The Perception of Melodic Closure

A study of the factors influencing
final note choice to achieve
melodic closure.

A thesis presented in partial fulfilment
of the requirements for the degree
of Master of Arts in
Applied Psychology at Massey University

Bryce Andrew Mills

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TABLE OF CONTENTS

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ABSTRACT

This study investigates the notion of closure put forward by gestalt theorists in reference to visual perception but applies it to aural perception of simple melodies. Specifically the study focusses on the final note chosen to effect melodic closure. It addresses the question of the selection of the final note and attempts to ascertain what major factors influence its selection.

To achieve this, three basic groups of subjects were tested; (1) children, - two groups of 20 males and 20 females, one group 10 years old and the other 12 years old (2) 20 male and 20 female young adults, 18 - 20 years, and (3) 10 performing musicians with an expressed preference for traditional western classical music and 10 performing musicians with an expressed preference for jazz and non-conventional music. From the first two groups a random sample of 5 males and 5 females was extracted for alternative treatment and the application of the Witkin Embedded Figures test.

The first two groups were presented with a recording of four simple melodies each played seven times providing a different final note. Twenty-eight items were therefore provided and subjects were required to indicate whether or not they felt satisfied with the melody as a completed entity.

The group of trained musicians were given in conventional notation the first 1¼ bars of a simple melody and asked to complete it exercising their own choice as to contour and the instrument used.

The random sample extracted from groups 1 and 2 were taught a simple unfinished melody on a metalophone and asked to provide two notes to complete it. They were also tested on the Witkin Embedded Figures Test to ascertain whether cognitive style was a relevant factor or not.

The results presented show that subjects do have clear preferences for melodic closure. The tonic of the perceived key is significantly chosen to effect closure but the degree of preference is tune specific and influenced by melodic contour.

The research also shows that closure choices are mediated by age, sex, and cognitive style, and the interaction of these factors.

Design A provides clear evidence of mediation of closure by melodic contour while Design B demonstrates that the interaction of sex and cognitive style is a significant factor influencing melodic closure.

A degree of conflict between results obtained in Design A and Design B suggests that the major factors influencing closure are tune specific.

Design C demonstrates that there is a difference in the way musicians of different "styles" affect melodic closure. However the difference was the reverse of that expected - "Jazz" musicians showed greater preference for tonic closure than did "Traditional" musicians.

This research demonstrates that people do have a definite preference to effect melodic closure with the tonic of the perceived key but this preference is not uniformly applied.

It is affected by tune specific factors, as well as the subject factors of age, sex, cognitive style, and the interaction of all four factors.

CHAPTER I

INTRODUCTION

This research arose out of the intergration of two different aspects of research in music. The first involved work on the dichotic processing of melodies put forward by Kallman & Corballis (1975) in which it was noted that unsophisticated musical listeners processed their music holistically in the right hemisphere, while sophisticated listeners processed their music analytically which is a left hemisphere mode. The second research emphasis that influenced this work was based on the notion of Gestalt psychologists and theorists who posit that people seek to complete their perception of visual stimuli (and possibly aural stimuli) in such a manner that it is simple unitary, and closed. The final factor influencing the present research was the personal observation during musical performances that a great majority of a musical audience seem unable to tolerate chordal accompaniments that do not resolve to the tonic. In one instance this was very evident when a song was left unresolved on a D sus 4 chord. The audience was "restless" but when resolution to D major was provided some 10 - 15 seconds later, the audience returned to their previous "settled" condition.

As a result of the interaction of these three inputs, the question was asked - What is the basis of this "restlessness" and what ending is necessary for people to feel satisfied with the melody? That resolution to the tonic was not the only possible conclusion was

suspected because numerous jazz musicians do not resolve their music to the tonic, either melodically or chordally. It appeared that the "musical rule" regarding resolution to the tonic did not necessarily satisfy all listeners, indeed some sought resolution to some other note.

Considerable work has been presented addressing the visual aspects of Gestalt theory (e.g. Kohler 1969) but there appears to be far less addressing the aural aspects. It was reasoned that if perception did follow Gestalt theory (Vurpillot 1976) then this should also be evident in aural perception, not just visual perception. To this extent then this present research does, to a degree, test Gestalt theory.

To achieve the aims of the research it was deemed necessary to work with three basic groups of subjects; children, young adults, and performing musicians. To study whether or not there is a developmental aspect involved the identity of each group was preserved, as was the expressed musical preferences of the performing musicians.

In terms of the above then, the experiment investigated the melodic perception of a sample of people covering a wide range of age, and musical experience, and attempted to discover whether people did effect melodic closure with a Gestalt type factor, and if so what this factor was, and what influenced its selection.

CHAPTER II

REVIEW OF THE LITERATURE ON CLOSURE AS APPLIED TO MUSIC

Perception involves the processing of very complex stimulus patterns. Because of the volume of incoming stimuli, some organisation of input is necessary to avoid the mammoth task of processing each and every stimulus, and dimension within each stimulus, if the processing was serial in nature. In recognition of the limited capacitie of a sensory register and in particular short term storage the establishment of some organisation would be necessary in order to sample more than just a minute section of the perceptual field. That we do not interact with the environment by processing individual inputs or sensations led to the development of the Gestalt principles of perceptual organisation by German psychologists such as Wertheimer, Koffka and Kohler.

Their approach is characterised by the basic tenet that "perception involves the organisation of sensory input into wholes or units rather than the processing of individual sensations" (Murch,1973,P131). The logic of this gestalt concept of perceptual organisation has been outlined by Wertheimer when he discusses a view out a window. He posits that we do not comment in the vein of - I see 327 different hues, but rather I see sky, trees hills etc. This organisation of the 327 hues (and shapes etc) into wholes such as trees, hills etc. is the basis of Gestalt organisation. (Murch Ed.1976)

Kohler (1969) interpretation would be that the whole scene is different from the simple sum of its parts. It is rather like the difference between an assembled jigsaw and a disassembled one. The parts have all the stimuli printed upon them but it is only when the parts are assembled and organised into a whole that the total scene is available for perceiving. There is nothing in the parts alone which allows for perception of the whole. The wholeness is as much a function of the interrelationships as it is of the separate sensory inputs.

In terms of musical stimuli this can be illustrated by consideration of three individual notes - G,B, and D. Together they form the chord of G Major. However there is nothing in any of the individual notes which would allow us to experience the quality of "majorness" in the chord. This chordal quality is unique to the interrelationships that exist when all three notes are played together. As such they form a new whole that no amount of knowledge about parts in isolation could allow us to perceive. The new whole is unique and different from the sum of its parts.

Wertheimer points out that some kind of spontaneous organisation seems to take place, which is very stable and relatively impervious to reorganisation. Koffka noted that, while agreeing with the above, several possible perceptual organisations were possible. From numerous experiments with the arrangement of sets of circles he concluded that the organised perception represented something more than the simple sum of the separate parts.

Koffka asked why does such organisation occur?

In answer to his own question, he observed that the relationship among stimulus elements are important only as proximal stimuli on which an organisational process is superimposed (Murch P132).

Let us now consider the stimulus variables according to Gestalt theorists, that give rise to perceptual organisation. The following variables which rely heavily on the work of Wolfgang Metzger (1966) should be considered as factors capable of contributing to a particular perceptual organisation. The term factor is preferred to the term law because Gestalt psychologists recognise only one "Law" - The Law of Pragnanz and this subject is beyond the scope of this study.

The following factors of perceptual organisation rely heavily on Gestalt psychologists from Metzger (1966) to present day adherents.

Factor of Similarity
Factor of Proximity
Factor of Common fate
Factor of Objective set
Factor of Inclusiveness
Factor of Good continuation
Factor of Closure
Factor of Fixation
Factor of Contour

Each of the factors will now be studied in terms of the primary purpose of this study, i.e. Audition and auditory perception particularly of music.

Factor of Similarity: Those elements presented in the perceptual field that display similar characteristics, will be seen as though grouped together.

In the aural field this factor can be seen clearly when listening to an orchestral recital. The comment, "listen to the strings" is perceptual grouping of instruments on the basis of similar timbre, despite the fact that it is unlikely that cellos, 1st and 2nd violins etc. will be playing the same melodic line. The similar factor in this case is timbre, but conversely if a group of instruments, of different timbre, were playing the same melody, they could also be perceived as a group.

An alternative illustration of this factor can be observed by lack of similarity. If an orchestra is playing a single melody line but one instrument is involved in variations upon this melody line, then it will be perceived because of its lack of similarity, i.e. Similarity observed by its absence or converse.

The case of aural ambiguity is another instance. Some people do not consciously hear cars going past on the road until one that is different passes. All the others were perceived as similar and this one, the one not running on all cylinders, stands out and is perceived as not being similar. This is also a question of "set" which is discussed later. It is also a function of figure/ground segregation. According to this factor, the unusual sound stands out as a separate figure on a common ground, because of its lack of similarity. Therefore, the factor of similarity operates not only by inclusion but also by

exclusion.

Factor of Proximity: Elements of the perceptual field located near one another will be perceived as a group. In the field of music, this can account for the phenomenon used by J.S. Bach to make one instrument sound like two, playing separate melodies. Warren and Obusek (1972) note that if the notes of one melody are alternated with another and the two melodies are separated sufficiently in pitch, then a listener does not perceive the temporal contiguity of successive notes. Instead the notes in each register are organised as separate sequences (or wholes), and he hears two melodies.

Dowling and Hollombe (1977) also found the above held true in the perception of melody. In their experiment, well known tunes such as "Yankee Doodle" were rearranged so that each note, while remaining an A or a D etc. was placed in a different octave than the previous note. When each note was separated by at least one octave, only 10% of the subjects recognised the tune whereas 88% had recognised it in its undistorted form. When two consecutive notes were kept in the original octave, and only the 3rd note displace recognition rose to 44%. Finally, when three consecutive notes were kept in the original octave, the recognition rate was 70%. Dowling and Hollombe concluded that wide pitch separation interfered with melodic perception and recognition because "The distortions of melodies in the present experiments violate the Gestalt principle of proximity in fugural organisation."

