketch of the statuette shown in Figure 2.3 with some details (Hickmann, 1951b, p. 26).

Hickmann (1946) also introduced a study of ancient Egyptian trumpets discovered in Tutankhamun's tomb, including the investigation of related representations and iconography, shown in Figures 2.5, 2.6, and 2.7.

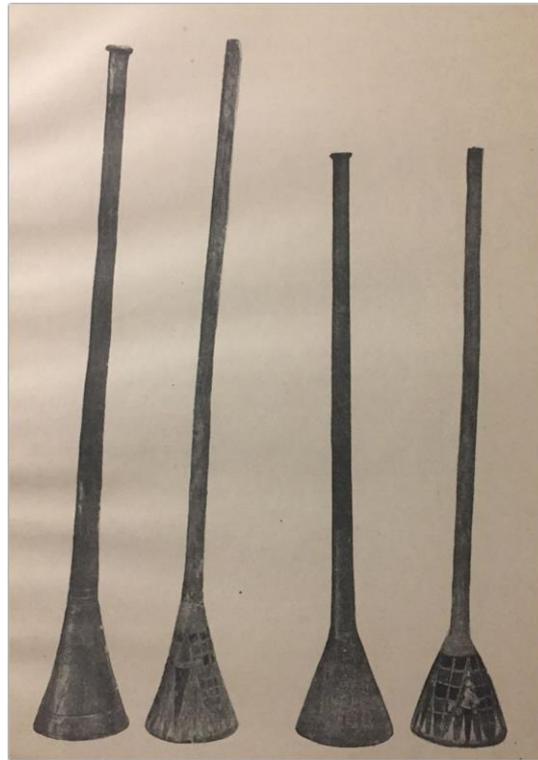


Figure 2. 5: Ancient Egyptian trumpets, including their wooden interior pieces discovered in Tutankhamun's tomb. (Hickmann, 1946, p. 1).

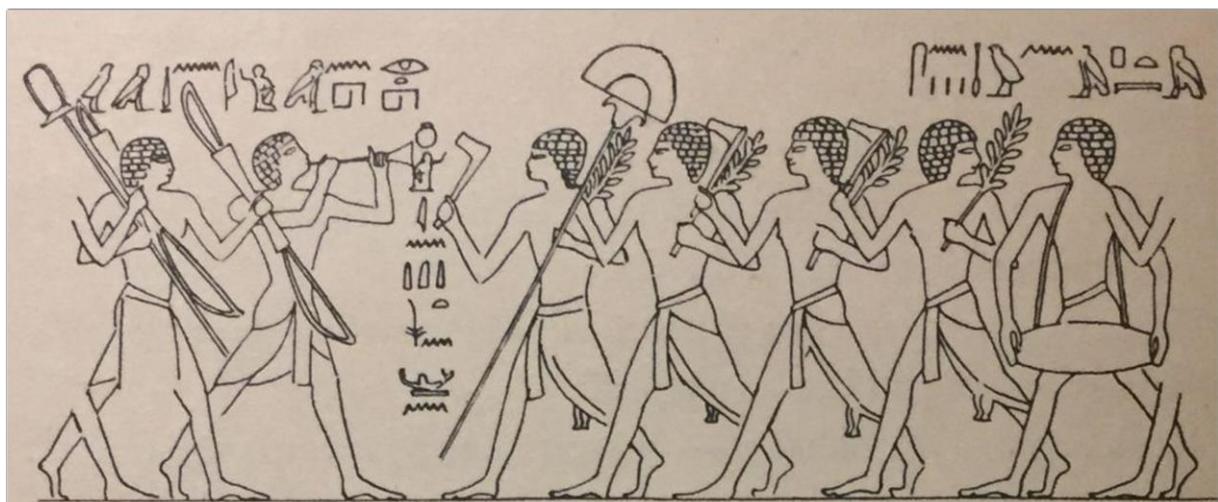


Figure 2. 6: 'A procession of soldiers in a festival'. A representation of Hatshepsut's (18th Dynasty) expedition to the Land of Punt from Deir el-Bahri, Luxor, Egypt, showing a trumpet player in front of the soldiers (Hickmann, 1946, p. 4).

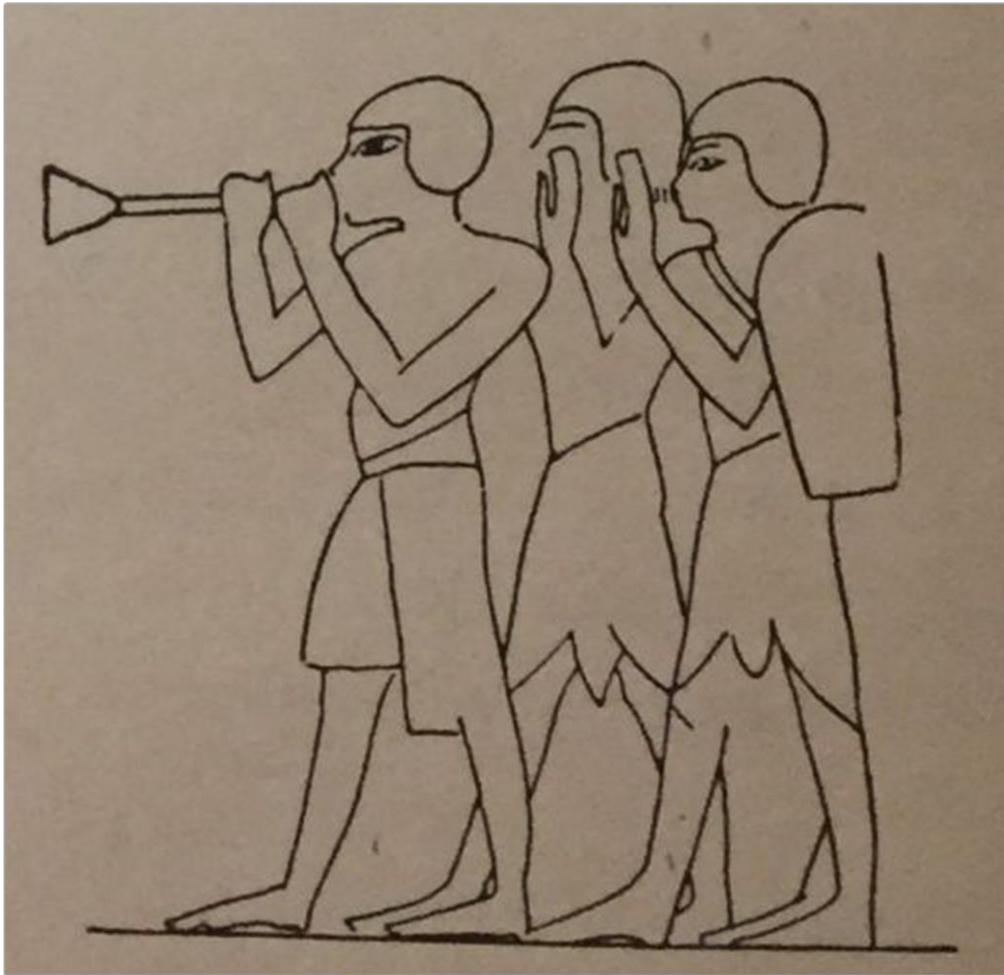


Figure 2. 7: Ancient Egyptian trumpet players precede a parade of soldiers (Hickmann, 1946, p. 4).

As a reflection of Hickmann's research in the ancient Egyptian music and instruments, particularly Hickmann (1949), there was an earlier study of the ancient Egyptian *nay* by Effat, Cribbs, and Saleh, hereafter referred to as 'the Egyptian group'. Their study attempted to discover the ancient Egyptian musical scale by examining and exploring the ancient Egyptian *nay* (Effat et al., 2000). Their research's primary purpose was to discover the nature of the ancient Egyptian musical scale and its relation to modern scales in Western and Arabic music. Their research depended mainly upon studying the *nay*, not any other ancient Egyptian flutes or wind instruments. The Egyptian group followed Hickmann's (1949) measurements of ancient Egyptian flutes, and they reconstructed replicas of *nays* preserved in the Egyptian Museum. They had evidence that four of the six original *nays*, specifically the four long *nays*, dated from the ancient Egyptian era; however, they did not exclude the two short *nays* from their study but mentioned that they would not emphasise the results from these two short *nays*

because they thought they might date from the Ptolemaic period (more details about the original *nays*' measurements, places, dates will be discussed later in the next chapters). The Egyptian group did not show any evidence for their conclusion about the dating of the two short *nays*, and it seems that they did not know about Hickmann's (1952) study on the short flutes (*nays*) used in ancient Egyptian times, which will be discussed later in the next chapters. Moreover, they did not publish any evidence that shows that the date of the short *nays*, as it is still unknown, according to information provided by the Supreme Council of Antiquities (SCA) (previously known as the Egyptian Antiquities Organization or EAO). Figures 2.8 and 2.9 show some pictures of the Egyptian group during their research on the ancient Egyptian flutes.



Figure 2. 8: The Egyptian group who made the first attempt to study ancient Egyptian flutes. From the left, Cribbs, Saleh, and Effat (Effat et al., 2000).



Figure 2. 9: Effat playing two original ancient Egyptian *nays*. Left: playing the short *nay* CG 69819; right: playing the *nay* CG 69817. (CG stands for the 'Catalogue Générale').

Despite the importance of the Egyptian group's research, their study suffers from some gaps, because the precise reasons are uncertain as to why they excluded many of the ancient flutes and chose only six from twenty-four flutes preserved in the Egyptian Museum, without explaining or giving pertinent details about their choice. Moreover, as mentioned before, they ignored the results of the two short *nays* they chose, which might help get better findings based on the analysis results.

In more detail, Alhefny (1936) explored the ancient Egyptians' music chronologically, monitoring every dynastic period and describing its musical aspects, including instruments, bands, dances, poem extracts, the changes of scale forms from pentatonic to heptatonic scale, and how the ancient Egyptians used them, especially in the New Kingdom. Moreover, he investigated the links between music and other sciences, explaining the connection between ancient Egyptian music and astrology; Gadalla (2017a; 2017b; 2018) undertook more recent studies on this subject. Gadalla's three books on ancient Egyptian music argue that the ancient Egyptians had an advanced music system; his conclusions were drawn from ancient Egyptian excavation and representations.

R. Perez Arroyo (2003) conducted a similar study of the ancient Egyptian music including detailed research on the preserved flutes in the Egyptian museum and giving measurements of the instruments similar to Hickmann's study (1949).

Nevertheless, all of these studies still provide inconclusive evidence and are still speculative without an understanding of the ancient Egyptian music itself, which would include more knowledge about its scales and interval systems and its approaches to polyphony. Pictorial representations in general give us an incomplete image, despite their benefits. Several sources reference such images of ancient Egyptian instruments and musicians (Smith, 1904; Commission des sciences et arts d'Egypte, 1986; Andreu, 1997; Muga, 2019).

Some music archaeology and musicology studies also describe Ancient Egyptian music by making suppositions from archaeological discoveries in Egypt, such as Southgate (1890, 1891, 1915); Broughton (2009); Li (2009); Emerit (2013); and Rehding (2014).

2.2 Coptic Music Literature Review

2.2.1 The notation group

The literature on Coptic music can be divided into three groups, I have called these the notation group, the spiritual reasoning group and the history group.

This first group focuses on Coptic music notation. Ghobrial (1916) notation was inaccurate because most Coptic hymns include three-quarter-tone intervals, whereas Ghobrial includes not a single note written with a microtone sign (Figures 2.10 and 2.11). The notes cannot be sung or played using Western scales with just tone and semitone intervals because the melody will be misrepresented. Thus, it is impossible to play Coptic music using fixed-pitch Western instruments such as the piano.

56

mi ka ta..... tas à mar ti..... as

..... mo

..... π

31 ALITHOS PISTEV

Al i tho..... s pes te...

Figure 2. 10: A transcription of Coptic hymns (Ghobrial, 1916, p. 56).

57

men

32 TENAHTI JEVAIPE
Te nah ti je... ra... i pe khen ou me th.

mi a mi

33 AMIN PISTEV

Figure 2. 11: A transcription of Coptic hymns (Ghobrial, 1916, p. 56).

Similarly, Farag (1995) also notated hymns without quarter-tone symbols, as he wrote in piano score. For example, Figure 2.12 shows the hymn `Πορρο` ‘*Eporo*’ written incorrectly based on the D major scale. However, it should be sung in an eastern maqam (scale), including three-quarter-tone intervals (using maqam *Bayati*) as transferred from generation to generation by oral tradition. The notations, including the correct maqam accidental signs, will be shown later in this chapter, in Figures 2.15 and 2.18.

The image displays a piano score for the hymn Πορρο 'Eporo'. It consists of five systems of music, each with a treble and bass staff. The key signature is D major (two sharps: F# and C#), and the time signature is 4/4. The melody in the treble staff is written in a style that does not include quarter-tone symbols, which is noted as incorrect in the text. The bass staff provides a harmonic accompaniment with chords and moving lines. The page number 44 is centered at the bottom of the score.

Figure 2. 12: A notation of the hymn Πορρο ‘*Eporo*’ in D Major (Farag, 1995, p. 44).

On the same subject of Coptic music notation, a project has been conducted in this field by Moftah, who worked consecutively with two groups; the first one included Newlandsmith (1929-1933). Figure 2.13 illustrates an example of this group notation. Moftah later continued similar work with a second group, including Tóth and Roy, and this work has been more recently published (Moftah et al., 1998). In their transcription of the St. Basil liturgy, Moftah tried to preserve this vital part of Coptic music repertoire. However, their attempts at notation were made very complicated by notating all of the sung ornaments, making the notated version rhythmically very complex (Figure 2.14).

Tóth was responsible for this repertoire's transcription, continuing the work of Newlandsmith (Figure 2.13), who had previously worked with Moftah. Tóth omitted the specification of microtones in the many well-known parts that are always sung traditionally with three-quarter-tone intervals. Perhaps because Tóth was not Arab or Egyptian, she was not used to hearing these intervals, in much the same way as Newlandsmith. To achieve their transcription, Moftah's teams used the only resource of Coptic music available, which was oral; they relied on using the cantor Mikhail Girgis Al-Batanouni's recordings. However, the problem was that although he was the most famous cantor in the Coptic Church at that time, unfortunately he was too old to accurately sing this complex liturgical heritage. This we can hear on many recordings available via the Library of Congress Washington, DC (Moftah. et al., 2005), such as tracks 'Procession of the Host 2'; 'Procession of the Host - Big Allelouia and Phai pe piehoo'; 'signings of the Lamb - Making the sign of the cross over the host'. Audio 2.1 is an example of M. Al-Batanouni's voice recording influenced by his old age.

<https://soundcloud.com/mina-salama-5/audio-21/s-IfTNW4MNtoQ>

Audio 2. 1: A Coptic hymn recorded through Moftah's project by the cantor Mikhail Girgis Al-Batanouni, whose voice performance is influenced by his old age (*Ragheb Moftah collection of Coptic music recordings: Volume I - The liturgy of Saint Basil A. The complete liturgy | Library of Congress, n.d.*)

In the Coptic Church, the cantor is known as *المُعَلِّم* 'Alm'allim'; it means *the teacher* and refers to the person responsible for leading and guiding the congregation through the liturgy to chant the hymns. Cantors and deacons continue the oral tradition process from generation to generation.

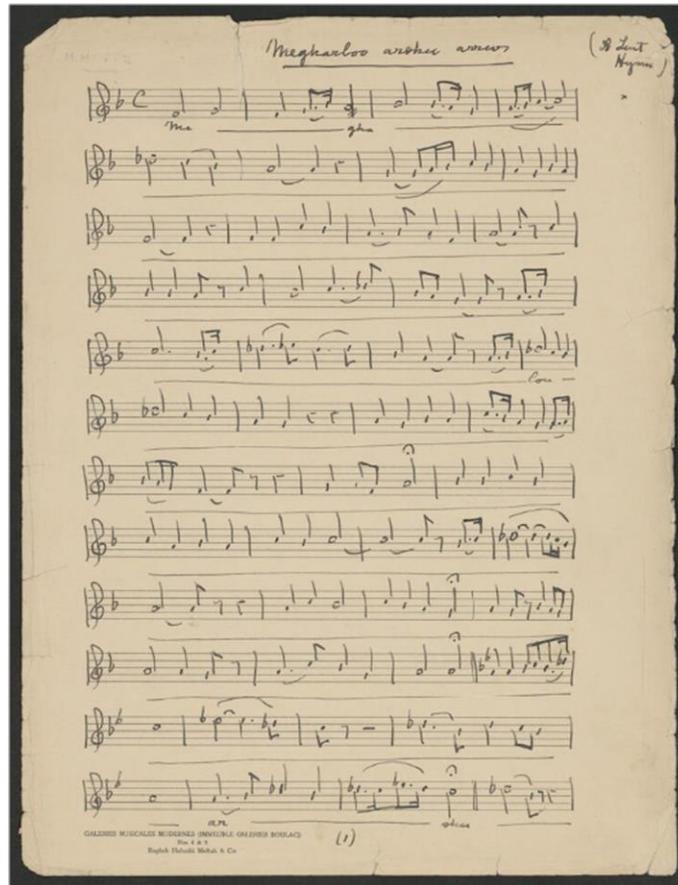


Figure 2. 13: The Coptic Orthodox liturgy of St Basil in Western musical notation written by Newlandsmith. (Image 4 of The music of the liturgy of St. Basil as used in the Coptic church | Library of Congress, n.d.)

