



PATTERNS OF THE SOUL: AN ANALYSIS OF THE
CONCEPT OF PROPORTIONS AND VALUES IN
GEOMETRICAL PRINCIPLES IN SELECTED WORKS
OF THE IKHWÂN AL ŞAFÂ

BY

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ABSTRACT

This research analyses the writings of the *Ikhwân as Şafâ* in regards to the relationship between the soul and mathematics. It draws upon mostly the translation of the *Rasa'il Ikhwân as Şafâ* and relevant literatures by contemporary commentators in connection with geometry and the spiritual realm, such as Nasr, Livino, and Lawlor. This research breaks up the description between arithmetical principles and geometrical principles into quantitative and qualitative proportions. The distinction between these two principles, along with the description of the soul, has presented the similitude of characteristics in the human soul and mathematics (geometry) thus enabling the possibilities of connection between the two. As the properties of the soul and mathematics falls within abstract manner, the process of findings were made possible by presenting affinities such as the connection theory between macrocosm (the universe) and microcosm (men), and the manifestation of golden proportions within the law of nature. By identifying these links, the research found the general metaphysical sense in geometrical principles – the Intelligible Geometry as coined by *Ikhwân as Şafâ* – as the instrument of symbolic interpretation. This principle goes beyond the visual forms of geometry to connect with the metaphysical realm. It is hope that the findings of this research will allow further investigation on the possibilities of incorporating the said link into the teachings of geometry.

ملخص البحث

يحلل البحث كتابات إخوان الصفا عن العلاقة بين الروح والرياضيات مع التركيز على ترجمة رسائل إخوان الصفا والدراسات ذات الصلة للنقاد المعاصرين المتعلقة بعلم الهندسة والمجال الروحي، أمثال نصر وليغينو ولولر. كما يقسم البحث توصيف المبادئ الحسائية والهندسية إلى نسب كمية ونوعية. يقدم التمييز بين هذين النوعين من المبادئ، جنباً إلى جنب مع وصف الروح، ووجه الشبه بين خصائص الروح والرياضيات (علم الهندسة) مما يمكن من الوصل بينهما. ونظراً لاندراج خصائص الروح والرياضيات ضمن المجردات، فإن اكتشاف أوجه الوصل بينها يتم عبر النظر في أوجه الشبه والتقارب كنظرية العلاقة بين الكون والإنسان ومظاهر النسبة الذهبية ضمن قانون الطبيعة. وقد اكتشف البحث، عبر دراسة هذه الصلات، المعنى الغيبي العام ضمن المبادئ الهندسية كما ذُكرت في كتابات إخوان الصفا، بوصفها أداةً للتفسير الإشاري. يتجاوز هذا المبدأ الأشكال المرئية في علم الهندسة إلى الصلة بالعالم الغيبي، ومن المأمول أن تتيح نتائج هذه الدراسة المجال لمزيد من البحث في إمكانية دمج هذه الصلة في علم الهندسة.

APPROVAL PAGE

I certify that I have supervised and read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Master of Arts (Islamic and Other Civilizations).

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Dean, International Institute of
Islamic Thought and
Civilization

DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

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Date

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SELECTED WORKS OF IKHWÂN AL ŞAFÂ**

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*To art
for bringing the curiosity.*

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TABLE OF CONTENTS

Abstract	ii
Abstract in Arabic	iii
Approval Page	iv
Declaration	v
Declaration of Copyright	vi
Dedication	vii
Acknowledgments	viii
List of Diagrams	x
CHAPTER 1: INTRODUCTION	1
Definition of Terminologies	3
The Soul	3
Geometry through Mathematics	12
Geometry	15
Literature Review	22
CHAPTER 2: THE GEOMETRY OF SENSIBLE AND INTELLIGIBLE	30
Identity	30
Empirical Geometry	35
Theoretical Geometry	36
Sensible Geometry	36
Geometrical Basics	36
Classification of Line	36
Classification of Plane	37
Classification of Solids	37
Origin of All Shapes	37
Tools of Measuring	38
Intelligible Geometry	39
The Understanding on Dimensions	39
The Nature of Dimensions in Rational Geometry	41
CHAPTER 3: PROPORTION AND THE SOUL	43
Proportion	45
Arithmetic Proportion	45
Geometrical Proportion	46
Musical Proportion	48
The Importance of Proportions	49
CHAPTER 4: CONCLUSION	58
BIBLIOGRAPHY	64