Proximity in music may also be viewed in terms of

temporal considerations and not just in terms of chromatic equivalence. Warren and Byrnes (1975) found that generally an interval of at least 200 m/s was necessary before a melodic sequence could be perceived as a sequence. They found that while notes occurring at intervals as low as 50 m/s could be detected as a "flutter" (occasionally used by Liszt and Ravel), metathesis occurs in musical patterns with such short intervals, with listeners unable to detect order. Warren (1974) had previously found that if temporal separation of notes was increased to beyond about 2 secs, perception of sequence was also difficult. He suggested that, in accordance with Gestalt factors, the time separation was such that notes were perceived as separate entities rather than belonging with its preceding or following notes. Since music, in part consists of the relationships between notes, clearly, modification of time (rhythm) and chromatic interval interfere with melodic perception.

It has been suggested by Warren and Obusek (1972) that perception of music is cultural in nature. Successive sounds of music are linked by complex sets of rules characteristic of the linguistic and musical communities of which the listener is a member. Within these auditory contigua it is suggested that the order of successive items is deduced from the identifiable configurations they form. An experiment by Warren and Byrnes (1975) lends further support to the notion of music perception being influenced by cultural factors. They found that perception of melody and sequence was inhibited when pitch separation was 0.3. semitones. This is a much smaller pitch separation

than is used in western music, but is fairly close to separations used in some eastern music. It would be interesting to discover whether people from say Iran, would have the same perceptual difficulties in this case as citizens of Western Societies.

This consideration of cultural factors suggests that perceptual set, which is partly culturally determined, may be a major factor in melodic and speech perception. This brings us to the next Gestalt factor. That of

Objective Set: Dowling and Hollombe (1977) noted that results obtained by Deutsch (1973) concerning exaggerated pitch separation, and mentioned previously, could be explained in terms of the subjects perceptual set. Van Noorden (1975) found that at slow presentation rates, the perceptual continuity of trills was markedly affected by set. Subjects with a set for hearing a continuous pattern heard that, with much wider intervals between notes than did subjects with a set for separation. At slow presentation rates, the listener can more easily impose a perceptual organisation of melodic continuity on a stimulus containing wide tonal skips. For example, the opening of Bach's "Mass in B Minor" moves slowly (2 notes/sec) and presents a series of pairs of notes progressively diverging in pitch. One usually listens with a set for hearing it as a continuous melody, but it is possible to alter set and perceive it as an alternation between diverging melodic lines.

Warren and Obusek (1972) note that if two melodies are played at one time it is difficult for most people to

perceive and accommodate both. Many can perceive one or other, or alternate between each, but few are able to perceive both as separate entities at the same time. Some, notably jazz and other "divergent" musicians are capable of this perception.

Factor of Common fate: In the field of auditory discrimination and music in particular this factor is essentially accounted for in terms of the factors of similarity and good continuation. Elements of the factor of closure and contour are also involved. Common fate refers to perception of a group on the basis of several items "doing the same thing". Wertheimer's example in the visual field involves the perception of 6 flies on the ceiling. If 3 are moving and 3 are still, the still and moving will be perceived as separate groups. Clearly this is very similar to the example used for the section on similarity, where mention is made of the string section of an orchestra.

Basic to Gestalt theory is the notion of the whole. The next two factors to be discussed inclusiveness and closure, relate strongly and directly to this aspect.

Bach's "Mass in B minor", mentioned earlier as an example of perceptual set, is also an example of inclusiveness. What notes or tones will a listener include in his perceived melody line. Clearly this is a function of set, but it is clearly also a function of the inclusive factor. If perceptual set is conventional, all notes in sequence will be perceived as belonging to one melodic line or effect, i.e. all notes are included in the one conceptualisation of the music. However, if a person's

perception set is such that notes are viewed as two contrasting and diverging sequences, then different notes are included in two sequences on the basis of tonic proximity.

The Factor of Closure is a major factor in perception of music. "Closure" has been interpreted by different authors in different ways (Vurpillot, 1977). Koffka, for example, used the term to refer to a "preferred Perception" but more latterly Bobbitt (1942) used the term in such a way as to include cognition. He saw it therefore as an organisation of perception. The latter tends to be the current use of the term and refers to the phenomenon of cognitively providing the "missing parts" to close the perception as an independent and complete entity, i.e. a whole.

Before looking at this aspect more formally, perhaps a practical example is in order as an illustration. Most western music ends on a home note, or chord, i.e. The tonic of the key in which the music is written. Recognising that this is probably culturally influenced, most people feel uncomfortable if a tune does not resolve to the home note. To leave a tune on a dominant 7th chord is frustrating to many listeners, because it does not give the resolution to the whole - the melody is not closed.

In support of the concept of closure, Warren and Obusek (1972) found that identification of words and syllables occurred much earlier than did identification of their constituent phoneme clusters or individual phonemes. From this sort of evidence it would appear that initial

identification of individual speech sounds, followed by their arrangement into syllables or words is not applicable to perception of speech. They go further and point out that "This evidence suggests to us that not only the perception of temporal order of phonemes in speech, but the very recognition of the presence of these sounds is an analytical process dependent upon prior identification of larger perceptual groupings". i.e. wholes.

Studies by Heise and Miller (1951) offer a very similar hypothesis as the above in the field of music perception. They found that if a tone in an extended sequence deviated by more than a "trill threshold", it no longer seems to be part of the closed series. It "pops out" as no longer belonging to the whole.

Warren and Obusek (1972) suggest that this inability to detect temporal order outside the coherent patterns of music may not correspond to a perceptual inadequacy, but may rather reflect mechanisms which, by excluding extraneous sounds, normally enhance the accuracy of pattern recognition within music. In other words perception of pattern tends to be a closed whole, and those perceived as not belonging to that closed whole, are rejected or not attended to.

Kallman and Corballis (1975) in their experiments on dichotic auditory perception, note that a right ear advantage for the processing of musical sequences is evident amongst sophisticated listeners, while unsophisticated listeners retained the usual left ear advantage. They interpret this as evidence that the sophisticated have the capacity to process the sounds analytically, which is a

left hemisphere mode, while the naive processed them holistically, a right hemisphere mode. This interpretation emphasises a point of major importance. Taken in conjunction with other experiments studying dichotic perception, it is noted that most subjects have a left ear advantage, but with experience this advantage is reduced and usually eliminated. This then suggests that initial processing is done in the right hemisphere (holistically) and analysis is later undertaken by the left hemisphere, i.e. analysis of music is a "learned perception". This therefore is in keeping with points made earlier about perception of patterns.

Moore (1977 P236), with reference to speech perception notes that speech is remarkably resistant to distortion. He notes that removal of all but a small part of the speech spectrum, or destruction of the time amplitude variations by peak clipping, does not destroy the intelligibility of speech. This technique destroys much of the individual phonemes but perception of the whole is assisted by the phenomenon of closure. The same is true of the amplitude modulation system used in N.Z.radio broadcasts. It could easily be accepted that this is a case of subjectively including the missing elements and frequencies to complete the whole.

Perceptual constancy (Moore P252) is another factor involved in the phenomenon of closure. This refers to the phenomenon of subjective inclusion of missing elements in accordance with previous knowledge. A person's voice can be altered quite markedly by differing acoustic effects

but still be recognised. Moore (ibid) suggests that this is very similar to the Gestalt principle of closure.

Another factor which may be included as an element of the phenomenon of closure, is the factor of good continuation. The example given earlier about leaving a chordal sequence unresolved is a violation of the factor of good continuation. Subjects desire to resolve the sequence suggests a perceptual preference for a closed whole.

Good continuation is rather similar in many ways to the factors of similarity, common fate, and inclusiveness. A prime example of these factors is "Hocus Pocus" by a rock group, Focus. In this, listeners are disturbed by the mixing of segments of basic heavy rock and yodelling of a Bachian type sequence. Personal experience of people's reactions to this piece suggest they find perception of this piece difficult because it is, either regarded as being <u>two</u> melodic pieces inappropriately mixed, or jarring because it does not conform to the expectancy of good continuation. In either case, clearly the total piece is not perceived as a unified whole but as two separate, and in some cases inappropriate, melodies. Memory of this piece is invariably confined to one sequence or an other, and only very rarely as a whole. Rhythm is another case of good continuation. In this case it is closely allied to expectancy. Dancers have trouble coping with and adjusting to changes in rhythm where the change amounts to more than a doubling or halving of the original pattern. Jazz musicians use the bending of rhythm as a technique of

improvisation, e.g. Brubeck often worked in 5/4 time. This is unconventional and where it occurs after a passage of, say, 4/4 time people's expectancy of good continuation is violated. As a consequence, many have difficulty perceiving the new temporal order as anything other than 'that funny part'.

One aspect of auditory perception not mentioned by Gestalt theorists is that discussed by Moore (1977) under the term "Precedence Principle". This principle refers to the phenomenon of the human auditory system accepting the first signal to reach the ear, and the listener being unaware of the reflected sound. This does not imply that we cannot detect reverberation or echo, but rather than in "normal" circumstances the first sound to reach our ears is the one attended to. Because of this factor we are able to locate accurately the source of sound, provided the reflections are not extreme.

Wallach, Newman and Rosenzweig (1949) researched this effect when S's were placed under headphones. Their results can be summarised as follows:

(1) When sounds (music) was presented to each ear with a delay of up to 40 ms fusion occurred and the two lines were perceived as one sequence.

(2) When the two sounds are fused, direction is determined largely by the location of the first sound.

(3) The second sound, or echo has a small but demonstrable effect. As the second sound departs more and more from the first, it

will pull the total sound up to a maximum amount of about seven degrees and then become progressively less effective.

(4) Fusion only occurs if the sounds are qualitatively similar.

The precedence effect is used effectively in modern stereo systems. However, this is precedence not in terms of temporal factors but rather in terms of intensities. If a listener sits equidistant from both speakers and the speakers are balanced, then a more intense output from one speaker will be perceived as coming from that speaker. Equal intensity will be perceived as being located between the two speakers. Stereo headphones demonstrate the same sound location phenomenon. When both speakers are balanced sound is perceived as "being in the centre of the head". The notion of a "stereo seat" is relatively close to the truth, because deviations of over about 60 cm from the central position causes significant changes in the stereo effect.

The major emphasis of Gestalt perceptual organisation is the concept of the whole. As mentioned earlier, Koffka noted that several perceptions (of the whole) were possible. It is reasonable to assume from this that there are several wholes capable of being perceived. i.e. There are wholes within wholes. There is in most sound sequences an heirarchical system of closed wholes. A piece of music usually has something equivalent to verse and chorus. In the light of the above, it is suggested that to perceive the chorus separate from the verse is not a violation of

holistic Gestalt principles. E.J. Gibson (in Vurpillot P189) posits that perceptual development takes place in terms of an increasing refinement of perceptual differentiation. The learner then, on the basis of this differentiated perception is able to progress to greater differentiation and respond in a different way to what was previously his normal response. Gibson's view then, tends to resemble an analytic view of perception and lends support to the work of Warren and Obusek (1972). It will be remembered that Warren and Obusek noted that perception of the whole was necessary before perception of the parts which is an analytic process dependent upon initial perception of the whole.