1/03/18 Πορρο ἠτε τζιρηνι المقام الأساسي: بياتي

100

Π ορ ρο ἠ τε τ ζι ρη

νη μο ι να

ν τε

κ ρη ρη νη σεμ πι

να ν τε

κ ρη ρη νη

χα νε ν νο βι να

ν ε βο

λ. λω ρ ε βο

λ ἠ νι χα

ζι ν τε

f

ε κ κλη ci ια ᾶ

36 مردات رفع البخور © Music Transcription: Fr. Abraam Guirguis

Figure 2. 15: A notation of Πορρο ‘Eporo’ using maqam Bayati (Guirguis, 2018, p. 1933).²

² The two small flat signs in the key signature refer to half flat or microtone or quarter-tone. Compare with Figure 2.10.

Many Coptic cantors and deacons have modified a kind of neumatic musical notation to develop a different method of notating Coptic music, one similar but not identical to the Byzantine system. The main reason for using this method is that the vast majority of Copts who are responsible for chanting the liturgy, like cantors, deacons and singers, do not learn how to read Western music notation, so they need help to perform the hymns, particularly the long ones because they find it difficult to memorise them. However, this notational method gives only some guide signs to know the notes' duration through the lyrics, but not the pitches, and this guide works mainly for the melismata, so it requires those who use it to have previous knowledge of the hymn they will sing. Lotfy (2018) is one of the cantors who has produced such neumatic notations for several hymns. There is also a web page (Hazzat, 2016a), dedicated mainly to this type of notation for Coptic music, although its neumatic scores are written differently from Lotfy's notation. Figure 2.16 shows part of **ΤΙ ΠΑΡΘΕΝΟΣ** '*Ti Parthenos*' hymn written by Lotfy (2018, p. 100), and Figure 2.17 shows **ΕΒΟΛ ΗΙΤΕΝ** '*Evol Hiten*' hymn by Hazzat (2016b, p. 34).

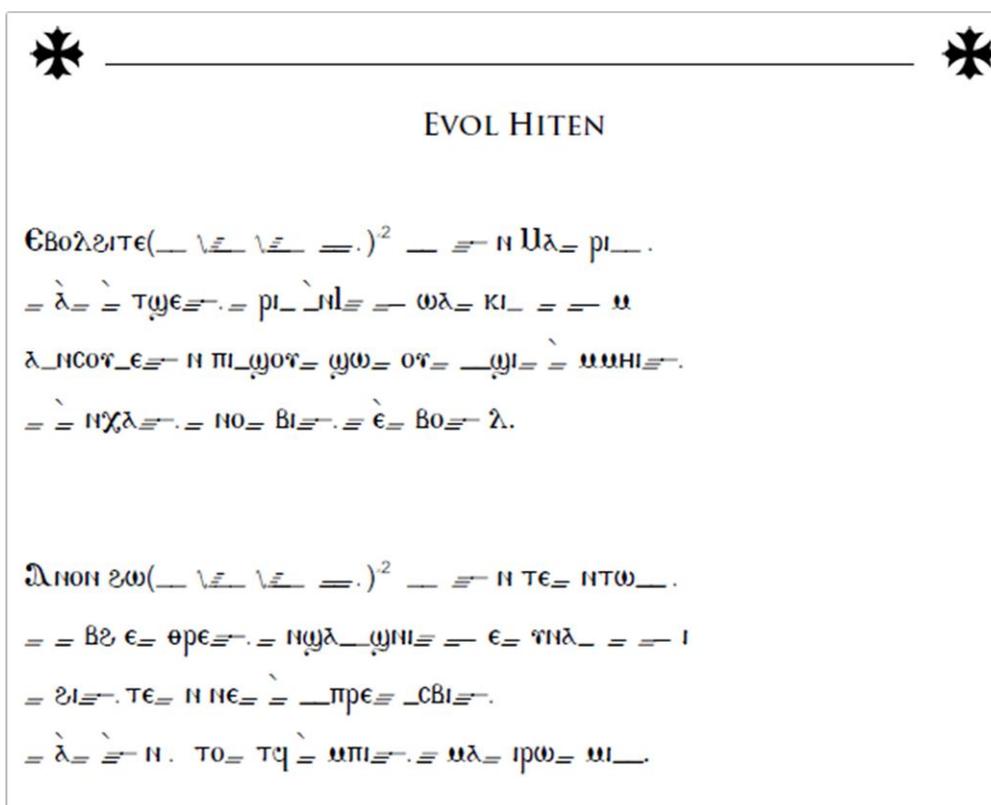


Figure 2. 17: A type of neumatic notation of the hymn **ΕΒΟΛ ΖΗΤΕΝ** ‘*Evol Hten*’ by Hazzat (2016b, p. 34)

2.2.2 The spiritual reasoning group of Coptic music literature review

The second group includes authors who have tried to explain Coptic music through spiritual reasoning, such as Makarious (2019), a bishop in the Coptic Church. He investigated Coptic music through its spirituality by researching the roots of its texts and also by comparing it with other liturgical music from different traditional churches.

Another researcher with similar methods was Kyrillos (2001, 2002, 2013); Kyrillos & Attallah (2006). In addition, he analysed some Coptic hymns using notation and other music-analytical techniques by examining a range of resources and not relying on a single source of recordings like some previous projects, such as those of Moftah and associates. He introduced a more accurate notational approach to those discussed above, which was closer to the chants of Coptic music, and therefore made them more manageable and clear to sing and play. By using this notation and conducting a remarkable study (Kyrillos, 2013) which used the Coptic hymns to write and conduct contemporary Egyptian music compositions, he was able to disseminate

several Coptic pieces worldwide. He also specialised in conducting and has established a dedicated orchestra and choir specifically for performing and recording Coptic music, the David Ensemble, a well-recognised orchestra to play Coptic music in the Coptic Church and present it at music festivals worldwide (*David Ensemble - Ensemble*, n.d.)

Figures 2.18, 2.19 and 2.20 show examples of Kyrillos's notation for three hymns, **Πορρο** 'Eporo', **Κατα Νι χωρος** 'Kata Ni Khoros', and **Οκ̄ε̄ριος Μετασο** 'Okerios Metaso'. We can see the differences from Moftah's groups' notations (Figures 2.13 and 2.14), with quarter-tones in Kyrillos's system being notated in the key signature and as accidentals as well when required. In Figure 2.20, we can see how the Coptic melody is written in an orchestrated form in his notation, an application of his study and a new presentation of Coptic music, including a notation of harmonized Coptic music melody in a Western notation form.

ΠΟΥΡΟ

يُنطق ابورو

$\text{♩} = 100$

من ألحان الأعياد والأكاليل

π ο υ ρ ο τ ε †
Σι ρ η
10 η η † μ ο ι η α η η
τ ε κ Σι
20 ρ η η η † σ ε λ η η ι η α η η
τ ε κ Σι
ρ η η η † χ α
30 η ε η η ο β ι η α

التصوير الموسيقي: جورج ميراس

﴿ ١٥٣ ﴾

Figure 2. 18: The hymn Πούρο ‘Eporo’ notated by Kyrillos (2002, p. 153), including a quarter-tone accidental sign (A) half flat in the key signature.

ΚΑΤΑ ΝΙ ΧΩΡΟΣ

3

95

100

104

109

113

118

122

125

Fine

Ν ς _____ ε
 Βο
 λ δε Ν ΝΗ
 εθ υω οτ Τ.

rit.

Music Transcription: George Kyrillos

Figure 2. 19: The hymn **Κατα Νι χωρος** 'Kata Ni Khaoros' notated by Kyrillos (2013, pp. 167–169).

إستخدام لحن أوكيوريوس ميتاسو
في كتابة موسيقى مصرية معاصرة

تأليف الباحث

4/4 A

Andante

Flute

Oboe

Clarinet in Bb

Bassoon

Horn in F

Trumpet in Bb

Trombone

Triangle

Piano

Lute

Choir

Andante

4/4 A

Violin I

Violin II

Viola

Violoncello

Contrabass

Figure 2. 20: The hymn Οκῳριος Μετασῳ 'Okorios Metaso' notated by Kyrillos (2013, p. 223) in an orchestration form.

2.2.3 The history group of Coptic music literature

This group studied Coptic music similarly to the previous two methods, but alongside transcribing and explaining spiritual subjects in this music, they added a historical dimension. Research has been done by Botrous (1976) on Coptic music and its relationship with ancient Egyptian music. He analysed hymns through the Arabic maqams, indicating a connection between Coptic music and both ancient Egyptian and Arabic music. It is part of this research project to study this triple connection. Samoul wrote seven books, then collected them together to make the *Coptic music Encyclopaedia* (2016). Erian (1986) divided Coptic music into a description of historical ages because it is logical to understand changes in civilisation, and thus aspects of art and music, against a background of historical changes within and between eras. Erian (2017) contributed a valuable study of Coptic music and its potential relationship with ancient Egyptian music. By contrast, Lieven (2010, pp. 110–112) states that it would be highly speculative to assume that Coptic liturgical music could serve as a window into ancient Egyptian music, meaning that Coptic music is not uncritically to be understood as a continuation of ancient Egyptian music.

Similar texts that are relevant to a lesser extent to this research tradition include Coptic Church (1905), Youhanna (1924), Atiya (1979; 2010), El-Shawan (1982), Atiya & Adams (1991), Malaty (1993), Kamil (2002), Henderson (2005), Meinardus (2010), Ayad (2016), Gabry-Thienpont (2017), Ramzy (2017) and Hanna (2018).

2.3 Arabic music and its influences on Coptic music

A multitude of approaches have been presented in the literature to explore Arabic culture, including Arabic music notation, maqams, and instruments, in order to investigate its relationship to Coptic music. This section will consider only the literature related to Egypt's Arabic culture and not that of other Arab countries.

The Coptic Museum in Cairo has preserved numerous manuscripts described by Simaika & Masih (1942). These manuscripts were written in Coptic and Arabic languages to present several aspects of Coptic culture: the Biblical, the Theological, the Canons, the Historical and

related to Coptic music, the Liturgical. These manuscripts illustrate how the Arabs influenced Egyptian Coptic culture and how Egypt changed from being a Coptic to an Arab country.

Egypt was not originally an Arab land; thus, its character is related to the ancient Egyptian population and their descendants, the Copts. Ibrahim stated that:

[s]tudies on modern Egyptian DNA support the view that neither Egyptian Muslims nor Copts are Arab. All the invasions that Egypt has experienced over millennia, including the Arab invasion, do not seem to account for more than 15% of modern Egyptians' ancestry. So Egyptians are not genetically Arabs. (Ibrahim, 2010)

Likewise, El-Behary (2017) stated clearly 'DNA analysis proves that Egyptians are not Arabs'

Despite the points made above, key findings suggest that Arabic music has nevertheless influenced Coptic music. Thus we find most of those who analyse Coptic music use Arabic maqams, pitch names and notation system, like Botrous (1976), Erian (1986, 2017), and Kyrillos (2001, 2002, 2013). The quarter-tone adjustment in Coptic hymns is sometimes different from what is common in Arabic music. For example, old Coptic cantors use different microtonal frequency values from what we hear commonly in Arabic maqams, such as these recordings in the Library of Congress (Moftah. et al., 2005). However, most scholars use only a common microtonal accidental sign like the half flat sign (\flat) to refer to a different microtone frequency value within the hymn, although there are many other signs to indicate various microtones adjustments, as Figure 2.21 illustrates.

♭	٢٤	♯
♭	٤٨	♯
♭	٦٦	♯
♭	٩٠	♯
♭	١١٤	♯
♭	١٣٨	♯
♭	١٨٠	♯
♭	٢٠٤	♯

Figure 2. 21: Various accidental signs could be used in Arabic notation to represent different microtones frequency values³ (Werdi, 1948, p. 602).

Altaweel (2014) presented a study of the similarity between certain Arabic folkloric songs and Coptic hymns in terms of their melody and composition structure, which shows the mutual influence of Coptic and Arabic music on Egyptian culture. Figure 2.22 demonstrates an example of the similarity between a part of an Arabic song called ‘*ya boniea*’ composed by Zakaria Ahmed (1970) and a lent Coptic hymn called Ἰεϋρηνῆ ἤτε Φῆ ‘*Ti Hierini*’.

³ The column from the left indicates flattened accidentals, the middle column indicates eastern Arabic numerals, and the column on the right indicates the sharp accidentals.



Figure 2. 22: The similarity between a part of an Arabic song 'ya boniea' composed by Zakaria Ahmed (1970) and a lent Coptic hymn Ἰεϋερηνὴν Ἰησοῦ 'Ti Hierini' (Altaweel, 2014, p. 54).

Similar conclusions are drawn by Guhary (1914), Farmer (1929), Hardie (1946), Mansy (1949), and El-Shawan (1982).

Chapter 3 Studying and Analysing Replicas of The Ancient Egyptian End-Blown Flute (The Ancient Egyptian *Nay*)

3.1 Introduction

Archaeological discoveries of many Egyptian musical instruments in the nineteenth and twentieth centuries motivated many studies of ancient Egyptian music. The ancient Egyptian end-blown flute, the *nay*, is one of these instruments and is still in use to this day. Southgate said the *nay* ‘is the origin of the entire flute tribe, also of all the flue pipes of the organ; the venerable instrument is still played in Cairo’ (1915, p. 12).

The word *nay* is originally Persian as there is a similar version of the same instrument from Persia, but the Egyptian instrument is different, especially in terms of sound production. Therefore, there could be a historical link between the instrument's name and the Hyksos (Persian) invasion of Egypt. However, the *nay* existed before the invasion in the Second Intermediate Period around 1650 BC; it is confirmed by ancient Egyptian representations (as shown later in this chapter) that the *nay* was found throughout the old Kingdom but we are not sure of its original name.

Sachs mentioned that the *nay* ‘shared the name *mat* or *māt* with both clarinets and oboes’ (2012, p. 104). We cannot strictly use the name *māt* because it refers to a group of instruments, not only the ancient Egyptian flute with which I am concerned. Moreover, the Egyptians themselves in the present-day use the same instrument and know it as the *nay*.

Many pictorial representations show the *nay* as a common instrument in ancient Egyptian ensembles, with various lengths, long and short, and a unique holding position that distinguishes it from the other wind instruments, particularly the flutes, and also differentiates it from the other instruments in ancient Egyptian ensembles as shown in Figures 3.1, 3.2, 3.3, 3.4 and 3.5.

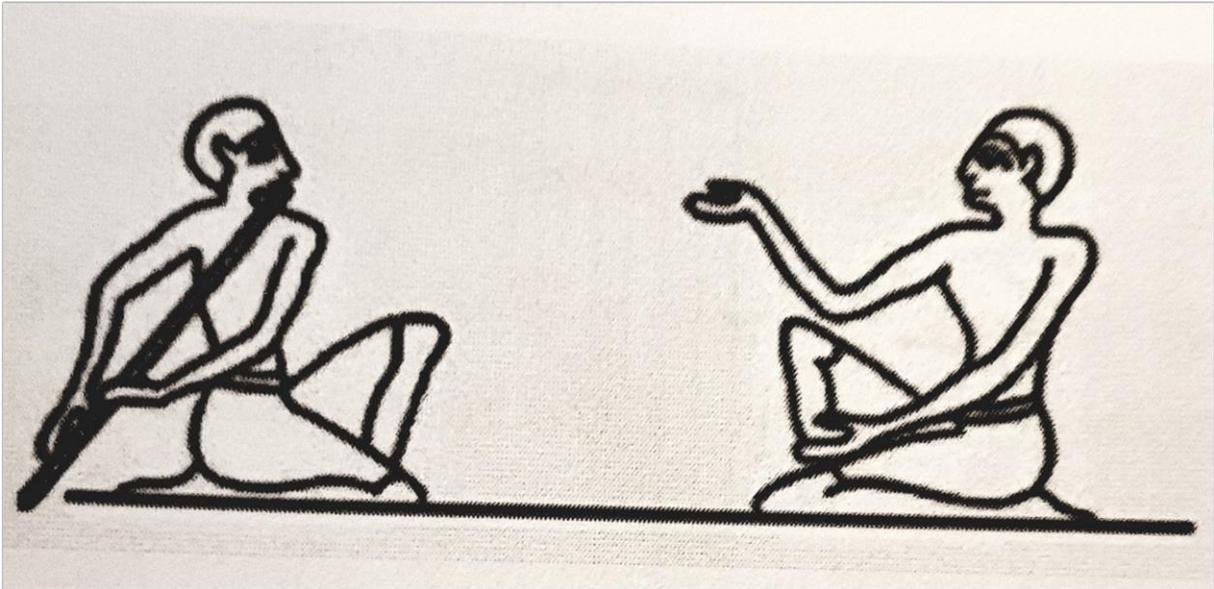


Figure 3. 1: The oldest ancient Egyptian flute player scene, 4th Dynasty (2613–2494 BC) in the Old Kingdom, from a tomb near the Giza Pyramids (Gadalla, 2018, p. 51).

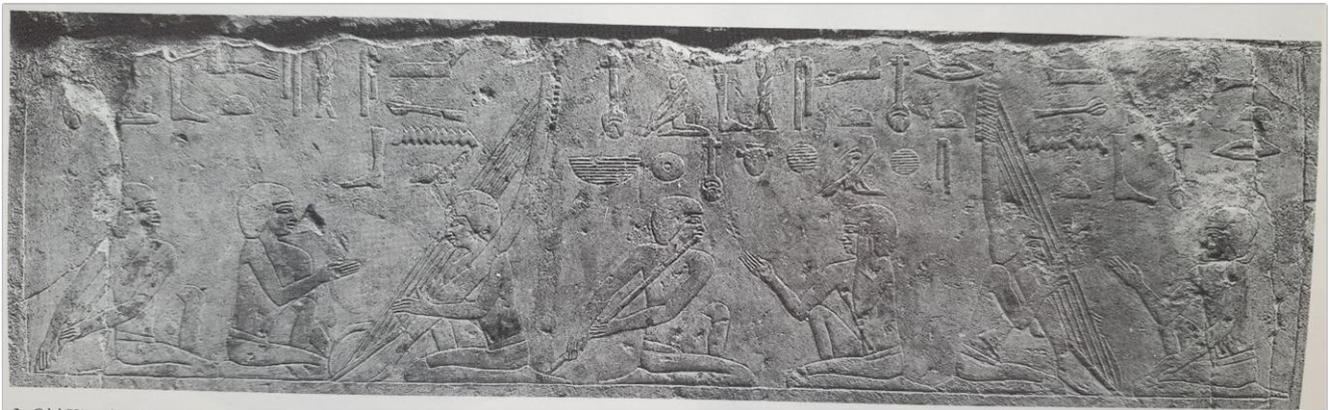


Figure 3. 2: Harps and flute (*nay*) players in front of chironomists (similar to music conductors) and singers from the Old Kingdom (2686–2181 BC)⁴ (Mannich, 1991, facing p. 96).