LIST OF DIAGRAMS

<u>Diagram No.</u>		<u>Page No.</u>
Diagram 1:	Construction of the Pentagon	2
Diagram 2:	Geometric progression from point, line, shape, pattern and solid	18
Diagram 3:	The Golden Proportion	55
Diagram 4:	The Rectangle in the Ratio of Phi	56

CHAPTER 1

INTRODUCTION

“All which is beautiful and noble is the result of reason and calculation.”

Charles Baudelaire.

This thesis will be an after thought of curiosities, intuitions, and probes on the translation of the “*Rasâ'il of Ikhwân as Şafâ* (Epistle Six): Arithmetical and Geometrical Proportions in Relation to Character and Purification of the Soul.” The immediate and fundamental questions which follow the title of this thesis circumscribe the description of the soul and its relationship to mathematics, a relationship which seems to be complex, since both the soul and mathematics are two abstract fields, and the references on both subjects can be traced as early as the history of mankind. Following a thorough study, it has been found that there is at least one venue which resides in both fields that can be made possible in order to decipher the relationship. This avenue is known as the *concept of proportion*.

As it is understood in the context of contemporary mathematics, the discipline of geometry involves computer technologies and mechanical instruments. Software like computer-aided design enables architects, engineers, or simply pure geometers to design and create geometrical patterns and forms to a great degree of complexity, all at their fingertips. The design software does most of the calculations to a very precise decimal point that is applied by engineers. These software are often accompanied by computer-aided machineries (also known as Create-And-Cut) to actualize geometrical drawings into objects such as strict geometrical solids for decorations and ornaments to complicated engineering parts like gearwheels and sprockets. Nevertheless, in revisiting the practise of geometry at its fundamental

practise – classified as the geometric constructions in mathematical terms today – one will find that there are only two instruments required in designing and creating geometrical patterns. These two instruments are known as the compass and a straightedge (ruler that comes without the markings of measuring units). At this fundamental level of geometry, the concept of proportion plays a very important role in determining the process of multiplication, subtraction and repetitions of lines and geometrical shapes in order to produce patterns or in designing objects. The opening of the compass and the placement to anchor the compass needle determines the pattern making in geometrical operations. (See diagram 1 below). Although this method of pattern making process involves many construction lines and curves, the result can be as precise as the one produced using computer software; all after, the software was programmed and originated by this fundamental concept of geometric constructions.

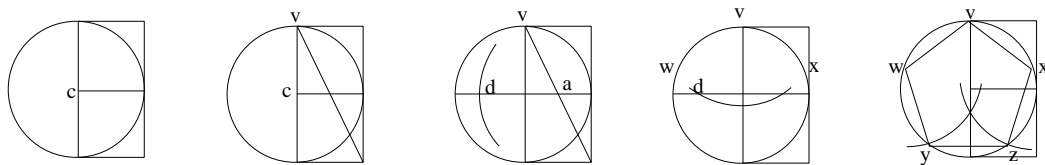


Diagram 1.1: Construction of Pentagon

On the other hand, the soul is an entity that is unseen, but nonetheless, exists. Whether it is agreeable that the soul has its own form, fashioned with certain characters or residing in a specific place, modern science could not deny nor proof its existence otherwise. In relation to *the concept of proportion and the soul*, God explained this in the Qur’an:

By the Soul, and the proportion and order given to it. (Ash-Shams 91: 7).¹

¹ Abdullah Yusof Ali, [trans.] *The Meaning of The Holy Qur'an* (Maryland, USA: Amana Publications, 10th edn., 2002), 1655.