The above takes an analytic or reductionist view, but it is also possible for synthesis to occur. Therefore perceptual refinement may not be just a case of reducing the size of the whole but could also be a case of increasing the whole. Indeed it would be illogical to presume that perceptual refinement was a uni-directional reduction process.

What is being argued here then is that refinement of perception can, logically, be directed towards increasing <u>complexity</u> and not just increasing <u>simplicity</u> as Gibson's theory suggests. This sort of refinement does not conflict with the Gestalt principle of perception of the whole, because perception is still organised holistically, but the whole is becoming more complex and/or extensive.

It would appear then that perception of sound, and music in particular, does indeed follow Gestalt principles.

Eliane Vurpillot (1977) confirms this view when discussing perception in general. She notes that there are times when the principles of Gestalt are in conflict or do not appear to hold true, but these instances are few in comparison with the vast number of cases where the principles hold. Regarding the question of conflict, it seems more reasonable to accept the view that in each instance of auditory perception, there will be a heirarchical ordering of importance of the relevant Gestalt factors. It has been noted earlier that the factors of closure, good continuation, similarity, and inclusiveness, could each be used to explain a particular instance of auditory perception. This does not weaken the case for Gestalt factors but rather strengthens it, because the factors are frequently supportive of each other rather than in conflict.

The above cited research suggests that perception of music is primarily in terms of wholes, and that the perception of parts of a musical sequence is a secondary process. To perceive a musical sequence holistically requires what in essence amounts to perception of a beginning, a middle, and an end. The question addressed in the following research does not directly involve the beginning or the middle of a sequence, but rather the end of the sequence. The question addressed is - What form of ending do people feel is necessary to produce the closed perception referred to by Gestalt psychologists? - What pitch must the final note in a musical sequence have so that it effectively closes the sequence in such a way as to be subjectively satisfying to a listener?

CHAPTER III

THE AIM OF THE RESEARCH

The Gestalt notion of closure has been well researched in terms of visual perception. Kohler (1969) for example cites extensive research supporting the view that people have a perceptual tendency to prefer the simple and complete rather than the complex and open, or incomplete, even to the extent of perceptually providing the elements necessary to effect closure.

However, little research effort appears to have been directed at forms of perception other than visual perception. Kohler makes passing reference (P53,54) to melodies being perceived as extended wholes, in the same sense that sentences are. He also suggests that the Gestalt qualities which musicians call "major" and "minor" are characteristics of musical phrases rather than of individual tones. These wholes have in them a certain pitch, the tonic, which is heard as a kind of resting point in the melody.

Informal surveys of the "resting" qualities of the tonic have led to the tentative hypothesis that people do indeed use the tonic as a final resting point in a melody. (Mills 1978). Frequently people are left apprehensive, dissatisfied, and unfulfilled unless a melody resolves to the tonic. However, some musicians seem to enjoy concluding a musical sequence on some note (in the particular key) other than the tonic, and still feel quite satisfied that the sequence is complete.

The major thrust then of this research is to investigate whether people, in their auditory perception of music, apply a Gestalt type factor of closure, and if so, what precisely is added to affect this closure. Another aspect of the study will be to note any differences in closure in terms of cognitive style. To this end the field dependent/field independent style postulated by Witkin (1962) and associates has been selected. The field dependent/field independent dimension of cognitive style is well researched and instrumentation is well developed so for these reasons it was chosen ahead of other conceptualisations.

The rationale for including cognitive style as a factor worthy of consideration was developed from a synthesis of four main pieces of research.

(1) Differential processing of musical sequences according to musical experience and the cerebal hemisphere employed. (Kallman & Corballis 1975).

(2) Perception of music parallels visual perception. (Rider 1977).

(3) The view that analytic processing of stimuli is characteristic of field independent people, while global processing is characteristic of field dependent people. (Kogan - In Lesser 1971).

(4) The "clumping" or serialist processing proceedure researched by Pask & Scott. (Floyd 1976).

Three types of experimental design were used in the present study. For two of these (Design A & Design B) different response modes were provided to allow for greater freedom of response in Design B than in Design A. In Design A a choice was forced between only two possible responses - closed or not closed, and experimentation and exploration were not possible. However, Design B allowed for a much wider range of responses and also allowed for experimentation and exploration on the part of the subject to find the preferred closure option.

The third experimental design was a continuation of this policy of reducing restriction and increasing freedom of response.

The music was set in the key of G Major because of it being a very commonly used key. It was important that factors such as key etc. did not interfere with the major focus of the study.

While no research evidence regarding differential musical response according to age and sex was located, evidence exists that other "artistic responses" do vary according to the age and the sex of the subject. Because musical responses may be considered "artistic responses" it was felt that the differences referred to above could well be parallelled in musical responses.

Four tunes were offered in Design A and two in Design B to allow the possible influence of melodic contour to occur. Each tune has a different contour and as a consequence allowed subjects to respond to key or contour. If responses

differed according to tune it could reasonably be implied that responses were tune specific rather than just key specific. - i.e. the tonic.

In terms of the above then, the following hypotheses were tested.

Hypotheses.

1. Subjects will wish to effect closure with the tonic.
2. The response to tonic/non-tonic closure will be mediated by the age and the sex of the subjects.
3. Field dependent subjects will seek closure that is different from that sought by field independent subjects.
4. There will be a difference between "traditional" and "non traditional" musicians in the choice of notes to effect closure.

CHAPTER IV

DESIGN OF THE RESEARCH

The design of the experiments called for four groups of subjects to be tested to ascertain their preferences for completing musical pieces. Two groups of children were required and one group of young adults. These three groups were asked to respond to 28 tune patterns and record whether they considered the pattern complete or not (Design A). From each of these three groups a random sample of five males and five females was extracted and asked to indicate their preferred melodic closure by responding "in kind" on a metalophone. To study the effect of cognitive style on perceived melodic closure, the sample was also subjected to the Witkin Embedded Figures Test and the results of this compared to the chosen closure options (Design B). The final group consisted of 10 performing musicians with an expressed preference for traditional western classical music and 10 with an expressed preference for jazz music. This group was offered the first $1\frac{1}{4}$ bars of a simple melody and asked to complete it on an instrument of their choice (Design C).

The three designs incorporated in the research are:-

Design A.

Age (3 levels) x sex x tune (4 levels) x closure (2 levels).

Design B.

Age (3 levels) x sex x tune (2 levels) x field independent/field dependent (2 levels) x closure (2 levels).

Design C.

Group (2 levels) x closure (2 levels). These designs are summarised and presented below in Table 1.

Table 1.

The Three Experimental Designs Incorporated Within the Study.

Design A.

Age Group	Sex	Tune No.	Closure - Tonic/non-tonic.
	M	1	
		2	
10 yrs.		3	
		4	
	F	1	
		2	
		3	
		4	
	M	1	
		2	
12 yrs.		3	
		4	
		etc.	

Design B.

Age Group	Sex	Field dep/ind.	Tune	Closure
10 yrs.	M	D	1	
		I	1	
		D	2	
		I	2	
	F	D	1	
		I	2	
		etc.		

Design C.

	Tonic	Non-tonic
Traditional		
Non-traditional		

Subjects.

The four groups of subjects were:-

1. 20 male and 20 female 10 year olds. These were drawn from West End School in Palmerston North.

2. 20 male and 20 female 12 year olds. These were drawn from Palmerston North Intermediate Normal School. It should be noted that West End School is a contributing school to P.N. Intermediate Normal. Selection of these two schools was deliberate and intended to account for, as much as possible, differences in socio-economic background. Both schools have as very similar catchment areas and indeed a large proportion of the twelve year old children were former pupils of West End School.

3. 20 male and 20 female "young adults" 18yrs - 22yrs. These subjects were drawn from the music curriculum classes at P.N. Teachers College. As all the subjects were studying music as part of curriculum studies, none had chosen to study music as a major elective. They were therefore not a group displaying a particular interest in music education but rather reflected the general population of the Teachers College.

4. 20 performing musicians. 10 with an expressed preference for traditional western classical music, and 10 with an expressed preference for current jazz music. The second group was drawn from members of the P.N. Jazz Club.

5. From each of the first 3 groups of subjects a random sample of 5 males and 5 females was selected for testing of cognitive style on the Witkin Embedded Figures Test - the adult or children's form as appropriate. This representative sample was also required to complete the two tunes offered in experimental Design B. (Appendix 3).

Materials and Measuring Instruments.

Materials required were as follows:-

(1) Prerecorded tape of four musical statements. Each statement is presented seven times, each time differing from the other presentation only in the pitch of the final note. The same proceedure applied to each of the four musical statements. (Appendix 1).

(2) Response sheet on which subjects recorded their perception of completion in terms of each of the 28 tune patterns presented. Subjects responded by ticking either C (Complete) or NC (Not Complete) for each item according to their subjective feelings about the tune pattern presented. (Appendix 2).

(3) Prerecorded tape of two incomplete musical sequences. Subjects were played the tape and taught the sequence and then asked to use any two notes on the metalophone to complete the sequence to their satisfaction. (Appendix 3).

(4) Metalophone set in the key of G major for subjects to respond to (3) above.

(5) Manuscript in conventional notation of the first $1\frac{1}{4}$ bars of a tune pattern in G major. (Appendix 4).

(6) Response Sheet. (Appendix 5) - The response sheet consisted of 28 response opportunities each with a complete (C) or not-complete (NC) option for subjects to check. Subjects were asked to mark for each item how they felt about the tune pattern - whether it was complete or not complete. They were also asked to check every item.

(7) (a) Children's Embedded Figures Test (Consulting Psychologists Press Inc.) This test was applied to the random samples of 5 male and 5 female subjects drawn from subject groups 1 and 2. Administration followed the proceedure given in the accompanying manual supplied by Massey University Education Department.