⁴ A relief engraving carved into a stone wall of the tomb of Kaemremet. Ny Carlsberg Glyptotek museum, Copenhagen (AIN 1271).



Figure 3. 3: A painted relief from the tomb of Nenchefka in the 5th Dynasty of the Old Kingdom (2494–2345 BC). (source: photo taken for this research project in the Egyptian museum 2019).

Figure 3.3 has been explained by Hickmann (1961) as an ancient Egyptian ensemble consisting of a flute (*nay*) on the left, a clarinet player in the middle, and a harp player. The other players are chironomists; the second person from the left seems to be singing as he puts his left hand on his ear.



Figure 3. 4: A *nay* player with a blind harpist from funerary chapel reliefs from the tomb of Paatenemheb in the necropolis of Memphis, 18th Dynasty (1550–1292 BC) of the New Kingdom, near Saqqara, Egypt.⁵ (*A nay player with a blind harpist*, n.d.).

⁵ The original is preserved in the Rijksmuseum van Oudheden museum, Leiden, Netherlands.

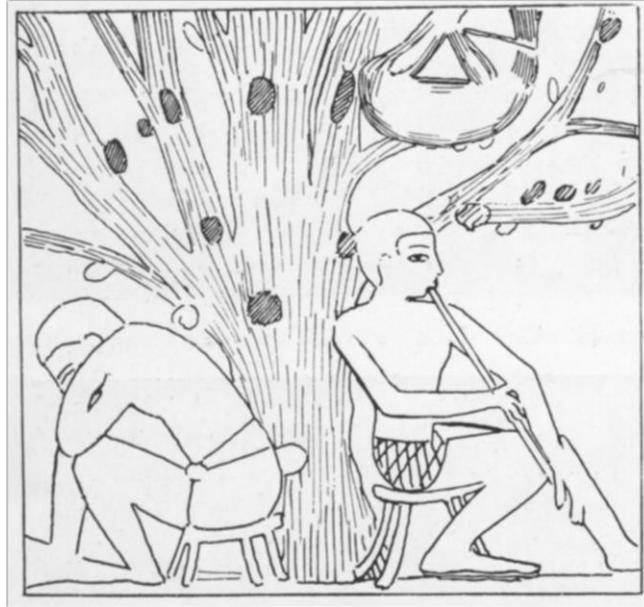


Figure 3. 5: A flute (*nay*) player under a tree. Relief in Theban tomb no. 69 of Menna, 18th Dynasty (1550–1292 BC) of the New Kingdom (Hickmann, 1961, p. 76).

From the previous five figures (3.1, 3.2, 3.3, 3.4 and 3.5), we can deduce the following information about the *nay*. Firstly, that the *nay* is an end-blown instrument found in Egypt since the 4th Dynasty (2913 – 2494 BC), as shown in Figure 3.1, and it continued to be used in the ancient Egyptian eras from the time of the Old Kingdom (as shown in Figures 3.1, 3.2 and 3.3), through to and beyond the New Kingdom (as shown in Figures 3.4 and 3.5).

Secondly, that the *nay* is an instrument used for ritual occasions such as funerals or celebrations (as shown in Figures 3.2, 3.3, and 3.4), and it was also used by the public (as shown in Figure 3.5).

Thirdly, that the *nay* was used in ancient Egyptian ensembles, which included harp (as shown in Figures 3.2, 3.3 and 3.4), also, the ensemble could have *tanboura* (as shown in Figure 3.4) and the *nay* could be played as a solo instrument (as shown in Figure 3.5), guided by a chironomist (as shown in Figure 3.1), or guided by a singer (as shown in Figures 3.2 and 3.3).

Fourthly, that the *nay*'s playing position is different from other wind instruments, suggesting that the modern Arabic *nay* is a development of the ancient Egyptian *nay* because of this unique feature that characterises both instruments.

Table 3.1 shows other representations depicting the *nay* preserved in different museums worldwide, corroborating the aforementioned (Gadalla, 2018, p. 50):

Representation	Date	Place of discovery	Museum
A slate palette depicts several animals, including a jackal, playing the <i>nay</i>	3,200 BC	Unknown	Ashmolean Museum-Oxford
A <i>nay</i> player on a relief	2,390 BC	Nekauhor tomb at Sakkara	The Metropolitan Museum of Art, New York
A <i>nay</i> player representations	During the 18 th Dynasty(1550 –1292 BC)	Thebes	Several tombs in Thebes

Table 3. 1: Other representations depicting the *nay*. (Gadalla, 2018, p. 50).

Some studies have used technology for analysing historic wooden instruments, for instance, Bissinger (2003) who applied it to a violin octet, and a study of a pan flute from ancient Egypt (Avanzini et al., 2015). There is also a method called ‘reference voice’ in Bonamini (2012). The latter applied the method to a case study of the grand piano, which suggested many guided approaches such as the material and geometry-guided approach, and the sound-guided approach. Bonamini (2012) spells out the steps of this method including examples of frequency and data analysis.

3.2 Describing the instrument

Description of the ancient Egyptian *nay* is vital for this research in order to compare it with the modern Arabic Egyptian *nay* and to arrive at some results related to Coptic music (discussed in Chapter 4). The *nay* is an end-blown instrument commonly made from bamboo reed plants that grow along the banks of the Nile; Egyptians have used the living resources of the Nile for many thousands of years. The *nay* is an empty hollowed-out cane with various finger holes and a sharpened rim on the near end. The cane contains some nodes, which tend to limit the breadth of the air column at each node. Despite its simplicity, it can produce a wide range of tones in various octaves, with a deep *sostenuto* and harmonics beside a characteristic *vibrato*. Producing sound from the *nay* is achieved by blowing across the edge of the orifice in the top part of the

instrument, which is called خزنة “khazna” and which is a wind chamber similar to the mouthpiece of modern wind instruments. This directs the wind into the tube, the vibrating air column length being changed by opening and closing the finger holes. The nay can produce different tones and octaves from the same position by changing the air pressure.

3.3 Analysis of the *nay* replicas

Following the information provided by the Supreme Council of Antiquities (SCA), I found 24 ancient Egyptian wind instruments (not including Tutankhamun’s trumpets) preserved in the Egyptian Museum. These wind instruments are located in one display case whose contents have been rearranged for an unknown reason; this rearrangement of the display case contents happened after the time of the Egyptian group’s research. (Figure 3.6 shows an old photo of this display case and a recent image taken especially for this research in 2019). I obtained replicas of six *nays* (Figures 3.7 and 3.8) by a *nay* maker called Adel Fouad, who was an assistant to the Egyptian group and had the exact dimensions and measurements of the originals. Also, Fouad put the CG (Catalogue Générale) numbers in eastern Arabic numerals to reference each replica to the originals; I have examined the replicas and made sure they correspond to the originals, as will be discussed later in this chapter.



Figure 3. 6: Display cases from the Cairo Museum showing old and recent photos of ancient Egyptian wind instruments (the right-hand image has been taken especially for this research project in 2019).



Figure 3. 7: Replicas of six ancient Egyptian flutes that Salama commissioned for this research project. The image shows the CG (Catalogue Générale) numbers in eastern Arabic numerals. (Photo by Salama).



Figure 3. 8: Replicas of six ancient Egyptian flutes that Salama commissioned for this research project. The image shows the playing holes of each instrument. (Photo by Salama).

3.3.1 Verifying the authenticity of the six original ancient Egyptian flutes (*nays*)

As mentioned in Chapter 2, archaeology is vital to study ancient music. It can help verify the authenticity of the six original ancient Egyptian flutes preserved in the Egyptian Museum, which have been replicated for the purposes of this research. Despite missing some information on flute CG 69819, there is information available for the other original five instruments. Table 3.2 shows details of the originals held at the Egyptian Museum. CG stands for the ‘Catalogue Générale’ number, JE stands for ‘Journal d’Entree’ number. I have checked all these details and found them identical to what is recorded in the Egyptian Museum and Hickmann’s (1949) description:

CG	JE	Date	Provenance	Discovered by and Year
69814	43328	Middle Kingdom (2130–1649 BC)	Beni Hassan	Garstang 1904
69815	46157	Unknown	Saqqara	unknown
69816	46158	Unknown	Saqqara	unknown
69817	63745	18 th Dynasty New Kingdom (1550–1292 BC)	Deir El-Medina	unknown
69818	27345	Unknown	Akhmim	unknown
69819	$\frac{27}{23} \frac{10}{4}$	Unknown	unknown	unknown

Table 3. 2: Details of the six original ancient Egyptian flutes held at the Egyptian Museum. (Hickmann, 1949, pp. 117–123)

From Table 3.2, we can come to the following conclusions. Firstly, that the *nay* has existed for thousands of years during the ancient Egyptian period, given that one of the original six *nays* is dated to the Middle Kingdom (2130–1679 BC). Secondly, that the *nay* has been widely used in different geographic locations, that it was a common instrument in ancient Egyptian music and used all over Egypt in the north (Saqqara) and the south (Akhmim). This corresponds with the fact that *nay* have been depicted on some pictorial representations in the north (Saqqara) and in the south (Theban-Luxor). That would also be expected if the instrument had been used for ritual and worship purposes, as the ancient Egyptian tombs and temples expanded over the country. Moreover, the Nile, the source of the instrument's material, stretches from the north to the south of Egypt. Thirdly, that the preserved *nays* are authentic based on the available archaeological information on their age and location and also that the preserved *nays* help acquire information about the ancient Egyptian music system (and consequently Coptic music, as we will explore later in this research) because of the age of the instruments.

The six original *nays* are made of wood, except for CG 69819, which is bronze. However, that does not undermine its authenticity as an ancient Egyptian instrument because bronze has been found in ancient Egyptian artefacts since the pre-Dynastic period (De Young, 2008, p. 3132).

Additionally, many other ancient Egyptian instruments were made in bronze; the most well-known example is one of two Tutankhamun trumpets CG 69851 from the 18th Dynasty (1550–1292 BC) (Hickmann, 1949, p. 144).

3.3.2 Verifying the *nays* replicas

Verifying the six replicas to make sure they are accurate copies has been done by using the description of the six original *nays*, and photos are provided from the following sources: the Egyptian Museum (also, the data related to its common names in the past: the Cairo Museum, or the Museum of Cairo); Hickmann (1949), which is a key reference for the Supreme Council of Antiquities (SCA) (previously known as the Egyptian Antiquities Organization or EAO); the description of the six original *nays* provided by the Egyptian group’s study (Effat et al., 1996, pp. 119–140).

The six replicas reconstruct six original ancient Egyptian *nays* preserved in the Egyptian Museum, stamped with the CG numbers 69814, 69815, 69816, 69817, 69818 and 69819. All replicas include the same numbers for each in eastern Arabic numerals, except two of them where the maker has miswritten it by changing the order of the numbers. I investigated this issue by comparing the two replicas’ miswritten CG numbers with the descriptions of the other original *nays* and made sure they were identical, as shown in Table 3.3 and Figures 3.9, 3.10, 3.11, 3.12, 3.13 and 3.14. The incorrect number order is not found in the Egyptian Museum instruments catalogue CG numbers. However, these two *nay* replicas are identical to two original *nays* with the same CG numbers but written in a different order, as shown in Table 3.3.

Original <i>nays</i> ’ CG	Replica <i>Nays</i> ’ CG	Correction
69814	٦٩٨١٤	-
69815	٦٩٨١٥	-
69816	٦٩٨١٦	-
69817	٦٩٨١٧	-
69818	٨١٨٦٩	٦٩٨١٨
69819	٩١٨٦٩	٦٩٨١٩

Table 3. 3: Verification of The CG numbers of *nay* replicas, including the miswritten and corrected CG numbers in the replicas CG 69818 and CG 69819 in eastern Arabic numerals.



Figure 3. 9: The replica of CG 69814 with eastern Arabic numeral ٦٩٨١٤.



Figure 3. 10: The replica of CG 69815 with eastern Arabic numeral ٦٩٨١٥.



Figure 3. 11: The replica of CG 69816 with eastern Arabic numeral ٦٩٨١٦.



Figure 3. 12: The replica of CG 69817 with eastern Arabic numeral ٦٩٨١٧.



Figure 3. 13: The replica of CG 69818 with eastern Arabic numeral ١١٧٩.



Figure 3. 14: The replica of CG 69819 with eastern Arabic numeral ١١٧٩.

I followed Hickmann's measurement method for the six original *nays*, as shown in Figure 3.15:

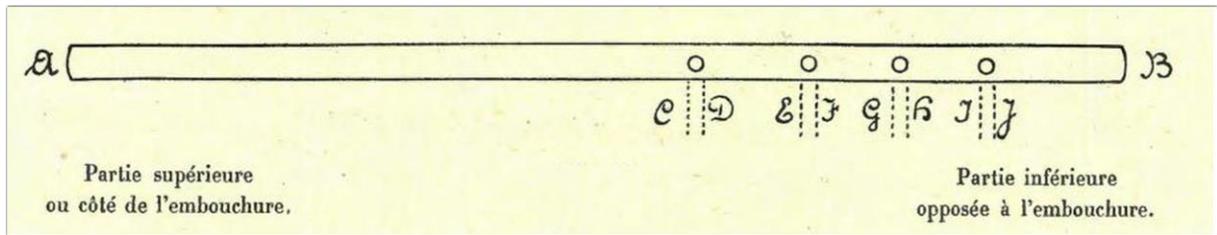


Figure 3. 15: Hickmann's measurement method for the six original *nays*. (A) is the upper part or side of the mouthpiece, (B) is the lower part furthest the mouth (1949, p. 116).

The following is a detailed description of the measurements of the replica of CG 69819 in comparison with the available references of the original preserved in the Egyptian Museum.

Figure 3.16 shows the measurement points of the replica of CG 69819:

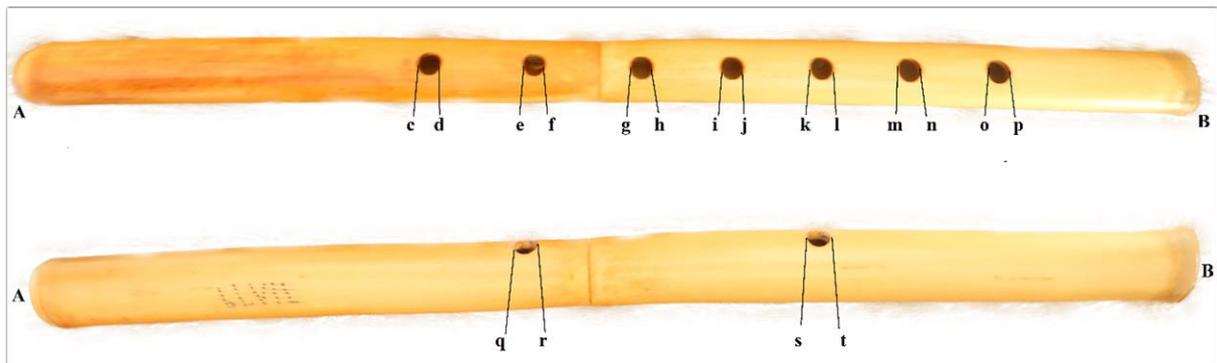


Figure 3. 16: Measurement points of the *nay* replica CG 69819 showing holes at the front and back. Photo by Salama.

Table 3.4 shows the measurements of the original and replica of CG 69819, based on the measurement points shown in Figure 3.16:

CG	Location	Measurement points	Original	Replica
69819	<i>Distances on the front</i>	A-B	38.9 cm	38.9 cm
		A-c	13.5 cm	13.4 cm
		A-d	14.1 cm	14.1 cm
		A-e	16.75 cm	16.75 cm
		A-f	17.45 cm	17.4 cm
		A-g	20.15 cm	20.1 cm
		A-h	20.85 cm	20.8 cm
		A-i	23.1 cm	23.1 cm
		A-j	23.75 cm	23.75 cm
		A-k	26.2 cm	26.15 cm
		A-l	26.85 cm	26.8 cm
		A-m	28.7 cm	28.7 cm
		A-n	29.4 cm	29.4 cm
		A-o	31.95 cm	31.95 cm
		A-p	32.65 cm	32.65 cm
	Distances between holes on the front	d-e	2.65 cm	2.65 cm
		f-g	2.70 cm	2.70 cm
		h-i	2.25 cm	2.25 cm
		j-k	2.45 cm	2.45 cm
		l-m	1.85 cm	1.85 cm
		n-o	2.55 cm	2.5 cm
	Diameter of the holes in the front		0.6 cm - 0.7cm	0.7 cm
	Distances on the back	A-q	16.0 cm	16.0 cm
		A-r	16.6 cm	16.7 cm
		A-s	25.7 cm	25.7 cm
		A-t	26.35 cm	26.4 cm
		t-B	12.55 cm	12.5 cm
Distances between holes on the back	r-s	9.1 cm	9.1 cm	
Diameter of the holes on the back		0.6 cm	0.65 cm	

Table 3. 4: Measurement points on the original and replica *may* CG 69819.