DEFINITIONS OF TERMINOLOGIES

The Soul

In the field of Islamic studies that uses English as the medium of acquiring knowledge, its students may arrive to some degree of difficulties in fully grasping Arabic terms which contain broad meanings. However, to explain them fully in English is possible. In the case of this thesis, the term soul seems to fall under this complexity. With resources that are available, from the aspects of linguistics as well as translated Arabic terms pertaining to the soul, all of this have been analysed and arranged accordingly for clarification. From the Qur'anic perspective the term soul is closely referred to either of these Arabic words, *نفس* and *روح* or, in some cases, it is interchangeable, or even referred to both. According to the translation of the Qur'an by Abdullah Yusuf Ali,² the Qur'anic terminologies from the root word of *نفس* appear in 170 verses which are translated into English as the soul³, corresponding to the meaning of something belonging to, and that will be return to God, as well as

² Abdullah Yusuf Ali, [trans.] *The Meaning of The Holy Qur'an* (Maryland, USA: Amana Publications, 10th edn., 2002).

³ The meaning derived from the root word *نفس* was translated in My Qur'an by Magnicode Inc. (2012) as such:

Was or became high in estimation, of high account or excellent, highly prized / precious / valuable and therefore desired with much emulation or much request, desired, it became loved or highly esteemed, console, cheer, envy.

Was or became avaricious / tenacious / niggardly of it because of its being in high estimation or excellent. Little too much good.

Brought forth (e.g. gave birth to a child), menstruated, blood.

Clear away grief / anxiety / sorrow, ease / relieve, delay.

Breath, gust, drew breath, sigh, spoke long (due to regular intake of breath), become extended / long / increased, ability.

Soul / spirit, the vital principle, intellect / reason / mind, inner desire or feeling, knowledge, pride, self-magnification, a state where there is ample scope for action, 'willingly' when used as adverb, nafs – soul of discrimination (mental) and ruh – soul of breath (physical), oneself / itself, whole, essential constituent, reality, sometimes ghayb and nafs are synonymous, a person / being / individual, quantity, man, life, soul + body, life-blood, body, contention / thought / face / substance, heart, stomach, gulp, drought.

Brother or co-partner in faith / religion / relationship.

Wide space, distance, width.

Greatness, nobility, glory, scarcity, absoluteness, unseen, hidden reality which is beyond human perception, intention, requital, punishment.

representing men or persons or self as a subject. Meanwhile the root word of ر و ح⁴ has a broader representation when it is translated into the English language. In the translation of the Qur'an it was used in the context of representing the Archangel Gabriel as a distinction from all other angels⁵. The same word ر و ح is also referred to in verses where stories of Jesus and/or Maryam were told⁶ in the context of God The Most Exalted who sent a spirit (*rûhul Quddus*) into Maryam. While in another context, it represents the life given to Adam during the process of creation⁷. In other instances, the word ر و ح refers to the one word given to prophets.⁸ Nevertheless in this thesis, there are two instances where the terminology of ر و ح is relevant which brings a meaning similar to the term نفس as discussed above. These instances have been referred to in the Qur'an in the context of the term is understood as the inner being of men.

... For such He has written Faith in their hearts, and strengthens them with a spirit from Himself... (Al Mujadilah58:22)⁹

and

He Who has made everything which He has created most good: He began the creation of man with (nothing more than) clay, And made his

⁴ From the same sources of Magnicode Inc. (2012), the root word ر و ح was translated as follows:
Raha - to go or do a thing at evening. Violently windy; good or pleasant [by means of the wind].
Become brisk, lively sprightly, active, agile, or quick [as though one felt the wind and was refreshed by it]

Rawahûn - he went, journeyed, worked or did a thing in the evening [for any time of the night or day], or in the afternoon (declining of the sun from its meridian until night)

Rûhun - soul, spirit, vital principle, breath which a man breathes and pervades his whole body.
Inspiration or divine revelation [since it is like the vital principle is to the body and quickens man]

turiihuuna (impf. 2nd. m. pl. vb. 4) - you bring home in the evening

rawaahun (v.n.) - blowing in the afternoon, evening journey

rauhun (n.) - soothing mercy, happiness, comfort, bounty, gift

ruhun (n.) - revelation, spirit, human soul, Gabriel, angel of revelation

raihaan (n. pl.) - fragrant flowery plants

riihun (n.) - punishment

riyaah (n. pl.) - divine blessings

⁵ Please refer to Qur'anic verses 16:102, 26:193, 70:4, 78:38 and 97:4.