(b) Embedded Figures Test (Adult form). The short form of the Witkin Embedded Figures Test, as described by Jackson (1956) was used. Jackson reported problems of time and fatigue if the full 24 pattern Witkin Test was used, and offered a shortened form of 12 complex patterns. The short form correlated highly with the full form of the test so was therefore considered satisfactory for present purposes. These correlations ranged from .96 when applied to Witkin's original data, to .99 when applied to 50 subjects tested by Jackson and his associates. Administration proceedure then followed the instructions contained in the manual. This test was applied to the random sample of 5 male and 5 female subjects drawn from subject group 3.

PROCEDURE.

Design A

Four simple melodies, played on the piano in the key of G were each presented seven times in random order, varying only the pitch of the final note. i.e. Each melody was played seven times, but the final note in each case was different. (G,A,B,C,D,E,F^{++}). Subjects were asked to respond as to whether they felt the melody was completed satisfactorily. - Responses (C) Complete (NC) Not Complete. (See Appendix 1).

The tune patterns were presented in random order in terms of the tune number and final note. The order of presentation and scripts of the tune patterns are given in Appendix 2.

Perusal of the namuscripts presented in Appendix 1 reveals that it is possible to perceive that the tunes are written in one of several keys. Design A accounted for this by accepting closure with the tonic of any of these keys as reflecting a desire to effect closure with the tonic. Therefore, tonic is defined in terms of the key the subject/ listener may assume. Tune 1 can legitimately be perceived as being either in the key of G Major or C Major; tune 2 as G,C, or A; tune 3 as D,G, or E; but tune 4 as G only.

Appendix 5 presents the data gained in Design A as the ratio derived from

(a) tonics chosen / the seven notes possible

(b) non-tonics chosen / the seven notes possible.

Design B

Tape recordings of two simple metalophone melodies, each with the final notes missing were played to each subject in the random sample of 5 male and 5 females drawn from subject groups 1,2, and 3. They were asked to provide on the same metalophone, two notes with which they wish to finish the melody. The stimulus tape was played as often as subjects required, and they were encouraged to explore possibilities as much as necessary for them to feel content with their choice of final notes.

The "Witkin Embedded Figures Test" was given to these subjects.

Design C

The initial 1¼ bars of a melody in G were presented in conventional notation and the subjects asked to continue and complete the melody. No restriction as to the number of notes was applied but subjects were asked that the whole sequence should not exceed approximately 10 seconds. The instrument used by the subject was of his own choice.

In Summary:-

Design A - was applied to all of subject groups 1 and 2 and 3.

Design B - was applied to a random sample of 5 males and 5 females from each of subject groups 1,2, and 3.

Design C - was applied to all subjects in group 4.

The above conditions were applied differentially in consideration of time required for subjects to complete the tasks set in each condition. Design A could be applied to groups of unlimited size, but Designs B & C required individual application. In deference to the authorities responsible for the subjects' welfare, it was felt that the disruption caused by individual application of 2 Designs to all subjects would be unreasonable, when, according to sampling theory, a random sample would in all probability reflect the views of the population.

CHAPTER V

RESULTS

Presented below are the results obtained in each experimental design, together with the results of the statistical analysis referred to below. In each case hypotheses were tested at the .05 level of significance. Table 2 refers to the results obtained in Design A.

Analysis of Data.

Results were subjected to the following analysis.

Design A

Analysis of variance - a four way analysis with repeated measures on the last two factors. Dependent variable-probability of saying closed, given tonic or non-tonic.

Design B

Analysis of variance - a series of smaller ANOVA's framed in terms of providing tests of relevant hypotheses. Dependent variable - closure with tonic or non-tonic.

Design C

Fisher Exact Probility Test. 2 x 2 design with independent groups. One tailed.

Below in Table 2 is a summary of the results of the analysis of variance applied to the data presented in Appendix 5. It relates to one factor differences, two and three factor interactions.

Table 2

Summary:- Analysis of Variance. Design A

AGE x SEX x TUNE x TONIC/NON-TONIC.

A B C D

Source	S.S.	D.F.	M.S.	F.	Significant
Between Subjects.					
A	0.5949	2	0.275	2.211	
B	0.0144	1	0.0144	0.107	
AB	1.0072	2	0.5036	3.743	*
Error between	15.3373	114	0.1345		
Within Subjects.					
C	2.5910	3	0.8637	8.707	**
AC	0.2922	6	0.0487	0.491	
BC	0.1398	3	0.0466	0.470	
ABC	1.8983	6	0.3164	3.190	**
Error 2	33.9239	342	0.0992		
D	5.7939	1	5.7939	86.248	**
AD	0.8194	2	0.4097	6.099	**
BD	0.0825	1	0.0825	1.228	
ABD	0.1653	2	0.0826	1.230	
Error 3	7.6583	114	0.0762		
CD	0.6062	3	0.2021	2.858	*
ACD	0.2123	6	0.0354	0.501	
BCD	0.4120	3	0.1373	1.942	
ABCD	0.2315	6	0.0386	0.546	
Error 4	24.1822	342	0.0707		

* Significant at .05 level

** Significant at .01 level

F ratios calculated on the basis of the analysis carried out and summarised in Table 3 are presented in Table 3 below.

Table 3

F ratios - Design A.

Source	F	D.F.
AB	3.5687	114
C	21.5322	342
ABC	13.8911	342
D	86.0714	114
AD	70.5952	114
CD	80.5374	342

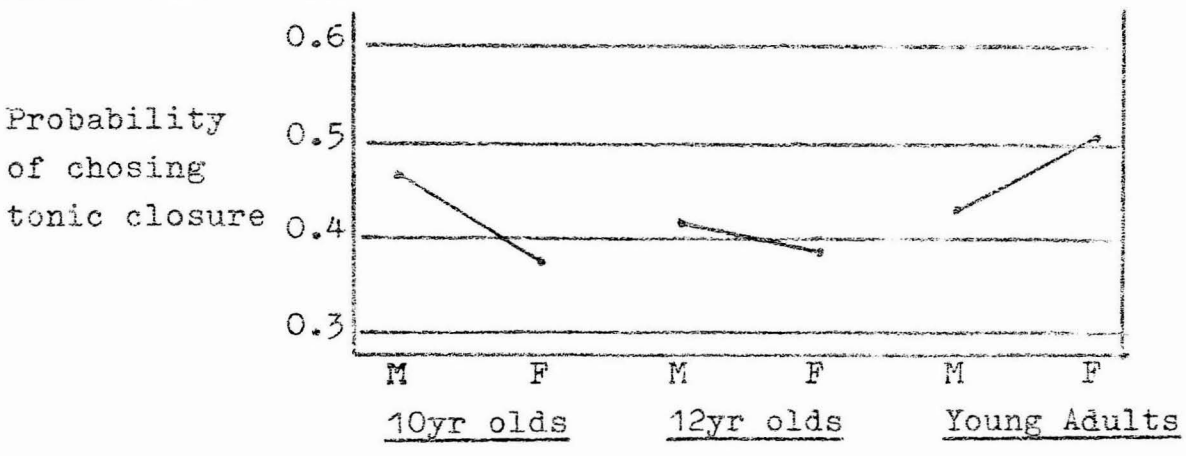
F ratios above are calculated from the difference in means according to sources listed.

A x B x C x D
Age Sex Tune Closure

Figures 1a - 1f present figures illustrating the significant differences identified in table 3.

Figure 1a.

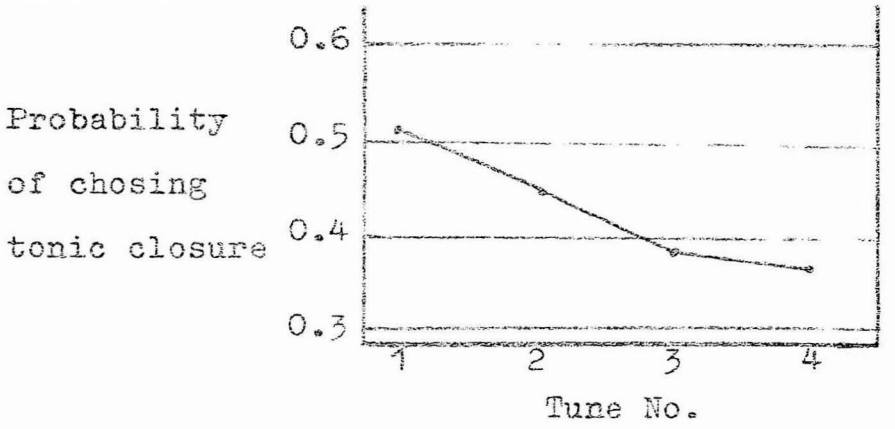
Age-Sex Interaction.



This figure shows the mean probability of saying closed for males and females across age.

Figure 1b.

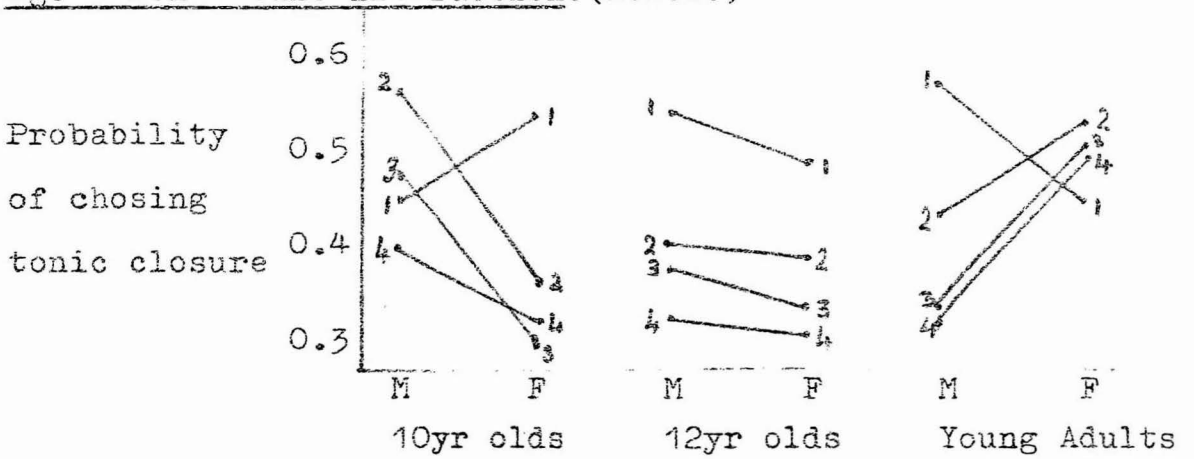
Tune Differences. - C factor



This figure presents average probability of tonic closure being accepted across tunes.

Figure 1c.