It is immediately noticeable from the measurements of the original and the replica *nays* that there are four long *nays* without back holes, and there are two short *nays* with back holes. Hickmann explained that the ancient Egyptians used short *nays* called *عَفَّاطَة* *uffatta*, which means a short flute) (Hickmann, 1952, p. 8). We can see this type in a representation of four flautists and three singers in the tomb of Kairer at Saqqara, from the Old Kingdom (Figure 3.17). Hickmann mentions that the short flutes in the Egyptian Museum are related to this category of *nay*; moreover, three examples of this type of *nay* are held in the British Museum as BM EA12742, EA54480, and EA6385. Figures 3.18 and 3.19 show two of the preserved short ancient Egyptian flutes in the British Museum.



Figure 3. 17: A musical scene from a tomb in Saqqara (tomb of Kairer) showing an ensemble of four flautists playing the long and short *nay* flute assisted by three singers and chironomists. (Hickmann, 1950, p. 8).



Figure 3. 18: Flute BM EA12742 in the British Museum found in Egypt. (The British Museum, 2020a).



Figure 3. 19: Flute BM EA6385 in the British Museum found in Dahshur (Memphis), Pyramid of Senusret III. (The British Museum, 2020b).

I have examined the six replicas and chosen CG 69819 as an example to analyse, including its frequencies, relative pitches, intervals, and scales.

Chapter 4 Investigation and Analysis of the Original and Replica *Nay* CG 69819

As mentioned, the original *nay* CG 69819 is made of bronze; the replica is made of wood as it is more readily available than bronze. There is, however, no effect on the produced frequencies caused by changing the material of the instruments (Coltman, 1971).

4.1 Original and replica *nay* CG 69819 frequencies, pitches and relative pitches

Video 4.1 explains some expressions of the instrument technique used in the analysis process of the original and replica *nay* CG 69819 (see also Table 4.1):

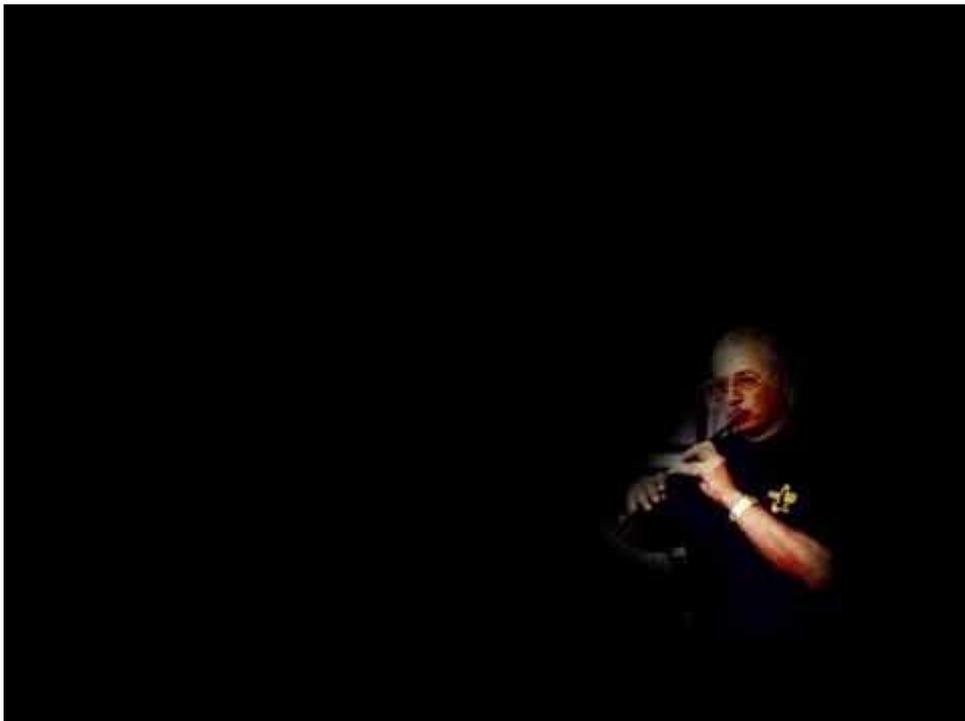


Video 4. 1: Salama explains some expressions of the *nay* technique used in the analysis process.

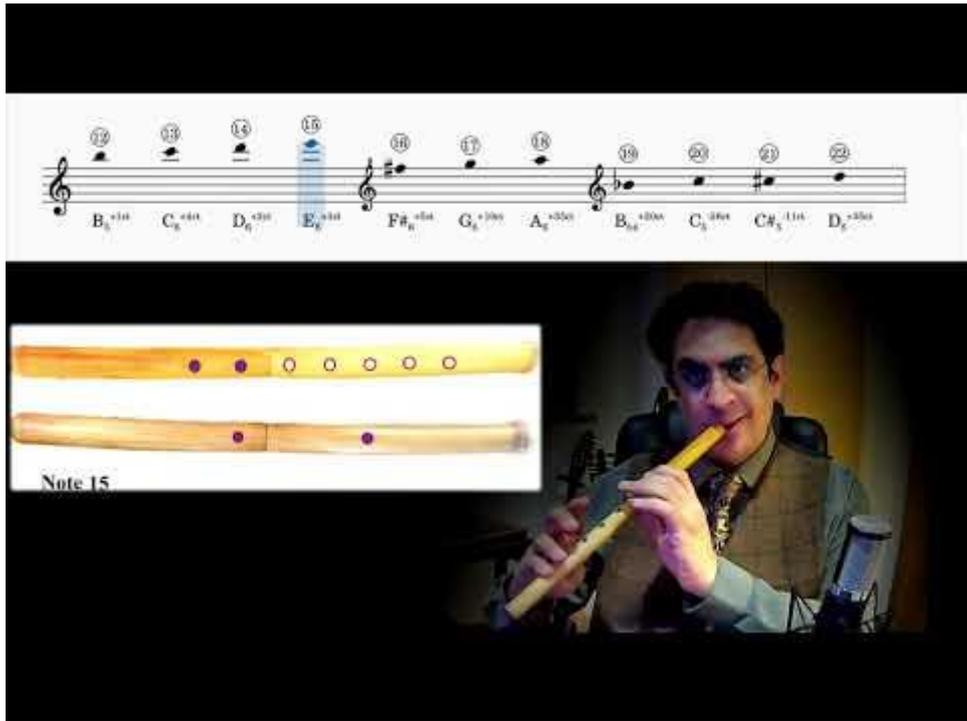
The results shown in Table 4.1 have been obtained using software called *Melodyne* (Celemony, 1997) (Figures 4.1 and 4.2), which has been used to analyse the frequencies of two recordings. Firstly, the available audio recording of the original *nay* CG 69819 by the Egyptian group. (Effat et al., 2000). Note that the player recorded the second and third octaves only by the simple fingering. Moreover, he generally did not play the compound fingering notes (see Video

4.2). I have also analysed my own recording of the replica *nay* CG 69819, which includes all the available notes which can be played on this instrument (see Video 4.3).

It is worth mentioning that both *nay* players (Effat & Salama) applied some of the stylistic effects common in the modern Arabic *nay* (Effat, 2005, pp. 40,44) while exploring either the original or the replica ancient Egyptian *nays* in the recorded videos in this thesis; these effects include vibrato, pitch bends, and ornamentations such as acciaccatura and trills.



Video 4. 2: The recording by Effat (the Egyptian group) used to analyse the original *nay* CG 69819, including playing the same notes by Salama on the replica *nay* CG 69819.



Video 4. 3: The recording used to analyse the replica *nay* CG 69819 by Salama, including playing all the available notes in different octaves and fingering positions

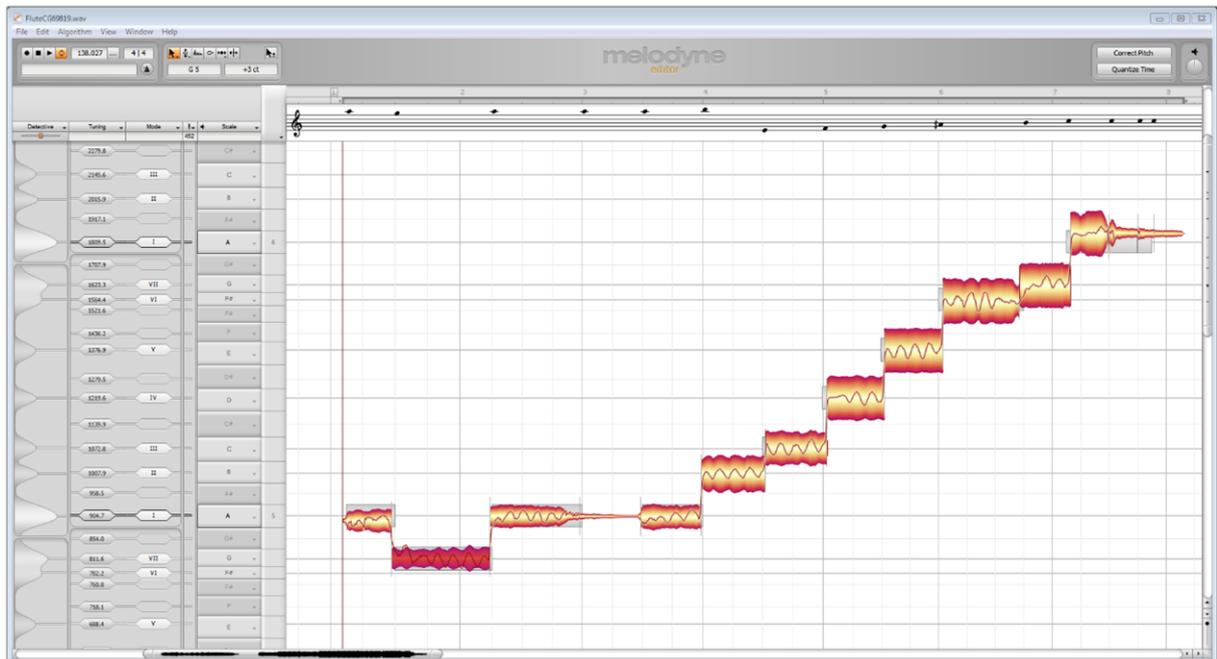


Figure 4. 1: A screenshot from Melodyne of the original *nay* CG 69819 played by Effat (the Egyptian group).

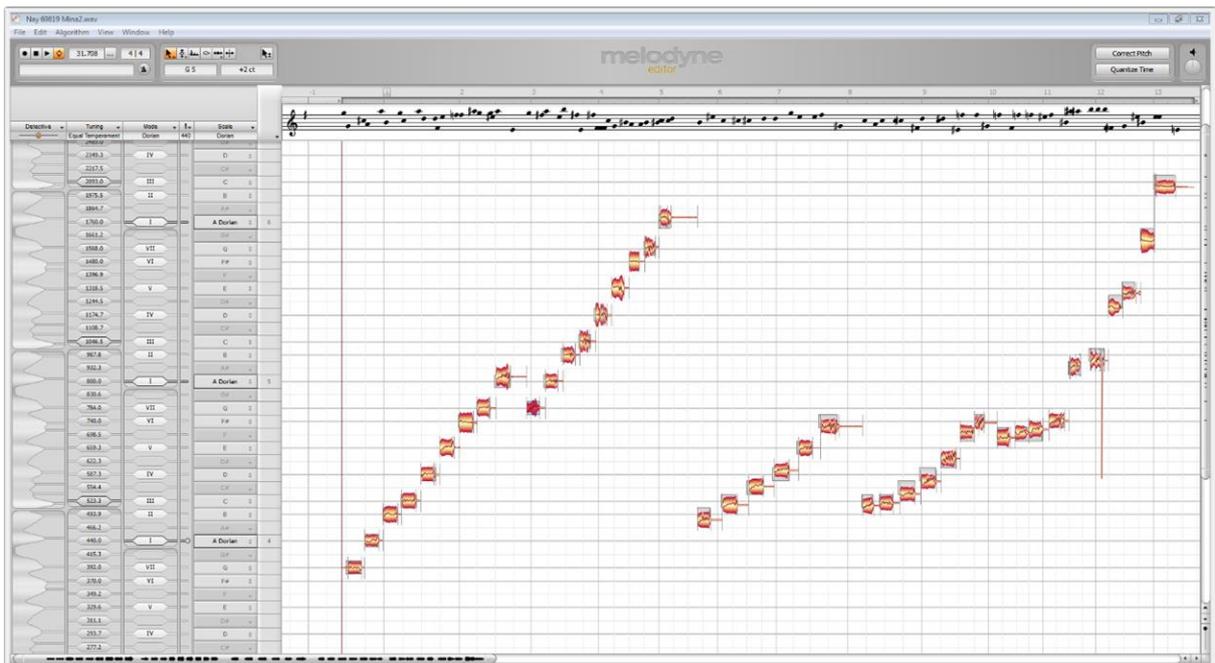


Figure 4. 2: A screenshot from Melodyne of the replica *nay* CG 69819 played by Salama.

It is worth noting that the produced frequencies from a wind instrument like the *ney* are not in a straight wave shape, so the software gave an average value for the frequency, as shown in Figure 4.3. Also, the program detected $A4 = 452$ Hz and converted the output to provide the results in 440 Hz for both recordings.

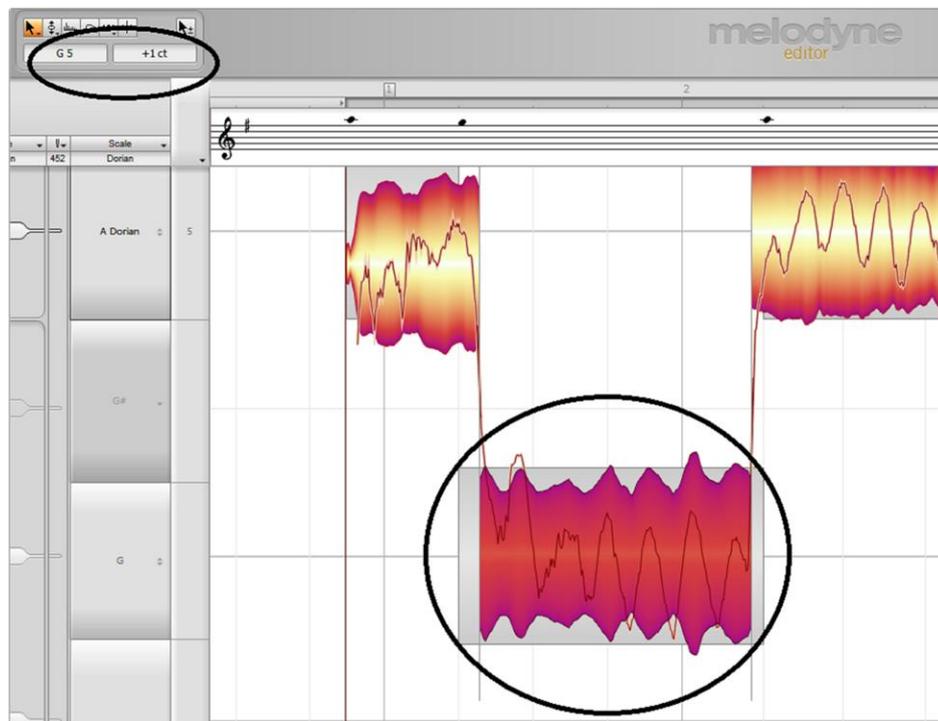


Figure 4. 3: The second note of the original CG 69819 audio recording shows that its wave shape is not straight, so Melodyne shows the average frequency value.

Figures 4.4 and 4.5 show the spectral frequency of the original and replica CG 69819 audio tracks by means of the *Spectra Layers pro* software (Steinberg, 2020).

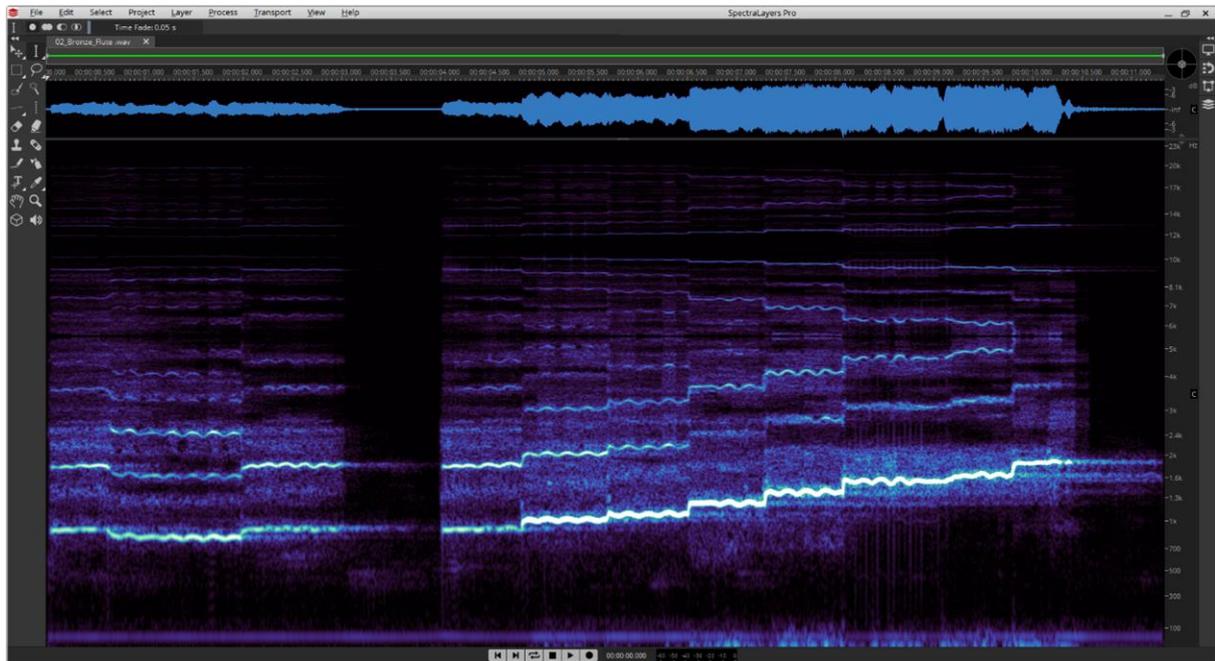


Figure 4. 4: Original CG 69819 audio track spectral frequency display.