⁶ Please refer to Qur'anic verses 2:87, 2:253, 4:171, 5:110, 21:91 and 66:12.

⁷ Please refer to Qur'anic verses 15:29 and 38:72. "Breathed into him of My spirit".

⁸ Please refer to Qur'anic verses 40:15.

⁹ Abdullah Yusof Ali, [trans], 1439.

progeny from a quintessence of the nature of a fluid despised. But He fashioned him in due proportion, and breathed into him something of His spirit. And He gave you (the faculties of) hearing and sight and feeling (and understanding): little thanks do ye give! (Al Sajdah 32:7-9)¹⁰

Maudûdi in his commentary of Qur'an explain the word spirit as the essential human characteristic which imbues man with consciousness and thought, discretion and judgement, discernment and discrimination, and not merely life which a living thing moves.¹¹

Thus the Arabic term نفس which is translated into English as soul is more relevant in the context of this thesis in regards to the Qur'anic perspective, while the Qur'anic term روح which is translated into English as spirit in the context of this thesis will be a reference to the Qur'anic verses 58:22 and 37:7-9 as quoted above.

Albeit with the explanation on the term soul as well as the attempt of this thesis, it is also important to justify that the knowledge pertaining to the soul and spirit, as well as subjects which revolves around it, are under the ultimate jurisdiction of God the Almighty. There is only little knowledge about it that has been given to men. The verse of the Qur'an and the saying of Prophet Muhammad (may Allah bless and grant him peace) below are the illustration of this limitation.

They ask thee concerning the Spirit (of inspiration). Say: "The **Spirit** (cometh) by command of my Lord: of knowledge it is only a little that is communicated to you, (O men!). (Al Isra' 17: 85).¹²

Abdullah (b. Mas'ud) reported: As I was going along with Allah's Apostle (may peace be upon him) in a cultivable land and he (the Holy Prophet) was walking with the support of a wood, a group of Jews happened to meet him. Some of them said to the others: Ask him about the **soul**. They said: What is your doubt about it? There is a possibility that you may ask him about anything (the answer of) which you may not like. They said: Ask him. So one amongst them asked him about the **soul**. Allah's Messenger (may peace be upon him) kept quiet and he

¹⁰ Ibid. 1047.

¹¹ Maudûdi in Tafseer Qur'an, translated in My Qur'an by Magnicode Inc. (2012).

¹² Abdullah Yusuf Ali, [trans.], 698.

gave no reply and I came to know that revelation was being sent to him, so I stood at my place and thus this revelation descended upon him: “They ask thee 'about **soul**. Say: The **soul** is by the Commandment of my Lord, and of Knowledge you are given but a little”.¹³

However this limited knowledge that has been revealed to men has become something that needs to be investigated which is partly the undertaking of this thesis.¹⁴ Since the discussion on the soul has intrigued many scholars both in the Muslim and the Western world, their opinions will be examined and discussed here before making a justification on the definition and characteristic of the soul adjudged to this thesis. The basis of referring to these following scholars is due to their reputable commentary of the soul and is referenced in the Muslim world.

The Classical Greek philosopher, Plato, for instance, has discussed the subject of the soul that has intrigued many early Muslim scholars such as ibn Sina, Al Farabi and ibn Miskawayh. The importance of referring to his thought in this thesis is also based on the fact that Plato had introduced a great number of theories linking mathematics and metaphysics. Plato suggested that the soul consists of three parts, the appetitive, the rational and the spirited. In the *Republic*, Plato outlined his theory of tripartite soul, which consists of:

- i. The appetitive soul that is the base desire on both the necessities and the unnecessary like thirst, hunger and sexual cravings.
- ii. The rational soul is the decision making aspect that he explained as the origin of logic from the word *logos* in Greek. It functions as the mind or intellect of a being.