Age - Sex - Tune Interaction.(A.B.C.)



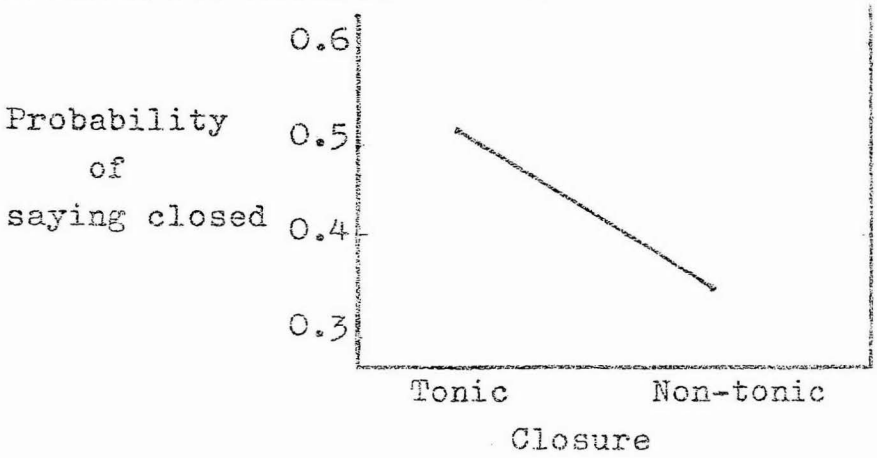
Tunes noted as 1,2,3,4, as per appendix 1.

This figure presents average probability of males

and females accepting tonic closure when tune number is considered across age.

Figure 1d.

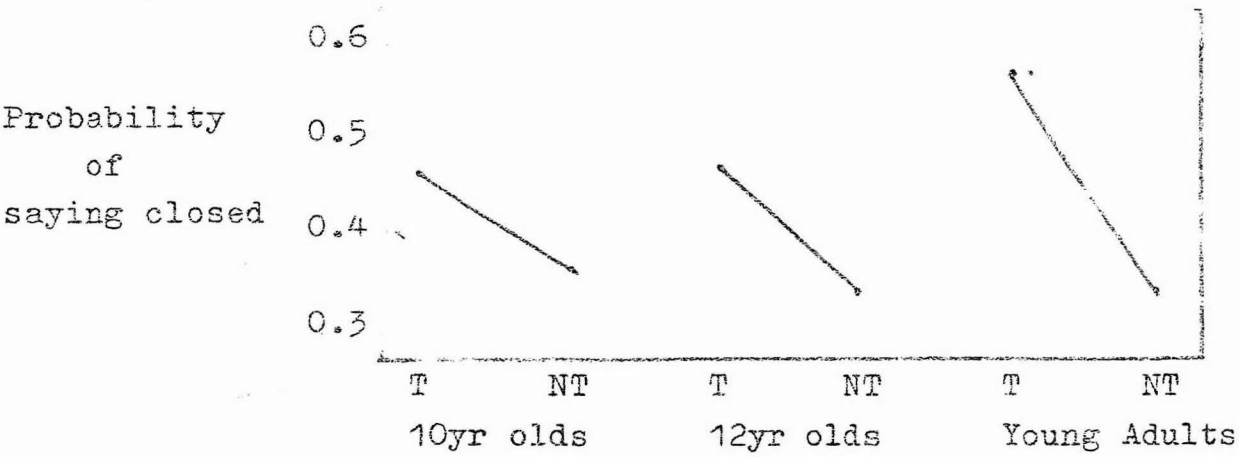
Tonic-Non-tonic Differences.



The average probability of accepting closure in terms of the tonic or non-tonic option.

Figure 1e.

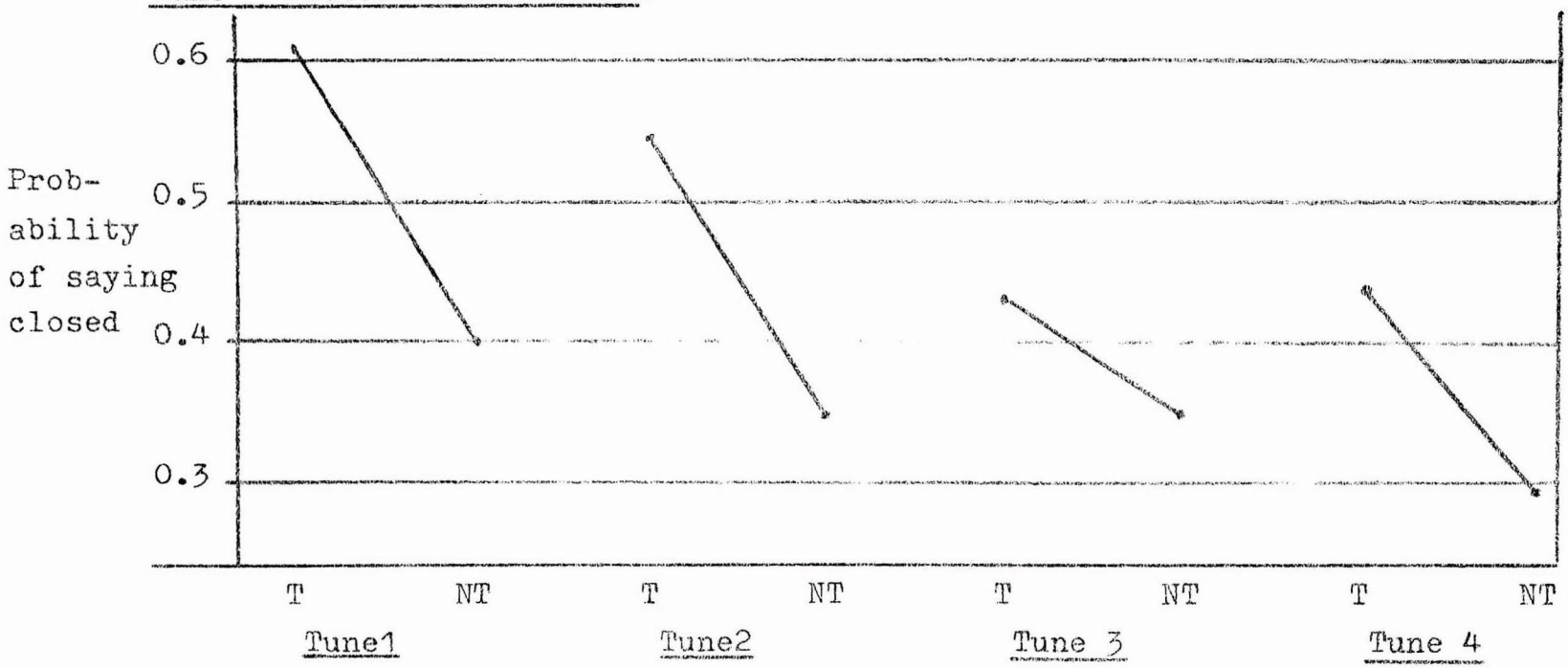
Age-Closure Interaction.



This figure presents average probability of responding to tonic or non-tonic closure across age.

Table 1 f.

Tune - Closure Interaction.



This figure presents average probabilities of choosing tonic or non-tonic closure across tunes.

Interim discussion; Design A.

Presented in Tables 3 and 4 and Figures 1a - 1c is evidence that the tonic is the most preferred means of closure but that this preference does not apply uniformly across age,sex, or melody.

Figure 1a shows that with increasing age males become less likely to seek closure with the tonic than females. Initially 10 year old males show a greater preference to close with the tonic than do 10 year old females, but upon reaching young adulthood this relationship has reversed.

Shown in Figure 1b is evidence that while the tonic is overall the preferred means of closure, (see Figure 1d) this preference is applied differentially according to the tune pattern presented and therefore the melodic contour. Tune 1 strongly encourages closure with the tonic but tunes 2,3, and 4 encourage tonic closure to a lesser degree. This difference is most marked when a comparison is made between tunes 1 and 4.

Figure 1c combines the two factors mentioned above and further illustrate that closure is a function of age and sex. However, by the introduction of tune as a factor it shows that the differences attributed to age and sex are compounded by melodic contour. It is shown in Figure 1c that for tunes 2,3, and 4, the trend for reversal with increasing age of comparative preference between males and females is similar to that shown in Figure 1a. Tune 1 also encourages a reversal in comparative preference between males and females, but this is quite the opposite direction of reversal for the other three tunes in interaction with

age and sex.

Figure 1d illustrates clearly the marked preference the group as a whole in Design A has for closure with the tonic.

That there is an increasing preference to close with the tonic with increasing age is shown in Figure 1e. When sex is omitted as a factor the trend is consistent and does not show the reversal evident in other figures.

While the tonic is the most preferred means of closure Figure 1f shows this preference is not uniformly applied. Therefore closure is not only affected by key but also by some other factor which is tune specific.

Design B.

Table 4 below presents the final note choices of subjects in Design B. It will be noted that there is a marked difference in the distributions of the two tunes. Chi Square analysis shows that there is no significant difference in the distributions at the .05 level but a trend toward G in tune 1 is evident as is a trend toward A in tune 2.

Table 4

Final Note Choices. Design B.

Tune No	Final Note Choice						
	G	A	B	C	D	E	F^{++}
1	11	6	5	3	3	1	1
2	6	9	2	3	7	0	3

Subjects were then ordered from field independent to field dependent in each age group, and the upper and lower thirds extracted for comparison. The upper third was classified as field independent and the lower third field dependent. The range of scores in each subject group was:-

10yr olds	23 - 6 raw score points	*See note below.
12yr olds	25 - 11 "	
Young Adults	4m55sec - 42m44secs.	

In the case of the 10 and 12 year old subjects scores are recorded as the number of correct responses independent of time, but in the case of young adults scores are expressed as time taken to complete the shorter version of the Witkin Embedded Figures Test. This proceedure is in accordance with the administratice instructions presented in the appropriate manuals accompanying each form of the test. A criticism of the proceedure for scoring the children's form is made later (P50)

From the above the groups defined as field independent and field dependent recorded scores as follows:-

	Field Independent	Field Dependent
10yr olds	23 - 20 incl.	12 - 6 incl.
12yr olds	25 - 24 incl.	15 - 11 incl.
Young Adults	4m55sec - 12m08sec incl.	18m42sec - 42m44sec.

The responses of the "field independent" group were then compared with those of the "field dependent" group. Table 5 below presents this data.

Table 5

Responses of Field Independent and Field Dependent Subjects. Design 2.