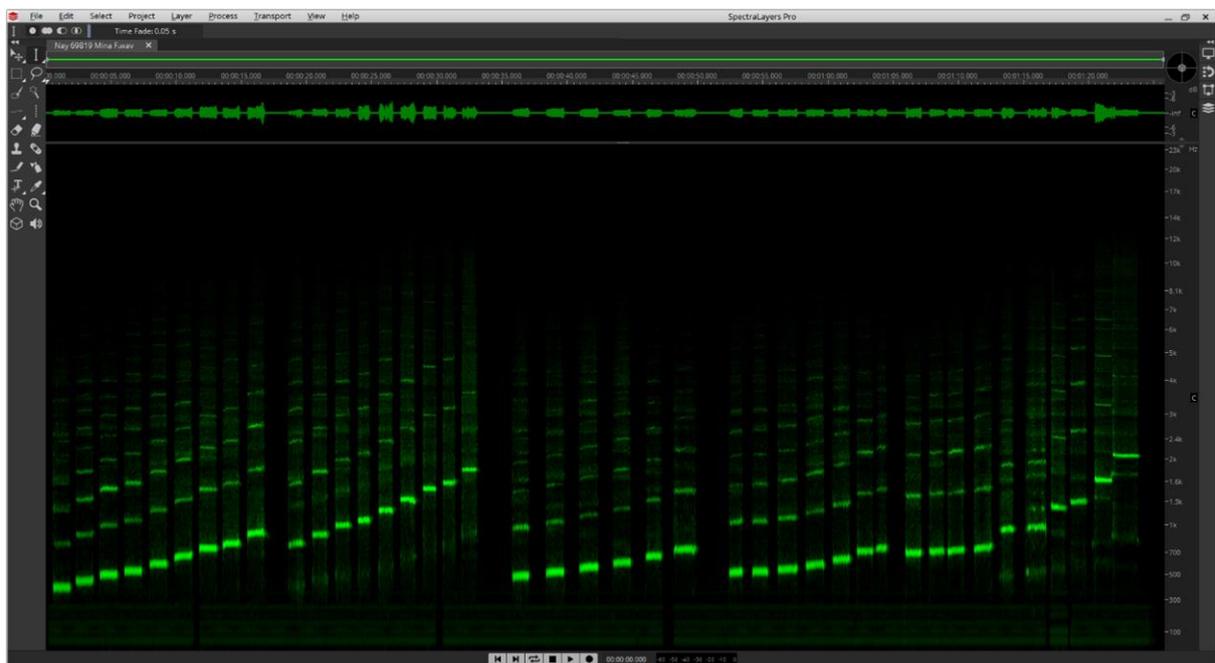


Figure 4. 5: Replica CG 69819 audio track spectral frequency display.

Table 4.1 shows the frequencies of both the original and replica *nays* CG 69819, including the difference in cents as shown in Videos 4.2 and 4.3.

Note	Hertz replica	Hertz original	Difference in cents	Air pressure	Fingering	Back holes 1 & 2
1	391.7	N/A	N/A	1	simple fingering	closed
2	441.5	N/A	N/A	1	sf	c
3	494.4	N/A	N/A	1	sf	c
4	523.8	N/A	N/A	1	sf	c
5	588.3	N/A	N/A	1	sf	c
6	660.3	N/A	N/A	1	sf	c
7	737.4	N/A	N/A	1	sf	c
8	784.8	N/A	N/A	1	sf	open 2
9	898.4	N/A	N/A	1	sf	open 1
10	784.8	784.4	-0.4	2	sf	closed
11	881.5	870.8 /880 /878.9	-10.7 / -1.5 / -2.6	2	sf	c
12	988.3	987.1	-1.2	2	sf	c
13	1048.9	1049.5	0.6	2	sf	c
14	1176	1174.6	-1.4	2	sf	c
15	1320.7	1318.5	-2.2	2	sf	c
16	1484.2	1480.8	-3.4	2	sf	c
17	1577	1566.1	-10.9	2	sf	open 2
18	1795.9	1801.1	5.2	3	sf	c
19	471.5	N/A	N/A	1	compound fingering	c
20	486.5	N/A	N/A	1	cf	c
21	557.8	N/A	N/A	1	cf	c
22	599.3	N/A	N/A	1	cf	c
23	659.2	N/A	N/A	1	cf	c
24	725.5	N/A	N/A	1	cf	open 1
25	829.6	N/A	N/A	1	cf	closed
26	533	N/A	N/A	1	Simple fingering	open 1
27	527.1	N/A	N/A	1	sf	open 1
28	568.6	N/A	N/A	1	sf	open 1
29	578.9	N/A	N/A	1	sf	open 1

30	629.4	N/A	N/A	1	sf	open 1
31	706.9	N/A	N/A	1	sf	open 1
32	742.1	N/A	N/A	1	sf	open 1
33	730.6	N/A	N/A	1	sf	open1&2
34	705.3	N/A	N/A	1	sf	open1&2
35	713.9	N/A	N/A	1	sf	open1&2
36	742.1	N/A	N/A	1	sf	open1&2
37	938.8	N/A	N/A	2	compound fingering	closed
38	966.8	N/A	N/A	3	cf	c
39	1215.3	N/A	N/A	3	cf	c
40	1293.6	N/A	N/A	3	cf	c
41	1621.4	N/A	N/A	3	cf	c
42	2052.3	N/A	N/A	4	cf	c

Table 4. 1: Frequencies of both original and replica *nays* CG 69819 with the difference in cents. ‘*sf*’ stands for simple fingering and ‘*cf*’ for compound fingering.⁶

⁶ The replica’s note numbers relate to Video 4.3 as the order of the notes in the recording.

Table 4.2 and Figure 4.6 show the pitches of both the original and replica CG 69819, including the difference in cents between the frequency values shown in Table 4.1

Note	Pitch replica	Pitch original	Difference in cents
1	G4 ^{-1ct}	N/A	N/A
2	A4 ^{+6ct}	N/A	N/A
3	B4 ^{+2ct}	N/A	N/A
4	C5 ^{+2ct}	N/A	N/A
5	D5 ^{+3ct}	N/A	N/A
6	E5 ^{+3ct}	N/A	N/A
7	F#5 ^{-6ct}	N/A	N/A
8	G5 ^{+2ct}	N/A	N/A
9	A5 ^{+36ct}	N/A	N/A
10	G5 ^{+2ct}	G5 ^{+1ct}	1ct
11	A5 ^{+3ct}	A5 ^{-18ct} / A5 ^{0ct} / A5 ^{-2ct}	-21ct / 3ct / -5ct
12	B5 ^{+1ct}	B5 ^{-1ct}	-2ct
13	C6 ^{+4ct}	C6 ^{+5ct}	-1ct
14	D6 ^{+2ct}	D6 ^{0ct}	2ct
15	E6 ^{+3ct}	E6 ^{0ct}	3ct
16	F#6 ^{+5ct}	F#6 ^{+1ct}	4ct
17	G6 ^{+10ct}	G6 ^{-2ct}	-12ct
18	A6 ^{+35ct}	A6 ^{+40ct}	-5ct
19	Bb4 ^{+20ct}	N/A	N/A
20	C5 ^{-26ct}	N/A	N/A
21	C#5 ^{-11ct}	N/A	N/A
22	D5 ^{+35ct}	N/A	N/A
23	E5 ^{0ct}	N/A	N/A
24	F#5 ^{-34ct}	N/A	N/A
25	Ab5 ^{-2ct}	N/A	N/A
26	C5 ^{-32ct}	N/A	N/A
27	C5 ^{+13ct}	N/A	N/A
28	C#5 ^{-44ct}	N/A	N/A
29	D5 ^{-25ct}	N/A	N/A
30	D#5 ^{+20ct}	N/A	N/A
31	F5 ^{+21ct}	N/A	N/A
32	F#5 ^{-5ct}	N/A	N/A

33	F5 ^{-22ct}	N/A	N/A
34	F5 ^{+17ct}	N/A	N/A
35	F5 ^{+38ct}	N/A	N/A
36	F#5 ^{+5ct}	N/A	N/A
37	A#5 ^{+12ct}	N/A	N/A
38	B5 ^{-37ct}	N/A	N/A
39	D#6 ^{-41ct}	N/A	N/A
40	E6 ^{-33ct}	N/A	N/A
41	G#6 ^{-42ct}	N/A	N/A
42	C7 ^{-34ct}	N/A	N/A

Table 4. 2: Pitches of both original and replica CG 69819, including the difference in cents.⁷

⁷ The replica's note numbers relate to Video 4.2 and 4.3 in terms of the note recording order.

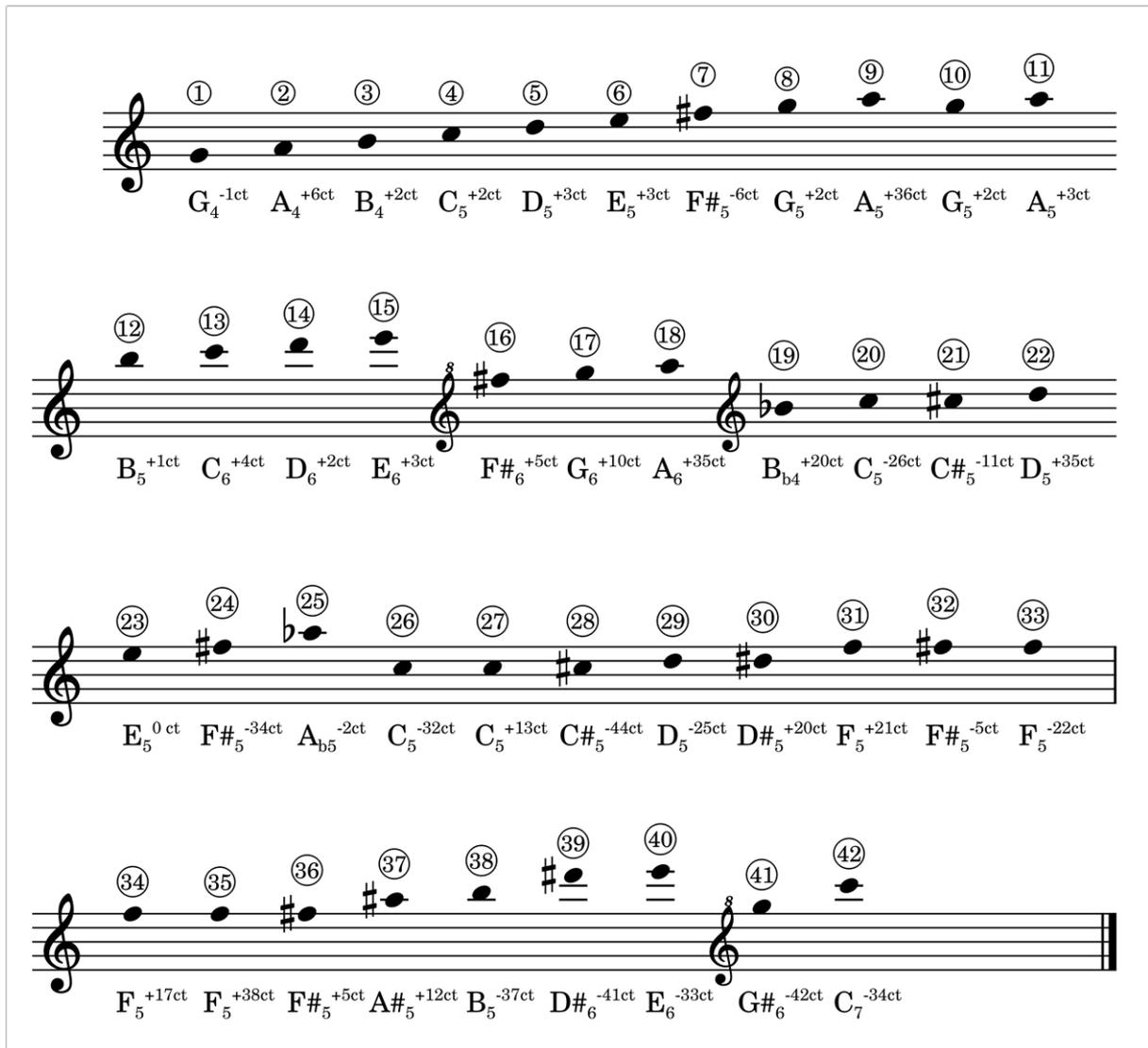


Figure 4. 6: All the available notes in different octaves and fingering positions on the replica *nay* CG 69819.⁸

Table 4.3 shows the relative pitches for both the original and replica, including the difference in cents. This can be obtained by selecting a note as a reference point to reset all note values to the closest value of 0 ct. It can be illustrated with the following example of choosing G5 as a note to reset its cents to 0 ct. This note is available in the original and replica *nay* CG 69819 audio recordings (included on video 4.2 and 4.3) (because the player of the original *nay* recorded only the second octave). Consequently, because G5 in Table 4.2 is +1ct for the original and +2ct for the replica, we can reset the value of all notes by taking away 1ct for both the original and replica note values.

⁸ The numbers inside the circles are the note numbers as given in Video 4.3.

Note number	Relative Pitch replica -1ct	Relative pitch original -1ct	Difference in cents
1	G4 ^{-2ct}	N/A	N/A
2	A4 ^{+5ct}	N/A	N/A
3	B4 ^{+1ct}	N/A	N/A
4	C5 ^{+1ct}	N/A	N/A
5	D5 ^{+2ct}	N/A	N/A
6	E5 ^{+2ct}	N/A	N/A
7	F#5 ^{-7ct}	N/A	N/A
8	G5 ^{+1ct}	N/A	N/A
9	A5 ^{+35ct}	N/A	N/A
10	G5 ^{+1ct}	G5 ^{0ct}	1ct
11	A5 ^{+2ct}	A5 ^{-19ct} / A5 ^{-1ct} / A ^{-3ct}	21ct / 3ct / 5ct
12	B5 ^{0ct}	B5 ^{-2ct}	2ct
13	C6 ^{+3ct}	C6 ^{+4ct}	-1ct
14	D6 ^{+1ct}	D6 ^{-1ct}	2ct
15	E6 ^{+2ct}	E6 ^{-1ct}	3ct
16	F#6 ^{+4ct}	F#6 ^{0ct}	4ct
17	G6 ^{+9ct}	G6 ^{-3ct}	12ct
18	A6 ^{+34ct}	A6 ^{+39ct}	-5ct
19	Bb4 ^{+19ct}	N/A	N/A
20	C5 ^{-27ct}	N/A	N/A
21	C#5 ^{-10ct}	N/A	N/A
22	D5 ^{+34ct}	N/A	N/A
23	E5 ^{-1ct}	N/A	N/A
24	F#5 ^{-35ct}	N/A	N/A
25	Ab ^{-3ct}	N/A	N/A
26	C5 ^{-33ct}	N/A	N/A
27	C5 ^{+12ct}	N/A	N/A
28	C#5 ^{-45ct}	N/A	N/A
29	D5 ^{-26ct}	N/A	N/A
30	D#5 ^{+19ct}	N/A	N/A
31	F5 ^{+20ct}	N/A	N/A
32	F#5 ^{-6ct}	N/A	N/A
33	F5 ^{-23ct}	N/A	N/A

34	F5 ^{+16ct}	N/A	N/A
35	F5 ^{+37ct}	N/A	N/A
36	F#5 ^{+4ct}	N/A	N/A
37	A#5 ^{+11ct}	N/A	N/A
38	B5 ^{-38ct}	N/A	N/A
39	D#6 ^{-42ct}	N/A	N/A
40	E6 ^{-34ct}	N/A	N/A
41	G#6 ^{-43ct}	N/A	N/A
42	C7 ^{-35ct}	N/A	N/A

Table 4. 3: Relative pitches of both the original and replica CG 69819, including the difference in cents, arrived at by subtracting 1ct. ⁹

4.2 Replica *Nay* CG 69819 Egyptian commas and number of semitones

Gadalla mentions that:

[t] he Ancient Egyptians expressed their knowledge of all subjects in a story-form fashion—as noted by all early Greek and Roman historians. The story of Isis and Osiris was the Egyptian model, used to explain all facets of knowledge. ... For the Egyptians, Isis and Osiris regulated the music of the spheres. The universal harmonies are played out between these two primal male and female universal symbols of Isis and Osiris, whose heavenly marriage produced the son, Horus (2017a, pp. 43, 44).

Gadalla explains ‘the numerical significance of the Egyptian triad Isis, Osiris, and Horus’ by Plutarch's writings in *Moralia VOL. V*, and how it is connected to the musical ratio of 2:3 (2017a, p. 44). Gadalla stated that Plutarch mentioned the importance of the Fifth for the Egyptians in his *Moralia* as he said ‘And panta (all) is a derivative of pente (five), and they [the Egyptians] speak of counting as “numbering by fives”.’ (2017a, p. 45).

Then Gadalla mentions:

that after 53 natural Fifths, any new Fifth expediently coincides with a prior existing Fifth. The increment between the 53 natural Fifths was/is called a comma. Accordingly, the Egyptians defined the tone system, with reference to the Circle of Fifths, on the basis of the unit of measure known as the comma, by subdividing the octave into 53 equal steps. This comma has a value of 22.6415 cents. (A cent is a standard unit for measuring musical intervals. An octave is equal to 1200 cents.). (2017a, pp. 49, 50).

⁹ The replica’s note numbers relate to Video 4.2 and 4.3 in terms of the note recording order.

Gadalla finally stated that:

[t]he Egyptian system, since its earliest history, used the musical comma that is equivalent to 22.6415 cents and its one-third value of 7.55 cents, calling it buk el-nunu—meaning the baby’s mouth as reported by early Greek writers (2017a, p. 50).

In light of this, and when we know that the Pythagorean comma is the frequency ratio $(3/2)^{12}/2^7 = 3^{12}/2^{19} = 531441/524288 = 1.0136432647705078125$, the result is equivalent to 23.460010384649013 cents, which means the Egyptian comma's value (22.6415 cents) is very close to the Pythagorean comma.

By using the formula for converting the interval frequency ratio f_2/f_1 to cents (c or ϕ), we can obtain the interval in cents and determine how many Egyptian commas and semitones occur between specific notes.

$$\begin{aligned} \phi \text{ or } c &= 1200 \times \log_2 (f_2/f_1) \\ \log 2 &= 0.301029995 \end{aligned}$$

Table 4.4 and Figure 4.7 show the frequency difference in hertz, cents, Egyptian commas and number of semitones between the notes of the *nay* CG 69819 replica when arranged in a similar chromatic form order using the first octave as an example.

Interval between note numbers		Pitches		Hertz	Cents	Egyptian commas	Number of semitones
From	To	From	To				
2	19	A ₄ ^{+6ct}	B _{b4} ^{+20ct}	30	113.8	5	1.1
19	3	B _{b4} ^{+20ct}	B ₄ ^{+2ct}	22.9	82.1	3.6	0.8
3	4	B ₄ ^{+2ct}	C ₅ ^{+2ct}	29.4	100	4.4	1.0
4	21	C ₅ ^{+2ct}	C _{#5} ^{-11ct}	34	108.8	4.8	1.0
21	5	C _{#5} ^{-11ct}	D ₅ ^{+3ct}	30.5	92.1	4	0.8
5	30	D ₅ ^{+3ct}	D _{#5} ^{+20ct}	41.1	116.9	5.1	1.1
30	6	D _{#5} ^{+20ct}	E ₅ ^{+3ct}	30.9	82.9	3.6	0.8
6	31	E ₅ ^{+3ct}	F ₅ ^{+21ct}	46.6	118	5.2	1.1
31	32	F ₅ ^{+21ct}	F _{#5} ^{-5ct}	35.2	84.1	3.7	0.8
32	10	F _{#5} ^{-5ct}	G ₅ ^{+2ct}	42.7	96.8	4.2	0.9
10	25	G ₅ ^{+2ct}	A _{b5} ^{-2ct}	44.8	96.1	4.2	0.9
25	11	A _{b5} ^{-2ct}	A ₅ ^{+3ct}	51.9	105	4.6	1.0

Table 4. 4: The frequency difference in hertz, cents, value-determination of an interval and Egyptian commas with the number of semitones between the notes of the *nay* CG 69819 replica.¹⁰

Table 4.4 shows that although the numbers of semitones are not consistent, they are very close to each other, indicating that a music system may have been found in the ancient Egyptian period that included a kind of chromatic scale. However, we cannot extend this evidence to generalise about the music system used in the whole of the ancient Egyptian era.

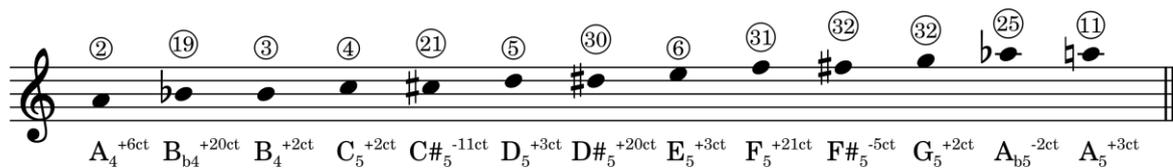


Figure 4. 7: The replica *nay* CG69819 produced a note sequence similar to the chromatic scale found in Western music.¹¹

¹⁰ The *nay* replica's note numbers relate to Video 4.2 and 4.3 in terms of the notes' recording order.

¹¹ The numbers inside the circles are the note numbers as given in Video 4.3.

4.3 Microtonal probabilities in the *Nay* CG 69819 replica

A known technique in playing the modern *nay* involves changing the angle of producing the sound to produce microtones, as shown in Figure 4.8 (Gadalla, 2018, p. 48; Effat, 2005, p. 12; Mashaal, 1984, p. 16). By applying this technique to the replica *nay* CG 69819, some microtones could be produced, and quarter-tone intervals can be created, as explained in Video 4.4.

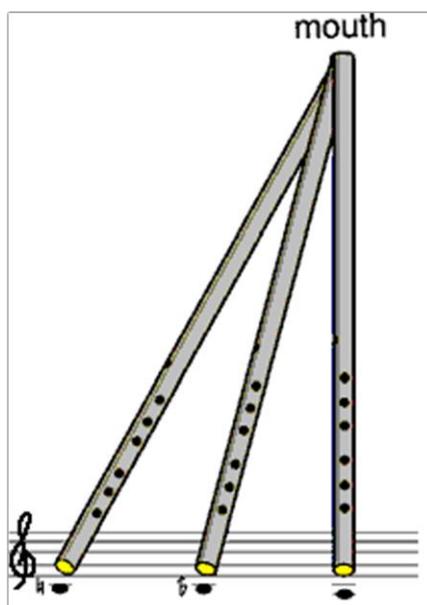


Figure 4. 8: Changing the *nay* angle can produce microtones (Gadalla 2018, p. 48).

Table 4.5 and Video 4.4 show an example of an available microtone after applying the angle technique to the CG 69819 replica.

Note number	Natural		Microtones	
	Hertz	Pitch	Hertz	Pitch
3	494.4	B ₄ ^{+2ct}	480.6	B ₄ ^{-47ct}

Table 4. 5: An example of a microtone note after applying the angle technique to replica *nay* CG 69819.¹²

¹² The replica note number relates to Video 4.3 in terms of the notes' recording order.



Video 4. 4: The *nay* angle technique showing an example of producing a microtone from the replica CG69819 by creating a three-quarter tone interval.

4.4 Probable scales for the *Nay* CG 69819 replica

Since the 18th century, Western music has used a standard tuning system known as twelve-tone equal temperament, or 12-TET. Ratios of 12-tone equal temperament (TET) notes are shown in Table 4.6, indicating the frequency ratio and its values in cents:

Interval	Frequency ratio	cents
Unison	1.000000 : 1	0
m 2nd	1.059463 : 1	100
M 2nd	1.122462 : 1	200
M 3rd	1.189207 : 1	300
M 3rd	1.259921 : 1	400
P 4th	1.334840 : 1	500
Aug 4th /Dim 5th	1.414214 : 1	600
P 5th	1.498307 : 1	700
m 6th	1.587401 : 1	800
M 6th	1.681793 : 1	900
m 7th	1.781797 : 1	1000
M 7th	1.887749 : 1	1100
Octave / P 8th	2.000000 : 1	1200

Table 4. 6: The division of the octave in 12-tone equal temperament.

Also, in relation to the previous analysis (shown in Tables 4.1, 4.2, 4.3 and 4.4), we can deduce some scales if we suppose some notes are root notes. Table 4.7 indicates the scale notes and degrees if we take note number 1 as a root note:

Scale degree	Note number	Pitches	Intervals from the root note
First	1	G ₄ ^{-1ct}	Unison
Second	2	A ₄ ^{+6ct}	M 2 nd ^{+6ct}
Third	3	B ₄ ^{+2ct}	M 3 rd ^{+2ct}
Fourth	4	C ₅ ^{+2ct}	P 4 th ^{+2ct}
Fifth	5	D ₅ ^{+3ct}	P 5 th ^{+3ct}
Sixth	6	E ₅ ^{+3ct}	m 6 th ^{+3ct}
Seventh	7	F# ₅ ^{-6ct}	M 7 th ^{-6ct}
Eighth	8	G ₅ ^{+2ct}	P 8 th ^{+2ct}

Table 4. 7: A scale example for the replica CG 69819 built from note number 1 when considered as a root note.¹³

The result obtained from Table 4.7 showed a scale rooted from note number 1 on the replica *nay* CG 69819, which is close to the diatonic Western G major scale in terms of 12-TET (as shown in Figure 4.9).

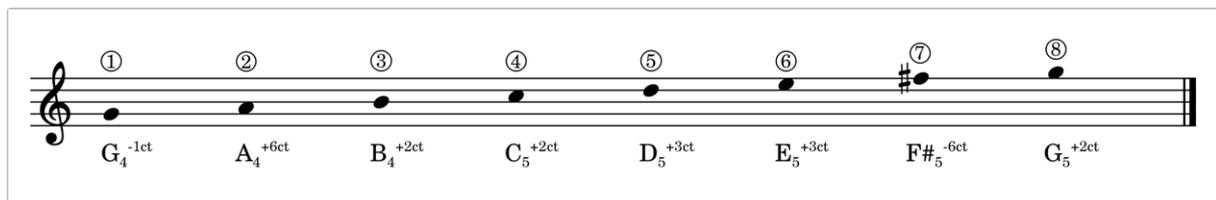


Figure 4. 9: A scale played on the replica CG 69819 from note number 1 close to a G major scale, showing the scale degrees including the names of the notes with their values in cents, together with the *nay* CG 69819 replica.¹⁴

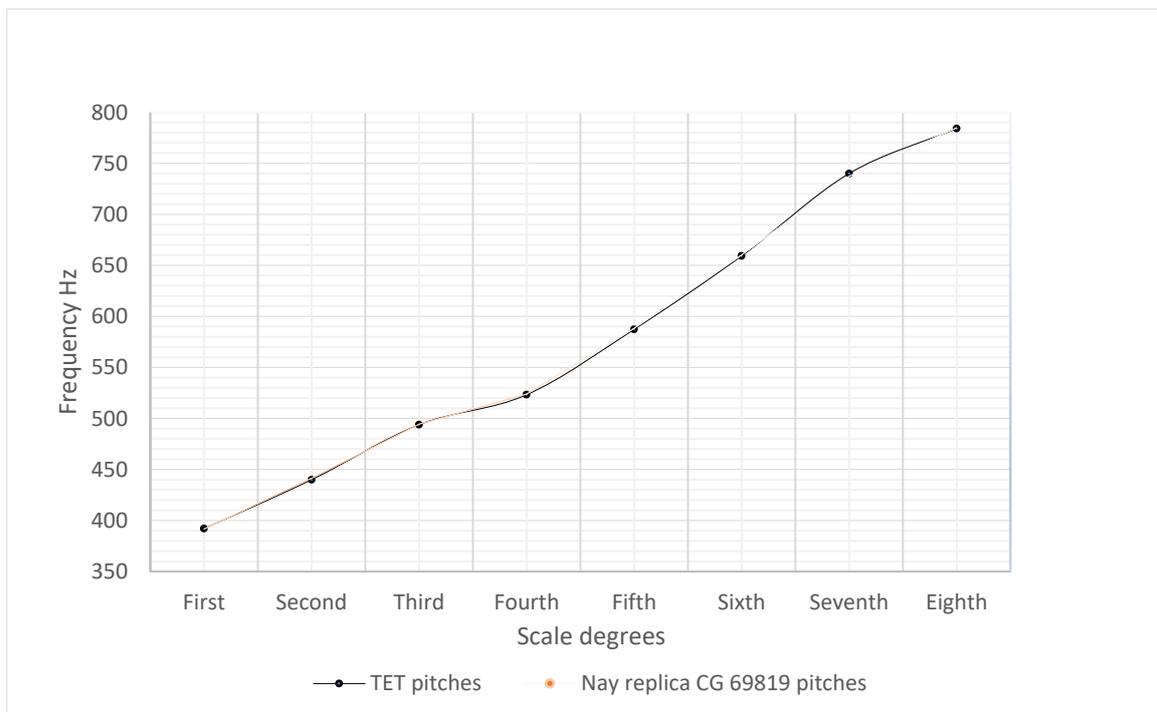
¹³ The CG 69819 replica note numbers relate to Video 4.3 in terms of the notes' recording order.

¹⁴ Note numbers inside the circles which are related to Video 4.1 in terms of the notes' recording order.

Table 4.8 and Graph 4.1 show the frequency values in Hz of a heptatonic scale of 12-TET pitches and the replica CG 69819 pitches' frequencies if note number 1 is taken as the root note, indicating how close their values are.

Scale degrees	12-TET pitches in Hz	Replica <i>nay</i> CG 69819 pitches in Hz
First	392	391.7
Second	440	441.5
Third	493.88	494.4
Fourth	523.25	523.8
Fifth	587.33	588.3
Sixth	659.25	660.3
Seventh	739.99	737.4
Eighth	783.99	784.8

Table 4. 8: Frequencies values in Hz of a heptatonic scale of 12-TET pitches and the replica CG 69819 pitches' frequencies if note number 1 is taken as the root note, indicating how close their values are.



Graph 4. 1: A heptatonic scale in 12-TET (black) and as played by the replica CG 69819 (orange) if note number 1 is taken as a root note.

Arabic music maqams mainly consist of two building blocks of four notes similar to the tetrachord function in Western music; these are called *ajnas* (the plural of *jins*, which means gender or genus in Arabic). That term gives these blocks of four notes, including their three intervals, the meaning of a specific mood and character for each one. If we suppose that there are *ajnas* A, B and C, there will be a probability to create a variety of maqams like AB, AC, BA, BC, CB, CA, etc. Applying this principle to the analysis of the replica *nay* CG 69819 creates various Arabic maqams.

For instance, Table 4.9 and Figure 4.10 show the same scale notes as Table 4.8 but applying the *nay* angle technique, which produces a microtone in the third note. This creates a maqam similar to the one related to the maqam *Rast* family called *Mahur* (as shown in Figure 4.10), which contains *jins Rast* on G as a primary *jins* and *jins Ajam* on D as a secondary *jins* (Farraj, 2001).

Scale degree	Note number	Pitches	Intervals from the root note
First	1	G4 ^{-1ct}	1
Second	2	A4 ^{+6ct}	M 2 nd +7ct
Third	3	B4 ^{-47ct}	M 3 rd -47ct
Fourth	4	C5 ^{+2ct}	P 4 th +3ct
Fifth	5	D5 ^{+3ct}	P 5 th +4ct
Sixth	6	E5 ^{+3ct}	m 6 th +4ct
Seventh	7	F#5 ^{-6ct}	M 7 th -5ct
Eighth	8	G5 ^{+2ct}	P 8 th +3ct

Table 4. 9: A maqam similar to *Mahur* (from the *Rast* family), if note number 1 in the replica CG 69819 is considered as a root note, including a third microtone note.¹⁵

¹⁵ The CG 69819 replica's note numbers relate to Video 4.3 in terms of the notes' recording order.

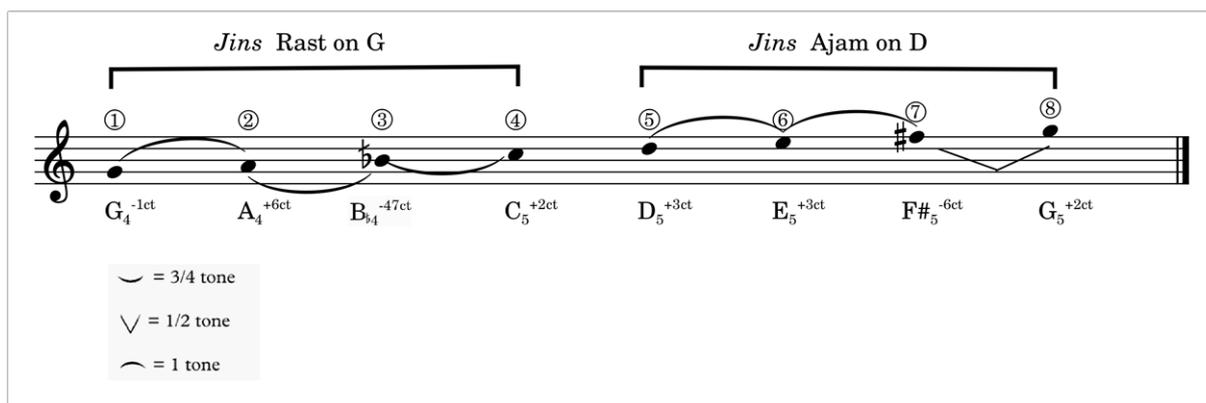


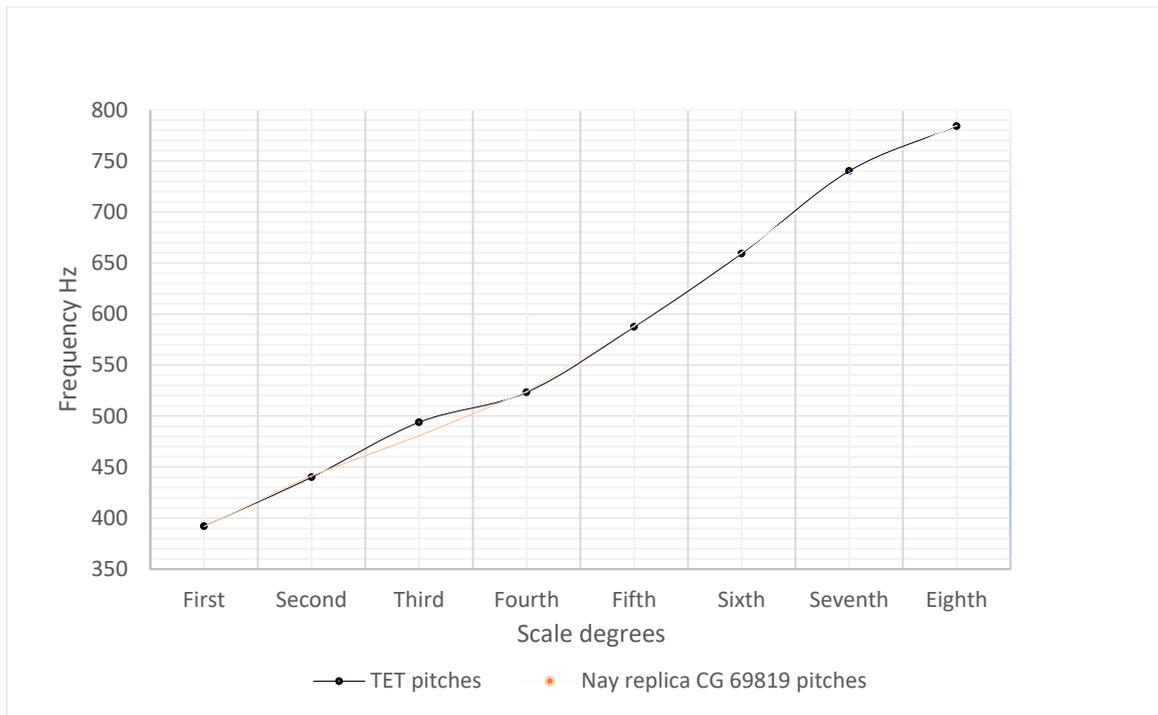
Figure 4. 10: A maqam similar to *Mahur* (from the *Rast* family), if note number 1 in the replica CG 69819 is considered as a root note, including a third microtone note.¹⁶

Table 4.10 and Graph 4.2 reveal the frequency values in Hz of a heptatonic scale of 12-TET pitches, and the replica CG 69819 pitches' frequencies, if note number 1 is taken as a root note, and the third is a microtone equal to 480.6 Hz, close to the microtone value of this pitch, which equals 479.8 Hz. This indicates how their values are close, except the third note which is closer to the microtone frequency value (-50ct from the TET value of this pitch).