Final Note Choice	Field Independent	Field Dependent
G	7	4
A	4	3
B	1	3
C	3	3
D	4	3
E	0	0
F++	1	2

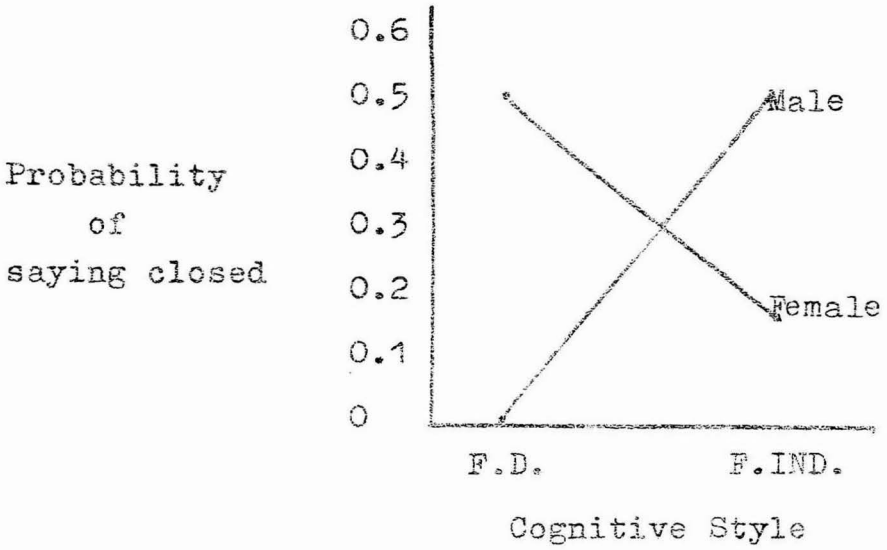
The series of small ANOVA's applied to this data treated the responses as dichotomous (tonic/non-tonic, see Appendix 6) and analysed it in terms of age, sex, and cognitive style as it affected closure. The interactions of these factors was also analysed. Only one effect was found to be significant at the .05 level. This was the interaction of sex and cognitive style as it affected closure choices.

Figure 2 below presents this one significant interaction and shows that field dependent males say closed when field independent females say closed and of course, the converse.

Tunes 1 and 2 proved to be identical in terms of responses based on age, sex, and cognitive style. (See ANOVA in Appendix 6).

Figure 2

Sex - Cognitive Style Interaction in Closure.



This figure shows average probability of saying closed for males and females across cognitive style.

Interim Discussion of Results - Design B.

The results presented in Table 5 were subjected to analysis of variance and only one interaction, sex/cognitive style, was found to be significant at the .05 level. This result is presented in Figure 2 and shows that again males and females, relative to cognitive style and closure again adopt opposite stances. In essence it shows females judged field independent are markedly more likely to seek closure with the tonic than are field/independent males. Similarly field dependent females are less likely to seek tonic closure than are field dependent males.

That this result should occur is surprising. Researches of Witkin do not suggest that this is likely. Indeed, without it being actually stated, Witkin's research would suggest that while cognitive style will affect responses this

effect would be uniform.

The data presented here shows that cognitive style does affect closure choices, but this effect is applied differentially to males and females.

Design C.

Table 6 presents the closures preferred by the two groups of performing musicians classified according to their expressed preference for musical style.

Table 6

Closure Choices of 10 Traditional & 10 Jazz Musicians.

Closure Choice	Traditional	Jazz
G	4	9
A	1	0
B	0	0
C	5	0
D	0	1
E	0	0
F++	0	0

The application of the Fisher Exact Probability Test to the reorganised data presented in Table 7 allowed for the rejection of the null hypothesis at the .05 level of significance. Therefore there is a difference in the way "traditional" and "jazz" musicians perceive melodic closure, with "jazz" musicians showing a preference to select the tonic.

Table 7

Responses, Design C.

	Tonic	Non-tonic
Traditional	4	6
Jazz	9	1

One tailed: $Md_{n1} \leqq 1$. (reject null hypothesis)

This figure presents the closure choices of subjects in Design C expressed dichotomously as tonic or non-tonic.

CHAPTER VI

DISCUSSION OF RESULTS

For many years musicians have suggested that for a piece of music to be completed satisfactorily it should resolve to the tonic. This view has been reinforced by recorded and broadcast music in that the vast majority of it does indeed resolve to the tonic, even if frequently in a chordal manner. To study people's responses to musical endings that do not resolve to the tonic is to frequently see discomfort and tension when the music does not continue to the expected tonic resolution. It has been the purpose of this study to investigate whether this "folk psychology" interpretation is correct or whether there are alternative forms of melodic closure that satisfy listeners.

The results presented in Figure 1d and Table 2 show that the tonic of the legitimately perceived key is significantly chosen to achieve melodic closure. This finding confirms Hypothesis 1 and is not altogether unexpected considering the conditioning we as musical consumers are subjected to by the recorded music broadcast to us for a large portion of our lives.

What is of major interest though is the information contained in Figure 1b. Here it is clearly shown that while the tonic is the preferred means of achieving melodic closure this preference is not uniformly applied. Contrasting tunes 1 and 4 illustrates that there are other factors affecting melodic closure choices. That the

difference occurs, allowing for differing key perception and consequently different tonics, suggests that the missing factors influencing melodic closure are tune specific. A very similar range of notes is used in all tunes, and the time values assigned to each note in each melodic sequence is the same. However the tune "shape" of each is different and it is suggested that this melodic contour is the factor that accounts for the response differences between tunes.

Terhardt (1978) posits that music is a "language" whose acoustic realisation is usually prescribed much more precisely and rigidly than is the case with other auditory signals including speech. In particular, the frequencies of musical tones and the time pattern in which they are realised are essential and significant carriers of information, but the ultimate receiver and interpreter of this information is the individuals auditory system. It is not the physical sound parameters as such that are the decisive criteria in perception of musical performance, but the corresponding auditory qualities such as subjective duration, rhythm, timbre, roughness, pitch, and harmony. Long (1970) suggests enculturation influences this subjective perception.

Despite this view of Terhardt, the results presented in Figure 1b and 1d suggest that at least one other factor should be added to his list of subjective auditory qualities. It has been shown that this factor is tune specific and argued that it is not legitimately affected by perceived key. As mentioned earlier the present research uses tune patterns that are identical in timbre

and roughness, (same instrument in each tune) rhythm, and harmony. It is recognised that none of the notes played on the piano are "pure" or fundamental pitches, but this factor is common to all the tunes in question. It would appear therefore, given the commonalities mentioned above, that the only source of variance is tune specific and involves the unique inter-relationships existing between notes in each tune. This inter-relationship has previously been referred to as "tune shape" or "melodic contour".

It has also been demonstrated that age and sex, singly and in interaction effect perceptions of closure. Ten year olds and young adults adopt opposite positions with regard to the choice of the tonic as a closure option. Whereas ten year old males show a greater preference for tonic closure than ten year old females, these relative positions reverse by young adult hood. That this trend is relatively smooth is suggested by noting the twelve year old groups responses presented in Figure 1a.

It would appear on the basis of this present research that between ages ten and young adulthood males seek tonic closure less and less, relative to females. Females on the other hand show a steadily increasing tendency to seek tonic closure.

If this trend was accounted for by enculturation, (Long 1970) it could be expected to affect both males and females similarly. However, that it affects males and females in markedly different ways suggests that the enculturation influence is strongly mediated by sex.

The above discussion has studied the results on an analytic basis and has tended to presume that untrained musicians, as were subjects in Design A & B, processed their music perceptions analytically. A pilot study of music discrimination conducted by Long (1970) found that elementary school children did not process their music analytically but as a gestalt. He also found that the ability to make musical judgements is a function of enculturation and the amount of musical training. Considering the subjects involved in this part of the study, it does not seem unreasonable to accept that these subjects did indeed effect closure in terms of their perception of a gestalt. None were trained musicians and therefore they made an asthetic response to a gestalt and did not analyse the tune patterns in terms of any "musical rules".

It is likely also that, since subjects in Design A were untrained musicians, they processed the tune patterns holistically in the right hemisphere of the brain. Kallman & Corballis (1975) cite the research of Bever and Chiarello (1974) where it was found that there is a difference between musically sophisticated listeners and relatively naive listeners, in their mode of processing musical sequences. They demonstrated that sophisticated listeners displayed a right ear advantage to dichotically presented musical sequences, while naive listeners displayed the usual left ear advantage. Their interpretation of this finding was that sophisticated listeners processed the sounds analytically, a left-hemisphere mode while naive listeners processed them holistically, a right-hemisphere mode.

This interpretation emphasises the holistic aspect of musical perception and suggests that naive subjects may be influenced by the general melodic contour and respond to preserve the perceived contour. It would appear that they are influenced by factors other than the key in which the piece is written or the penultimate note, when selecting their preferred mode of closure. Subjective judgements as to melodic contour and the felt effectiveness of the whole appear to be factors of equal importance.

Study of Figures 1b and 1f confirms the view that closure tends to be tune specific. It has been suggested that this specificity involves "tune shape" or contour. Perceived key would not appear to be a major factor in terms of this specificity because key operates to specify the notes available for use, whereas tune shape or contour refers to the arrangement of these notes and the tonal inter-relationships existing between them. In other words two tunes could use exactly the same notes and time values, and be fully representitive of one key only, yet be markedly different in terms of the sequence of note presentation. This difference in note sequence and consequently the different inter-note relationships determine the perceived tune differences rather than the key.

The relatively naive listeners used in Design A appear to process their music holistically rather than analytically and are therefore not influenced to any great degree by "musical rules". - They respond holistically to what "sounds right", and the results of Design A suggest

that there are several alternative closure possibilities that people find satisfactory.

For Design B, the criterion was the subjective satisfaction of the subject. It is of interest to note the great variation in time taken to learn the tune patterns. Some subjects learned the pattern after one hearing and one demonstration, while others required numerous tape replays and considerable teaching. From this it is suggested that there was between subject variability with regard to pattern perception and melodic memory. Unfortunately the subjects who learned rapidly were not identified in the data as speed of learning was not considered as a variable of consequence. On reflection however, it seems that speed of learning which perhaps reflects quality of memory for melody could be an important variable.