Scale degrees	TET pitches in Hz	The replica <i>nay</i> CG 69819 pitches in Hz
First	392	391.7
Second	440	441.5
Third	493.88	480.6
Fourth	523.25	523.8
Fifth	587.33	588.3
Sixth	659.25	660.3
Seventh	739.99	737.4
Eighth	783.99	784.8

Table 4. 10: A heptatonic scale of 12-TET pitches and the replica CG 69819 pitches' frequencies in Hz.

¹⁶ The CG 69819 replica's note numbers inside the circles relate to Video 4.1 in terms of the notes' recording order.



Graph 4. 2: A heptatonic scale in 12-TET (black) and as played by the replica CG 69819 (orange) if note number 1 is taken as a root note and it seems the points are very close except the third note which is close to a microtone value which should equal -50ct.

Given the similar chromatic format shown in Table 4.4, it is not surprising to find this replica producing a heptatonic scale in different keys. The Egyptian group mentioned regarding their experiments with different original and replica *nays*, that the ancient Egyptian music system had both a pentatonic scale and a diatonic scale with seven notes; moreover, the two-scale types are similar to the Western major scale and also the Arabic maqams, including their various *ajnas* (Effat et al., 1996, p. 130).

4.5 The hypothesis of the origin of the Pythagorean scale with the Ancient Egyptians

The Egyptian group raised an important question in their study of the six ancient Egyptian *nays*, namely, ‘were the Greeks the first people to know the diatonic scale?’ (Effat et al., 1996, p. 121), mentioning that they considered the historical hypothesis that:

Pythagoras, the Greek mathematician to whom the modern Western musical scale is attributed, had lived in Egypt for 21 years and that the Greeks wrote a lot about the quality and perfection of the ancient Egyptian music (Effat et al., 1996, p. 121)

Additionally, Ferguson mentioned what Isocrates said about Pythagoras’s long visit to Egypt, noting that “Isocrates was intent on showing that the Greeks owed their learning to the Egyptians and had added very little ... ‘Pythagoras went to Egypt, and having become their Pupil’” (2008, p. 23).

Likewise, Gadalla mentioned that:

Plato, Aristotle, Plutarch, and other Greek notables were writing in their time about the poor status of music in their country. ... the celebrated Pythagorean centre was established by Pythagoras and his followers after he spent 20 years studying in Egypt in the 5th century BCE. ... their writings show extensive use of the Ancient Egyptian system that was handed down to them by Pythagoras. But because of a loss of principle, their writings are fragmented, erroneous, and confusing. (2017a, pp. 29–31)

This hypothesis, which many scholars have raised, creates an engaging scenario that may change our understanding of the origin of the Pythagorean tuning system, which it appears may have been inspired by ancient Egyptian ideas, so it is worth examining this system on an instrument related to the ancient Egyptian culture such as the replica *nay* CG 69819.

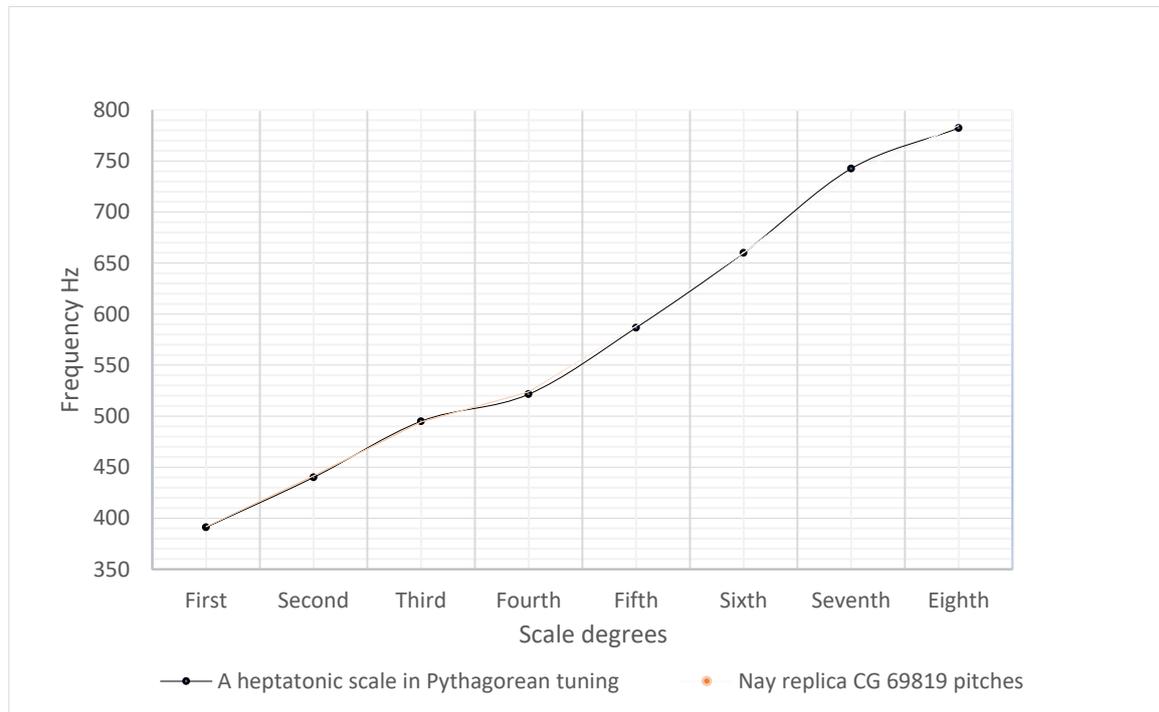
Table 4.11 presents a heptatonic scale on G4 (the major diatonic scale form) using the Pythagorean tuning with A4 = 440 Hz, compared with another scale rooted from note number 1 in the replica CG 69819.

Scale degree	A heptatonic scale in Pythagorean tuning			Scale rooted from note number 1 on the replica <i>nay</i> CG 69819			Differences	
	Pythagorean ratio	itches	Pythagorean tuning in Hz	The note number on the replica	itches	Frequency in Hz	in Hz	In cents
1	1:1	G4 ^{-3.9ct}	391.11	1	G4 ^{-1ct}	391.7	-0.59	-2.9
2	9:8	A4 ^{0ct}	440.0	2	A4 ^{+6ct}	441.5	-1.5	-6
3	81:64	B4 ^{+3.9ct}	495.00	3	B4 ^{+2ct}	494.4	0.6	1.9
4	4:3	C5 ^{-5.8ct}	521.48	4	C5 ^{+2ct}	523.8	-2.32	-7.8
5	3:2	D5 ^{-1.9ct}	586.66	5	D5 ^{+3ct}	588.3	-1.64	-4.9
6	27:16	E5 ^{+1.9ct}	660.0	6	E5 ^{+3ct}	660.3	-0.3	-1.1
7	16:9	F#5 ^{+5.8ct}	742.5	7	F#5 ^{-6ct}	737.4	5.1	+11.8
8	2:1	G5 ^{-3.9ct}	782.22	8	G5 ^{+2ct}	784.8	-2.58	-5.9

Table 4. 11: A comparison between a Pythagorean scale and a major heptatonic scale rooted from note number 1 in the replica *nay* CG 69819, showing the difference in Hertz and cents.¹⁷

¹⁷ The *nay* CG 69819 replica’s note numbers relate to video 4.1 in terms of the notes’ recording order.

Graph 4.3 outlines a heptatonic scale using the Pythagorean tuning and a heptatonic scale containing similar notes on the replica *nay* CG 69819.



Graph 4.3: A heptatonic scale using the Pythagorean tuning and a heptatonic scale containing similar notes on the replica *nay* CG 69819, indicating that their values are close.

4.6 Discussing the analytical findings of the replica *nay* CG 69819

The analytical results from the replica *nay* revealed frequency values close to the 12-TET pitches and the Pythagorean tuning system, which can create scale forms similar to the chromatic scale form, including intervals very close to the semitone. In addition, it is possible to recognise heptatonic scales similar to Western diatonic scales and also several Arabic maqams, including those with microtones, with a variety of related maqams containing various *ajnas*.

This is not a surprise because a number of scholars discuss the existence of the diatonic scale alongside the pentatonic scale in the ancient Egyptian music system. However, most sources do not provide quantitative numerical evidence. Previous research has not incorporated findings such as those regarding the *nay* CG 69819. For comparison, I have also produced an analytical study of the *nay* replica CG 69814. That is, I have compared it with the Pythagorean tuning, given that it is a reconstruction of an original instrument dated to the Middle Kingdom (2130–1649 BC) found in Beni Hassan by Garstang in 1904 (as shown in Table 3.2), with more secure dating and archaeological data than CG 69819.

Table 4.12 compares the frequency values between the replica CG 69814, Pythagorean tuning for the same notes and the difference between them in Hz; it is noted that the Major 3rd is flattened by 1.3 Egyptian commas as the third note differs on the replica CG 69814 and Pythagorean tuning.

<i>Nay</i> replica CG 69814			Pythagorean tuning	Difference in HZ
Note number	Notes	Pitches in Hz	Pitches in Hz	
1	E4 ^{+36 ct}	336.5	330.0	6.5
2	F#4 ^{+44 ct}	379.4	371.25	8.1
3	G#4 ^{+28 ct}	422	417.66	-29.66
4	A4 ^{+7 ct}	441.7	440.0	1.7
5	B4 ^{-17 ct}	488.9	495.0	-6.1
6	C#5 ^{+15 ct}	559.1	556.88	2.3
7	E5 ^{+63 ct}	683.6	673	10.6
8	F#5 ⁺²¹	748.9	758.8	-9.9
9	G#5 ⁺³⁷	848.5	844	4.5

Table 4. 12: Differences between frequencies of the replica *nay* CG 69814 and the Pythagorean tuning system.

The study of the replica CG 69819 discussed its originality, given that the original CG 69819 is located in the Egyptian Museum in a collection of 24 ancient Egyptian flutes, some of them dated as being thousands of years old. However, the original *nay* CG 69819 has an unknown date, so it is necessary to find conclusive evidence whether it is an original instrument related to the ancient Egyptian era or a more modern copy. It may require future investigations to date the instrument through its material (the bronze), or through its relationship to other tools and elements made of the same material at that time, and perhaps explore any cultural influences from people who invaded Egypt on the making or use of this instrument. In another hypothesis, by comparing the original *nay* with other *nays* that share a similar structural and material description, such as BM EA12742 (The British Museum, 2020a) and EA6385 (The British Museum, 2020b), and also by consulting the Catalogue of Egyptian Antiquities in the British Museum (Anderson, 1976), it might be concluded that CG 69819 is, alternatively, a Ptolemaic or an Early-Coptic artefact.

Chapter 5 Comparison of the replica *nay* results and the modern Arabic *nay* and their probable influence on Coptic music

5.1 Introduction

In this chapter, I will introduce the Arabic Egyptian *nay*, a comparatively modern instrument that developed from the ancient Egyptian *nay*, which: ‘with its characteristic quality, still exists today all over the Islamic world. It is best known under its Persian name *nay*, which has replaced the Arabic name *qasaba* or *qassaba*’ (Sachs, 2012, p. 105). *Qasaba* or *qasaba* is the popular Egyptian Arabic word of the bamboo wood grown on the Nile bank, used to make the *nay*. Consequently, if we use the *nay* as a guidance tool, as an instrument known in ancient Egyptian time and changed to its present status, it can give us some knowledge of how ancient Egyptian music has been converted to Arabic music in modern times. Accordingly, this could tell us the impact on Coptic music by both ancient Egyptian and Arabic cultures, as it sits between them chronologically. Moreover, the *nay* has been used by the Copts in their meetings, called ‘Aghabi’, until 190 AD; it was then replaced by St Clement of Alexandria with the cymbalon (Kyrillos, 2002, p. 130), which is still used alongside the triangle (or the ‘trianto’ as the Copts call it) in the Coptic liturgy.

5.1.1 Impact aspects of ancient Egypt on Coptic music

Hickmann’s study (1958) explored representations of chironomy on ancient Egyptian iconographic monuments and depictions of musical scenes that interpreted the chironomists gesture-expressions to decipher some of the ancient Egyptian music practice and particularly the use of the voice and singing (Hickmann, 1958, p. 97). Usually, the chironomists were singers too, so Hickmann connected this analysis to modern Coptic chanting by illustrating his research with some photos of the known Coptic cantor Mikhail Girgis Al-Batanouni (who is mentioned in Chapter 2 in this research). This gives some indication that Coptic chanting, even in its modern form, is an extension to ancient Egyptian singing, as there is some correlation between them. Figure 5.1 shows some photos from Hickmann’s study, illustrating different hand gestures and fingers signs and demonstrating the links he made between ancient Egyptian chironomists and the modern Coptic cantor M.

Al-Batanouni. Gillespie (1971) confirms this conclusion regarding the similarity between ancient Egyptian vocal practice and Coptic chanting, discussing ‘a relief on the tomb of Nenchefka (2077 BC) at Sakkara ... I personally have seen the choirmaster at the Institute of Coptic Studies in Cairo use exactly these same movements: slapping one hand to his knee to maintain a rhythmic pulse, he extended the other hand in full view of the choir to indicate the general movement of the melodic line.’(Gillespie, 1971, p. 11).

On the other hand, according to Dominicus (1994, pp. 167–178), we should not rely on Hickmann’s study of the chironomy because she did not find supporting evidence for Hickmann’s theory so that it cannot yet be proven, and thus more comprehensive studies and a more sophisticated methodology are needed.



Figure 5. 1: Different images from Hickmann’s study about the Chironomy in ancient Egypt showing the similarity between the ancient Egyptian chironomists and Coptic chanting, showing the Coptic Cantor M. Al-Batanouni. (Hickmann, 1958, pp. 102, 103, 104, 105, 108, 109, 112, 114).

Gillespie (1971) also mentioned, '[t]he other strong likeness between Coptic chant and ancient Egyptian music originates in their striking custom of singing vocalises on vowel sounds' (Gillespie, 1971, p. 11). Melismatic singing is a common feature of many Coptic liturgical hymns. Gillespie linked the Coptic chanting melisma to the ancient Egyptians through the work of many scholars and historians, including a crucial first-century treatise about the ancient Egyptian priests:

[a]-treatise formerly attributed to Demetrius of Phalerum ... said that "In Egypt the priests hymn the gods through the seven sounds (vowels) in direct succession." ... The same practice is mentioned in Gnostic writings, and Egon Wellesz noted that "from Oriental mystery rites it is known that single vowels or groups of vowels were uttered by the initiate to intensify the effect of the incantation." ... In a hymn to the god Min, Hans Hickmann discovered a repeated sign that to him suggested a rhythmical repetition of a syllabic interjection. Armand Machabey in an interesting study listed the melisma as one of the two most significant elements of *bel canto*, supporting his theory with paintings found on a tomb at Beni-Hassan (Middle Empire), where signs designating ha, ha, ha, ha and i, i, i, i placed beside the singers seem to indicate vocalises. ... A hymn may take fifteen minutes to sing yet have only one or two words. (1971, pp. 11, 12, 15)

Some Coptic tunes in the Coptic liturgy hymns repertoire are to be sung on specific occasions related to the ecclesiastical seasons of the Coptic calendar. Some of them express a sad occasion such as the Holy week and the Good Friday, and others are for joyful occasions, for instance, the Resurrection Coptic feast followed by the Holy Fifty Days feast. Some of these tunes are related to the names of particular ancient Egyptian towns such as the sad Coptic tune style, called Edriby, named after Edribah or Adreba, a city in Upper Egypt whose ancient temple was changed to a Coptic church by Abba Shenouda (Shenoute) archimandrite (348 – 466 AD). (Moftah, 1958). A further example of this is the joyful Coptic tune style called the Singari tune, which refers to a city on the Nile delta in Egypt, founded during Pharaoh Ramses II's reign (1303 - 1213 BC) (Moftah, 1958).