Of note also with regard to Design B was the general difficulty subjects had finding a satisfactory ending for tune 2. All subjects required greater experimentation to find a closure possibility they were satisfied with than for tune 1. Most expressed the view that they could have more easily closed the melody with one note rather than two. Study of the namuscript in Appendix 3 reveals that the range of notes in tune 1 is a third and in tune 2 a fourth. Neither range is large nor are the ranges markedly different. However tune 2 does appear to have a more distinct tune shape or contour, and this relatively clearly defined contour may be the variable that posed the experienced difficulties.

Table 5 presents the data collected from the whole group of subjects in Design B and perusal of this table confirms a preference for the tonic in closing tune 1 but in the case of tune 2 the preference is to close with a ninth. While neither of these preferences are significant they do suggest that for tune 1 there is a strong tendency to select the tonic and in tune 2 a weaker trend to selecting the ninth.

It would be expected that results obtained in Design B would reflect those obtained in Design A but in the case of tune 2 a new alternative to effect closure is introduced. The arguments offered in discussion of Design A still apply in this case, particularly the notion of melodic contour and gestalt perception. As the subjects for Design B constitute a random sample of reasonable size (25%) taken from subjects in Design A it would be expected that unless the stimulus variables were markedly different similar results should be obtained in both conditions. That the results are different, given the random sample used, suggests that the stimulus variables must be the basis of the difference observed. Of the 9 subjects who used A to achieve closure, 3 used G as the penultimate note, 3 used B and 3 used A itself. Therefore there appears to be no consistent pattern or expressed link between the penultimate note and the final note. Because of the lack of any consistency in pattern it must be assumed that subjects responded individually to the tune as a whole. This view is supported by observation during the experimental session. Almost all subjects, after a period of experimentation played the

whole piece, with their chosen ending, to check whether their ending was concordant with the incomplete melody. If they found it was not, further experimentation was undertaken until concordance was achieved.

The third task asked of subjects in Design B was the taking of the Witkin Embedded Figures Test. The 10 and 12 yr old children were tested on the children's version while the young adults completed the adult short form. (Jackson 1956). The short form of the Witkin was used to overcome the fatigue problems reported with the full Witkin test, and as the short form correlated with the full test at the .96 level at least, it was felt that the advantages of applying the short form outweighed the disadvantages.

Whereas the adult form of the test was based upon time taken as well as accuracy, the children's form was based almost entirely upon accuracy. It is felt that this allowed the test to become rather non-discriminatory at the field independent end of the style continuum. During testing it was noted that some children were quick and accurate while others were much slower but still accurate. It seems reasonable to assume that the testing method recommended led to crowding at the field independent pole by disadvantaging those fast accurate responders who, by detecting the embedded figure more quickly, would appear to be more field independent than the slower responders.

The closure choices made by the two groups of subjects are presented in Table 5.

Figure 1a shows that closure choices are modified according to age and sex. Figure 2 shows that closure

choices are modified according to sex and cognitive style. The combination of these two figures seems to suggest that cognitive style operating differentially upon the sexes is a major factor affecting closure choices. That age has been excluded is to recognise the findings of Witkin that cognitive style is relatively consistent with increasing age.

Support for the linking of visual perception with auditory perception comes from research by Rider (1977). His work was designed to research the relationship between auditory and visual perception on tasks employing Piaget's concept of conservation. Whereas Piaget used visual tools to assess cognitive development Rider used auditory tools, music, in an attempt to similarly measure cognitive development. He found that correlations between his auditory tools and Piaget's visual tools were all positive and significant at the .01 level. He concluded therefore the "The significance of the aural conservation tasks with the visual conservation tasks is emperical evidence that they may be substituted for the visual tasks in assessing the cognitive developmental level of children." (P135).

In terms of this research then it seems plausable that visual measures of cognitive style may well be applicable to aural cognitive style and therefore carry similar implications.

Various researchers (e.g. Shouksmith (1970), Kogan in Lesser (1971) have noted a relationship between cognitive style and cognitive processing. This is so in the case of the relationship between field independent

style and analytic processing. It would also appear that the same could be true of the Pask & Scott (In Floyd. et al 1976) conception of serialist v holist processing. The field independent females seem likely to approach the musical tasks analytically and process the melody serially, whereas the field dependent females seem likely to adopt a non-analytic holistic approach where the gestalt is of greater importance. The reverse of this is true for males.

Therefore, on reflection the results obtained in Design B for females would appear consistent with the various theories of cognitive style, cognitive style, cognitive processing and learning styles but the same cannot be said about males. That the field independent females showed a significant tendency to seek closure with the tonic while the field dependent females did not, suggests that the field dependent females responded in terms of the melody as a whole, processing the stimulus as a gestalt, whereas the males responded in quite the opposite way.

Therefore the data gathered in Design B tends to support the data gathered in Design A, and encourage the view that melodic closure for untrained musicians and unsophisticated music listeners need not be achieved only by using the tonic but other viable alternatives are available. Which of these alternatives is chosen depends primarily upon the tune itself as a whole and not upon the key in which the piece is written.

The results obtained in experimental Design C and presented in Tables 6 and 7 support hypothesis 4. While

it is not unexpected that there is a difference between the groups, the quality of the difference was unexpected. It was expected that the "traditional" group would be more likely to seek closure with the tonic than the "jazz" group, but this is not shown in the results presented in Table 6. All but one "jazz" musician closed with the tonic but of these one sustained D as the penultimate note and then closed rapidly with a low register G of very short duration. The jazz musician who closed with D played a descant recorder and modulated across to the key of D minor and therefore closed in the tonic of that key. In general modulation across keys was relatively common amongst jazz musicians but uncommon amongst traditional musicians.

The traditional musicians tended to fall into two main groups; those that used F^{++} frequently and closed with the tonic, and those that did not use the F^{++} at all and resolved their music with C. By not using F^{++} they were in essence using the key of C major and therefore by closing with C resolved to the tonic of the key in which they actually played. To this extent then, it can be considered that all jazz musicians closed with the tonic and 90% of the traditional musicians did likewise. The difference appears to be in the degree to which jazz musicians modulated across keys freely but returned to the key of G, while 90% of the traditional musicians did not modulate across keys but in 50% of cases responded not to the key of G major but the key of C major.

A substantial portion of traditional musicians who closed with C remarked that they could do little else

because they had started with C, even though they expressed the view afterwards that they felt they should have ended on G. They felt a strong intellectual pull toward the tonic but asthetically or emotionally they felt compelled to close with the C. It would appear therefore, that for these subjects, how the melody functioned as a whole was more important than the musical "rule" requiring that melodies end on the tonic.

For both groups of musicians to show such a preference for closure with the tonic or the tonic of the key modulated to is not really unexpected for as trained and sophisticated musicians it is likely that processing of the melody was done analytically in the left hemisphere of the brain. It seems reasonable to assume that all the above musicians constructed their music as they proceeded and to this extent they followed the "rules" of music in their particular field. While all the traditional musicians responded on the piano, a wide variety of instruments was used by the jazz musicians. These ranged from a simple descant recorder (this musician plays a large number of instruments, including piano) through brass instruments to keyboard instruments. Despite the range of instruments used, this appears to have had little impact upon the closure sought.

There are two major reasons that could be used to explain the preference these musicians showed for closure with the tonic. The first has already been stated; they processed their music analytically and followed the established music "rules" regarding closure, and finished

on the tonic or a melodically neutral note in the key of G major (B or D). The second reason is equally likely and can be viewed as being influenced by the first reason offered above: The closure choices are a function of the whole melody. Support for this view comes from the statements made by the traditional musicians who closed with C to explain their failure to close with the tonic as they felt they should. They stated that they felt the tune they had composed and performed was complete when C was used to effect closure even though they knew theoretically they "should" have ended their performance on the tonic.

CHAPTER VII

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

It has been the aim of the current research to test four basic hypotheses. (P.22).

The findings can be summarised as follows:-

(1) People, as represented by the sample in this research, do show a preference to achieve melodic closure with the tonic.

(2) This preference is mediated by sex, age, cognitive style (Field dependent/independent conception) and tune specific factors.

(3) There is a difference in the way traditional musicians and jazz musicians achieve melodic closure.

It has been argued that as tonic closure is not uniformly chosen across tunes, the factor influencing melodic closure is tune specific. It has further been suggested that this factor involves the inter-relationships existing between notes in the tune. This inter-relationship has been termed "tune shape" or "melodic contour" and may be used to explain the essential differences between tunes rather than "perceived key" which specifies the notes available but does not specify the arrangement of these notes.

The conclusions that can be drawn from this study suggest that there is a definite resting quality perceived in the tonic. It is evident that non-tonic closure is not

perceived as satisfactory closure, by the majority of people but this research did not address the question of what quality the final note possessed but rather attempted to ascertain which notes (tonic or non-tonic) provided satisfactory melodic closure.

Whether there is an inherant quality in the tonic or whether it is chosen under the influence of conditioning cannot be determined by the present research. However, that tonic closure was not uniformly sought clearly suggests that at least one tune specific factor is operating on listeners and influencing their closure choices. It has been suggested above that this factor is the tunes melodic "shape" or contour. If this is the case it would appear that a tune is perceived as a whole and in the majority of cases it is the tonic which completes the whole. This would therefore confirm the gestaltist view that perceptions tend to the simple and complete.

Evidence has been presented which illustrates that sex, cognitive style, and age also have an effect upon closure choices, further demonstrating that the tonic as a closure choice is differently chosen according to these factors singly and in interaction. The above then gives directions for further research in that how music is completed is subjectively determined and is influenced by four major factors:- age, sex, cognitive style, and perceived melodic contour.

Each of these factors offers a source of further research. Increasing age is shown in the results presented to encourage greater acceptance of the tonic as the

preferred means of closure. Is this a result of "conditioning" or is it a question of maturation? Sex (is suggested) as a variable in this but its influence also varies according to the tune pattern involved. Design B presented evidence that males and females respond in markedly different ways according to cognitive style. This was not expected, and not suggested by other researchers so the question as to whether this difference is generalisable to the whole population or is just a sampling peculiarity cannot be ascertained from this pilot study.

That the tonic is the clearly chosen means of effecting closure is evident but is this a result of conditioning or is it because of inherant qualities in the tonic? This question was not addressed in this paper but by further experimentation some clarity could be bought to the situation.