Moftah (1958) stated that: 'Egyptians usually preferred to use blind singers. There were many, and the Coptic Church still chooses its cantors among blinds. But we should take care and choose only the talented ones'. So, until this day, there are many Coptic cantors, especially the chanting leaders (known as *المعلم* 'Alm'allim'), who are blind.

Atiya & Adams (1991) mentioned that ancient Egyptian music continued to be performed during the first century (after St Mark converted Egypt to Christianity) giving the example of two ancient Egyptian musicians converted to Christianity; 'Hourdsha, a harpist, and 'Ankhep, a temple musician and cymbal player ... are two professionals whose names indicate their Egyptian roots' (Atiya & Adams, 1991, p. 1732).

They also mentioned a connection between one early Coptic hymn and an ancient Egyptian one: 'Hickmann proposed a connection between the Kyrie and the ancient Egyptian rites of the sun-god' (Atiya & Adams, 1991, p. 1732). Furthermore, they indicated 'In the Songs of Isis and Nephthys (Middle Kingdom texts, trans. both Faulkner and Schou), evidence exists of antiphonal singing, which still remains today as a basic feature of Coptic music' (Atiya & Adams, 1991, p. 1732).

Many scholars (Erian, 2017; Gillespie, 1971; Kyrillos, 2001, 2002, 2013; Moftah, 1958) consider the continuation of some ancient Egyptian customs and traditions through the period of the early Copts until the present day in Egypt, including the continuation of use of their music too, either specific hymns or musical themes. These scholars also mention that the Copts are 'ultraconservative in art and religion', so they are known to have preserved many traditions till the present day. For example, burial rituals, customs of grief for the dead, the making of pavilions and banquets for funerals, and the remembrance at the fortieth day. It is also true that the Coptic Calendar is based on the ancient Egyptian calendar and is used to the present day. Several feasts exist for varying occasions, the most notable is a celebration every month on the 12th for *Hapi*, the god of the Nile, which the Copts replaced with a celebration of the commemoration of Archangel Michael on the same 12th day of every month of the Coptic calendar. Moreover, the Coptic Easter Monday (known as *βωμ ἡνιχιω*- *Shom Ennessim* in Coptic then changed to be *شم النسيم* - *Sham Ennessim* in Arabic) was an ancient Egyptian national festival celebrating the beginning of spring, replaced by the Copts to be the next day of the Coptic Resurrection feast. As a further example of this preservation of traditions, the Copts use ancient Egyptian expressions and words regularly which do not exist in the Arabic language. (Cairo Scene staff writer, 2014)

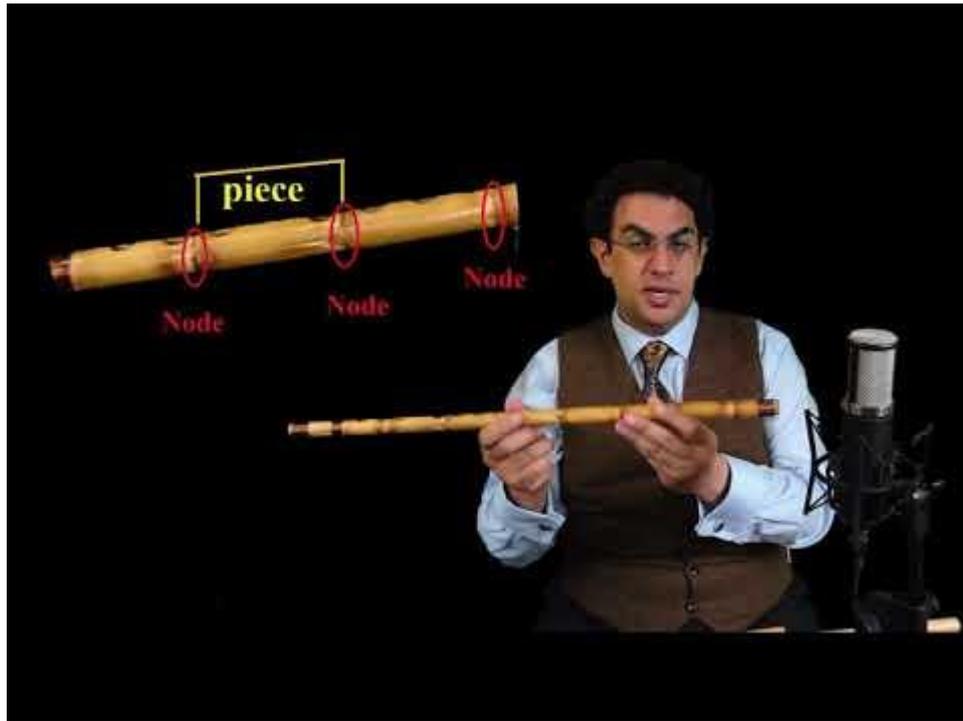
5.1.2 Influences of Arabic Egypt on Coptic music

Since the 7th century when the Arabs conquered Egypt, they have tried to Arabise the Egyptian identity, including the Coptic one. They have done this through such practices as the prohibition of the Coptic language, first replacing it with the Arabic language in all government departments in 709 AD, a few years after their entrance to Egypt, then in 799 AD Al-Hakem Be-Amrillah made use of the Coptic language illegal at any place, home or street. However, the Copts kept it in their prayers and hymns in churches and homes, but this practice was constantly threatened. Consequently, Coptic music is a hybrid because its main lyrics and text are largely in Coptic but the Arabisation of the hymns influenced the music itself. One example, a liturgical hymn $\Theta\text{ΙΤΕΝ ΝΙΠΡΕΣΒΙΑ}$ ‘*Hiten Epresveya*’ has been completely changed, with its Coptic lyrics replaced with Arabic (Kyrillos, 2001, pp. 64, 65). This link <https://youtu.be/FTjYuL4C8EI> shows the original Coptic version of this hymn, while this link <https://youtu.be/ASMdXuNLVD4> shows the Arabic version to demonstrate the changing of the melody of this hymn after replacing its Coptic text with Arabic.

Another noteworthy influence on Coptic music is the Arabic maqam tradition. Its history poses significant queries, such as what was the Coptic music performance before the arrival of the Arabs and their culture, including their music, into Egypt? Moreover, why does Coptic performance nowadays clearly sound Arabic? This is something that appears in the notation and analysis as well as chanting. One answer could be to compare ancient Egyptian replica and Arabic *nays*, and the performance of the $\Sigma\text{ΟΛΥΘΘΑ}$ ‘*Golgotha*’ hymn, as an example of a probable Coptic hymn derived from the ancient Egyptian era; this what is explored in the following section.

5.2 The modern Arabic *nay* and the Ancient Egyptian *nay* replicas

Studying the ancient Egyptian *nay* replicas and the modern Arabic *nays* reveals the probable influences of their music systems on Coptic music. I discuss in Video 5.1 the modern Arabic *nay* and the ancient Egyptian *nay* replicas, showing some similarities and differences between them. See video 5.1.



Video 5. 1: Salama shows a comparison between the ancient Egyptian *nay* replicas and the modern Arabic Egyptian *nay*.

5.3 Performance of the Coptic hymn $\Sigma\omicron\lambda\sigma\omicron\theta\alpha$ ‘*Golgotha*’ on ancient Egyptian *nay* replicas and the Arabic *nay*

The hymn $\Sigma\omicron\lambda\sigma\omicron\theta\alpha$ ‘*Golgotha*’, is one of the Coptic hymns. Moftah (1994), Kyrillos (2001, 2002) and Erian (2017) suggest that this hymn derived from the ancient Egyptian era, relying for their sources on first-century historians like Philo (also known as Philon), the Alexandrian Jewish historian who lived at the same time of Jesus’ apostles. Philo discusses the early Christians in Egypt (the Copts), describing the ‘Therapeutae’ (physicians of the soul and body) (Erian, 1986, p. 102) ‘that they took some melodies from the ancient Egyptians and added Christian texts, one of these tunes is the Golgotha hymn, which was sung by the ancient Egyptians during the mummification process and at funerals’ (Moftah, 1994, p. 97) (Kyrillos, 2002, p.159). Knowledge of Philo’s statement is widespread among the Copts; they adopted Philo’s testimony, which was later mentioned by Eusebius of Caesarea (Meskin, 1979) in his works on Coptic church history (Maier, 1999). He explained Philo’s references to the early Christians in Egypt in his work *De vita contemplativa*, 80 (Taylor & Hay, 2020).

The performance practice of the hymn $\Sigma\omicron\lambda\sigma\omicron\theta\alpha$ ‘*Golgotha*’ in the Coptic Church, supports Philo’s statement, because the hymn is sung at the 12th hour of the Coptic ritual of Good Friday.

At the end of this hour is the remembrance of Jesus' burial after his crucifixion and death. At this time, the archpriest, the priests and the deacons, stand around the altar and chant **Σολσοθα** 'Golgotha' hymn. After a procession of a Burial Icon, wrapped in a white linen veil, they bury this icon amidst roses, before covering it. Figure 5.2 shows TV footages of the Burial Ritual of the Crucifixion Icon by the archpriest, while chanting **Σολσοθα** 'Golgotha'. This practice is similar to the ancient Egyptian process of embalming, part of their funeral rituals. The ancient Egyptians developed elaborate funeral practices as they believed it was necessary for immortality. These included mummifying the body and interring it with specific grave goods, which they believed would be needed in the afterlife. Although not certain, it seems that Christians may well have adopted an Egyptian piece of music relating to mummification and eternal life, for use in a Christian context relating to Jesus' entombment, and resurrection.



Figure 5. 2: Footage from a Coptic TV Channel showing the Burial Ritual of the Crossefaction Icon by archpriest his Holiness Pope Tawadros II Patriarch of the See of Saint Mark the Evangelist of the Coptic Orthodox Church of Alexandria; while chanting the hymn $\Sigma\lambda\gamma\omicron\theta\alpha$ 'Golgotha'.¹⁸

¹⁸ The sentence written in Arabic in the bottom of the screen is 'The Burial Ritual Of The Good Friday.'

The hymn includes two main musical sections expressing contradicting emotions, sadness and joy. This is a similar concept for both the ancient Egyptians and the Copts, as each in his particular funeral event is sad because of the death of his king while, at the same time, having a joyful hope because of the expected new life of this dead person. This hope was the main reason for the embalming process because the belief in an afterlife incorporates the notions of resurrection and immortality, which is also a fundamental Christian dogma.

In Video 5.2, I explore the two ways of performing the hymn $\Sigma\omicron\lambda\gamma\omicron\theta\omicron\alpha$ ‘*Golgotha*’ in the Coptic Church, performing parts of its two sections.



Video 5. 2: Salama explores the two ways of performing the hymn $\Sigma\omicron\lambda\gamma\omicron\theta\omicron\alpha$ ‘*Golgotha*’ in the Coptic Church.

Video 5.3 presents the two music systems which are mentioned in this research as thought to have influenced Coptic music, that is ancient Egyptian music and Arabic music, played on the *nays* used in this research.

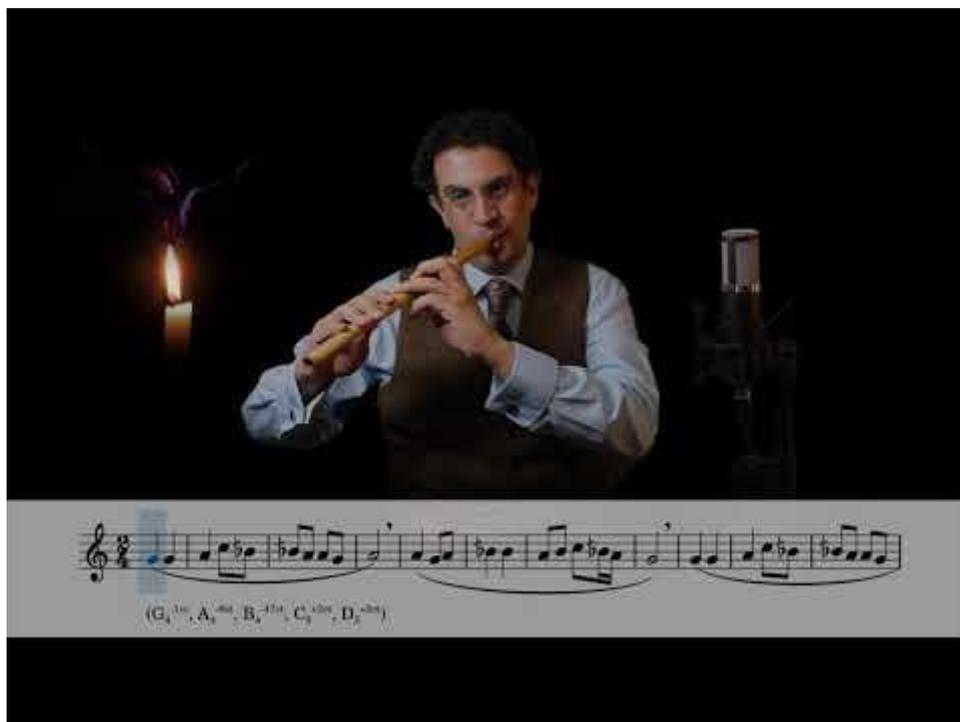
The performance by Salama of the Coptic hymn $\Sigma\omicron\lambda\gamma\omicron\theta\omicron\alpha$ ‘*Golgotha*’ includes four performances. Firstly, a performance on the ancient Egyptian *nay* replica CG 69814; in a maqam similar to maqam Ajm on Bosalik (E) in Arabic music, which at the same time, is

similar to the E major scale in Western music but closer to Pythagorean tuning and sounds to our modern ear like equal temperament (as shown before in Table 4.12).

Secondly, a performance on the ancient Egyptian *nay* replica CG 69819; in a maqam similar to maqam Ajam on Nawa (G), which is similar also to the G major scale in Western music, and close to 12-TET frequencies (as shown before in Figure 4.9, Table 4.8, and Graph 4.1).

Thirdly, a performance on the ancient Egyptian *nay* replica CG 69819; in a maqam similar to maqam Rast on Nawa (G) with a flattened third note ($B_4^{-47\text{ct}}$) after applying the *nay* angle technique and change the *nay* position to produce a quarter-tone interval between the second note and the third on the scale (as explained before in Video 4.4, Table 4.5, and Graph 4.2). That is more Arabic influenced and compares closely to the sound of playing on a modern Arabic Egyptian *nay* as in the next performance.

Fourthly, a performance on a modern Arabic Egyptian *nay* Doukah (D); in maqam Rast on Rast (c), this *nay* has a quartile tuned including a flattened third note ($E_5^{-50\text{ct}}$).



Video 5. 3: Salama performs the Coptic hymn **Γολγοθα** ‘*Golgotha*’ on the ancient Egyptian *nay* replicas CG69814, CG 69819, and on a modern Arabic Egyptian *nay* Doukah (D).

Chapter 6 Conclusion

In this thesis, I have investigated the relationships between Coptic music and its neighbouring cultures in Egypt, namely the ancient Egyptian and Arabic cultures. Chapter 1 outlined the research questions and methodology of this study.

Chapter 2 argued that literature on ancient Egyptian, Coptic and Arabic music showed how Coptic music emerged from ancient Egyptian music; the key is simply history, how the Copts as the descendants of the ancient Egyptians inherited their culture, from an anthropological, ethnological, philological point of view. Accordingly, the Copts inherited ancient Egyptian music.

Chapters 3 and 4 introduced an investigation of a *nay* replica and analyses of its frequencies, including the scales that can be produced from it. This answered another question of this study, verifying the authenticity of the model ancient Egyptian *nay* thence trusting a replica of this original, and allowing its use to analyse results for research purposes. This enables one to use the instrument to test the hypothesis in the literature related to the ancient Egyptian music system in a practical way. The research in Chapters 3 and 4 showed how the analysis of the replica *nay* could guide a future investigation of the potential origin of the Pythagorean tuning system from the music of the ancient Egyptians.

The results in this research suggest that 12-TET and Pythagorean tuning systems are based on, or at least inspired by, ancient Egyptian music.

In Chapter 5, I showed the relationship between Coptic music and both Arabic and ancient Egyptian music through a comparison of their *nays* and in a performance of the Coptic hymn **Σολζοθα** *Golgotha* whilst exploring traditional and musical theorisation between the ancient Egyptians and Copts, and the relationships that exist in the chanting of this hymn. That showed how intonation could guide one to find the relationships and influences between the three music systems involved, and consequently to answer one of the research questions about how much of Coptic music emerged from the previous one to it chronologically, ancient Egyptian music, and later Arabic music. The research into the **Σολζοθα** *Golgotha* hymn illustrated the influences on Coptic music from both the ancient Egyptian and Arabic. Of course, one hymn cannot answer for the whole Coptic music repertoire, however, it was possible to explore some clear indications of the impact of successive civilisations on each other, bearing in mind other

probable influences on Coptic music that could occur because of the invasions by many people of different cultures into Egypt through history.

Analysis of the ancient Egyptian *nay* replicas, comparison with the modern Arabic Egyptian *nay*, and applying both to performance of the **Σολζοθα** *Golgotha* hymn; emphasized the possible triple connection between ancient Egyptian, Coptic and Arabic music. Moreover, it shows how the Copts were influenced by both cultures found in their land, and crystallizes the impact that human civilisations have on each other. Nevertheless, it remains unclear in what stages Coptic music predates the Coptic civilisation. Moreover, it is unknown how much of the Coptic hymn repertoire goes back to the ages before the first century AD when Christianity was founded in Egypt. May more studies be required to uncover some details of specific hymns that are believed to belong to the pre-Coptic civilisations.

This research also shows how, more generally, civilisations are influenced by historical and political events and these anthropological changes, resulting from various peoples and their cultures, which contribute to changes in musical history through time.

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