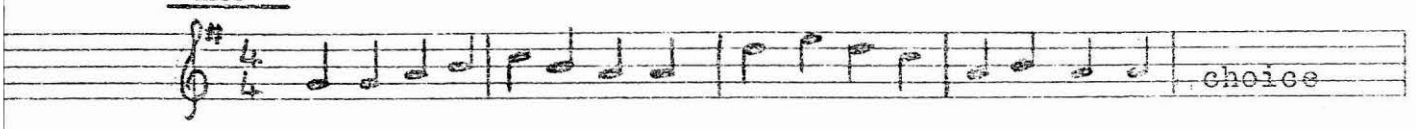
All the above suggestions have focussed upon the single note melodic closure and have excluded the chordal aspects of music. This in itself would constitute a major study worthy of persuit.

However it would appear from the work carried out here that while the tonic is the preferred means of achieving melodic closure, it is not a simple case of choice being influenced only by the stimulus but one in which respondent characteristics are of at least equal importance.

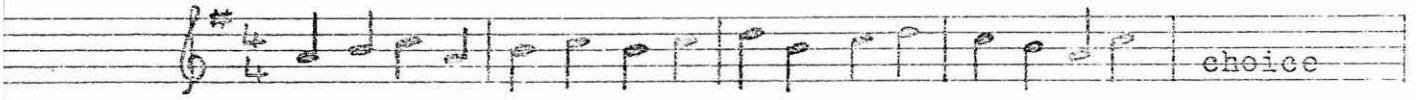
Appendix 1

Musical Stimuli, Condition 1.

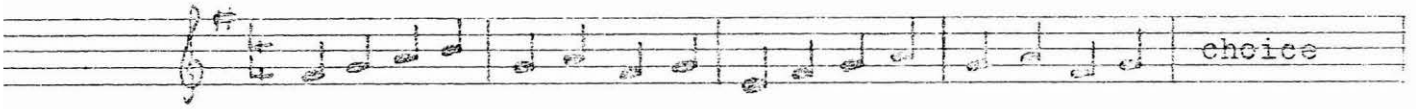
Tune 1



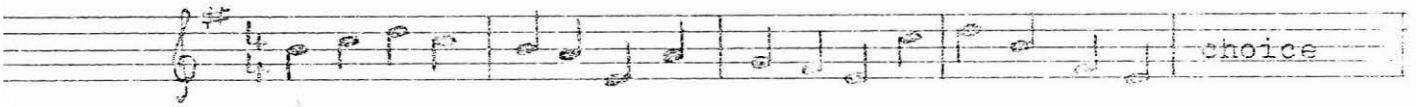
Tune 2



Tune 3



Tune 4.



Appendix 2

Response Sheet.Condition 1

PREFERENCES IN MUSICAL SEQUENCE COMPLETION.

CHRISTIAN NAME. _____ AGE _____

MALE OR FEMALE. _____

Place a tick on either (C) or (NC) according to the way you feel about the tune pattern played.Tick (C) if you feel the tune pattern is satisfactorily completed,or (NC) if you feel the tune pattern is not really completed.

THERE ARE NO RIGHT OR WRONG ANSWERS.- You are asked to indicate how you feel about each tune pattern.

MAKE SURE YOU COMMENT ON EVERY ITEM.

PRACTICE ITEMS a. (C) (NC) b. (C) (NC)

PREFERENCE ITEMS.

1. (C) (NC)	11. (C) (NC)	21. (C) (NC)
2. (C) (NC)	12. (C) (NC)	22. (C) (NC)
3. (C) (NC)	13. (C) (NC)	23. (C) (NC)
4. (C) (NC)	14. (C) (NC)	24. (C) (NC)
5. (C) (NC)	15. (C) (NC)	25. (C) (NC)
6. (C) (NC)	16. (C) (NC)	26. (C) (NC)
7. (C) (NC)	17. (C) (NC)	27. (C) (NC)
8. (C) (NC)	18. (C) (NC)	28. (C) (NC)
9. (C) (NC)	19. (C) (NC)	
10. (C) (NC)	20. (C) (NC)	

	G	A	B	C	D	E	F#
1							
2							
3							
4							

Appendix 3

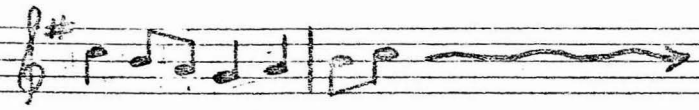
Musical Stimuli, Condition 2.

Tune 1

Tune 2

Appendix 4

Musical Stimuli, Condition 3.



Appendix 5

Appendix 5. Design A. Proportion of Subject Choices saying Closed Given Tonic or Non-Tonic.

	Sex	Tune No.	Closure	Subject No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
y.	M	1	T	33	67	33	67	33	33	67	67	33	33	100	67	33	100	33	33	33	67	33	33
	F		NT	25	25	25	50	25	0	75	25	0	25	25	50	75	75	25	25	75	0	50	75
	M		T	67	100	67	100	67	67	100	33	67	33	33	67	33	67	67	0	67	67	100	67
	F		NT	25	50	50	75	25	25	100	50	75	50	75	50	0	25	25	25	50	50	75	75
	M	2	T	33	33	33	33	33	67	67	33	100	67	67	67	0	67	67	0	0	100	67	0
	F		NT	50	75	75	0	0	75	25	100	50	50	0	0	25	50	75	25	25	100	50	0
	M		T	33	33	100	33	67	67	100	0	100	33	33	100	33	33	33	67	33	33	33	33
	F		NT	50	25	0	0	75	25	50	25	50	75	25	75	0	25	0	0	0	75	0	25
	M	3	T	67	67	33	67	33	33	100	67	67	100	33	67	67	67	67	67	33	67	0	100
	F		NT	75	25	50	100	25	75	100	50	25	75	0	50	0	25	75	25	50	50	0	25
	M		T	67	67	33	33	33	67	33	33	33	67	100	33	100	0	0	33	67	33	0	0
	F		NT	25	25	25	25	50	25	25	25	50	25	50	25	0	0	50	0	75	50	25	50
	M	4	T	0	0	0	0	0	0	0	100	0	100	0	0	100	0	100	100	100	0	100	0
	F		NT	17	67	67	33	17	33	17	67	33	50	33	33	17	33	0	33	17	0	0	0
	M		T	0	100	0	0	100	0	100	100	0	0	100	0	100	0	0	0	0	0	0	0
	F		NT	67	83	0	17	67	17	67	17	67	17	50	50	50	17	17	17	50	33	0	0
y	M	1	T	67	33	100	33	33	67	67	33	33	100	33	67	100	67	67	67	67	33	67	67
	F		NT	25	25	25	25	75	50	50	50	75	75	75	50	50	25	50	0	50	25	75	50
	M		T	33	67	33	67	67	33	33	33	33	67	33	100	33	33	67	67	67	33	33	67
	F		NT	50	25	0	25	25	25	0	0	25	50	50	50	75	25	50	50	25	0	50	50
	M	2	T	33	67	67	33	67	67	33	0	67	67	0	67	0	67	33	33	67	67	33	33
	F		NT	0	25	75	25	25	25	0	25	25	75	25	75	25	25	50	25	25	0	50	75
	M		T	67	0	33	33	33	67	67	33	67	0	33	67	33	67	33	67	67	67	67	33
	F		NT	0	25	0	25	0	0	25	25	0	25	25	50	25	25	0	100	0	0	0	25
	M	3	T	100	100	100	67	33	33	67	100	33	33	33	33	33	33	67	100	33	67	33	100
	F		NT	50	25	25	75	25	50	0	50	25	75	50	50	0	25	25	75	0	25	50	75
	M		T	67	100	67	33	33	67	33	67	33	33	67	67	67	33	33	67	0	33	67	33
	F		NT	75	25	0	0	25	50	25	50	25	25	25	50	0	25	75	0	50	75	0	25
	M	4	T	100	0	100	0	100	0	0	0	0	100	0	0	100	0	0	0	0	100	0	0
	F		NT	67	67	67	33	50	33	67	0	17	50	17	17	50	33	75	50	33	33	50	17
	M		T	0	100	0	0	0	100	0	0	100	0	0	0	0	100	100	0	0	100	100	0
	F		NT	33	17	0	17	33	0	67	17	33	50	17	17	17	17	50	67	17	17	50	17
.A.	M	1	T	67	100	100	67	100	67	100	67	100	67	67	67	67	33	33	33	67	67	67	67
	F		NT	50	25	25	50	100	25	50	100	75	50	50	50	25	25	0	0	50	75	75	0
	M		T	67	67	33	33	67	33	67	67	100	33	100	67	33	33	67	33	33	100	33	67
	F		NT	50	50	0	25	25	75	0	50	0	75	75	0	0	0	75	0	0	75	0	50
	M	2	T	67	67	0	33	67	33	67	33	100	33	100	0	0	67	33	0	33	67	33	33
	F		NT	50	0	0	50	25	50	50	25	75	25	25	0	0	25	25	0	25	25	0	25
	M		T	33	33	67	33	33	67	33	33	33	0	67	100	33	33	33	67	33	0	100	33
	F		NT	0	0	0	0	25	0	0	25	50	25	75	50	0	50	75	50	0	50	25	0
	M	3	T	100	33	67	67	67	100	67	67	67	67	67	67	0	100	100	67	33	33	33	67
	F		NT	50	0	0	25	0	75	0	25	25	25	25	25	25	25	75	0	0	25	50	75
	M		T	100	67	67	100	67	33	0	100	100	33	100	33	67	33	100	33	100	67	100	67
	F		NT	25	25	0	75	25	50	0	50	25	50	100	25	0	25	50	100	75	25	25	0
	M	4	T	100	100	0	100	100	100	100	100	100	0	100	0	100	0	100	100	100	0	0	0
	F		NT	50	17	33	33	33	50	50	17	67	67	17	75	17	67	67	33	50	17	50	33
	M		T	100	0	0	100	100	100	0	100	0	100	100	0	0	100	0	100	100	0	100	100
	F		NT	67	33	17	33	33	50	0	67	75	33	67	67	17	33	50	50	50	33	0	67

Appendix 6

Analysis of Variance - Design B

Source	D/F	MS	F	P
Between Subjects				
A	1	0.0941	0.5430	.5213
B	1	0.0941	0.5430	.5213
AB	1	1.5059	8.6878	.0097*
SUB W/1/6ps	15	0.1733		
Within Subjects				
C	1	0.0235	0.1038	0.7497
CA	1	0.0235	0.1038	0.7497
CB	1	0.0235	0.1038	0.7497
CAB	1	0.0235	0.1038	0.7497
SUB W/1/6ps	15	0.0235	0.1038	0.7497

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