¹³ Muslim. Book 58, Hadith 6712

¹⁴ A statement was made by a student during a lecture by Osman Bakar, that Allah mentioned in the Qur'an that the knowledge of the soul is limited; therefore one should accept the fact and stop questioning. Osman Bakar replied to that was the limitation is not a reason to not further investigate the limited knowledge as there are still many which could be discovered. His replied has inspired to the realization of this thesis.

- iii. The spirited soul is the highest level of the three, which command the rational soul. In its purest state or what Plato called as the 'just soul', the spirited soul ensures that the dictates of reasons are followed.

Plato also explained the soul as both rational and irrational. While the rational soul is the heart, the irrational is appetite and anger. He continued that everyman's action must be checked by the rational soul. In the case where the rational soul is over the irrational, justice will prevail, when it is otherwise, man becomes slave to his own desires.¹⁵

Aristotle is another figure before the coming of Islam that has discussed on the soul. His writings have also influenced some early Muslim scholars such as Ibn Rushd and al Kindi. Aristotle who is generally known as the First Teacher, on the other hand explained the definition and description of the soul as three substances of Matter, (potentiality), Form (actuality) and The Compound of Matter and Form in his writings, *De Anima*. Aristotle is in a position to think that the soul is part of the body which could not exist independently. Although it is a material, but it does not take any shape but rather a form in actuality. The soul is a capacity in living being. This capacity is responsible to perform activities such as self-nourishment, growth, decay, movement and rest, perception and intellect; and it is the causally responsible for the behaviour of that living thing. For him the soul is a kind of instrument to animate the body and does not differ from one another. In other words it has little to do with personal identity and individuality.¹⁶

A very important figure among the Muslim scholars that has discussed the subject of the soul, is Imam Abu Hamid al Ghazzali, wrote in *Al-Madnûn Bihi 'Ala*

¹⁵ R.C. Cross and A.D. Woozley, *Plato's Republic* (Macmillan Education Ltd. London, 1964), 112-133.

¹⁶ The soul is the first actuality of a natural body that is potentially alive. (412a27)

Ghair Alihi (The Mysteries of the Human Soul) defined the soul as animal power which is opposed to the rational power.

He mentioned that the soul is not an accident, like the knowledge in the mind of the learned.¹⁷ It is an essence which is the inner strength of man and able to know, to hear, to sense and possessed its own consciousness and able to recognized itself, its Creator and spiritual realities. However in regards to spirit (*nafs*), Imam al Ghazzali, had not clearly defined it as material or immaterial, but stated that the difference between the soul and the spirit is in its characteristics, not in essence.

A thirteen century (of the Common Era) Muslim scholar, Ibnu Qayyim al Jawziyyah (B. 1292/3 D 1349/50 CE), wrote extensively on the characteristics of the soul in his book *Ar Rûh*¹⁸. His explanation could be divided into three parts:

- i. The affairs between the spirits of a dead person to the living person.
- ii. The state of the spirit after death; and
- iii. The discussion and classification between the 'substance' known as the soul and the spirit.

Since the objective of this section is to define the term soul, the focus of Ibnu Qayyim's writing will be in the third part of the book. Ibn Qayyim asserted that روح is a form of being (*makhlûk*) which is new and created substance rather than being a part of ever existed Godly soul. For Ibnu Qayyim, the Qur'anic verse,

Behold, thy Lord said to the angels: "I am about to create man from clay: "When I have fashion him (in due proportion) and breathed into

¹⁷ Al Ghazzali gave two definitions in explaining the soul:

First definition: (1) In *Kimiya al Sa'adah*: *nafs* as vehicle of the heart, applied to the body.

(2) In *Al Risalah al Laduniyah*: it is what the Sufi's call animal spirit.

(3) In *Mizan al Amal*: animal soul and human soul

Second definition: Subtle spiritual substance, essence of man.

¹⁸ Ibnu Qayyim Al-Jauziyah [trans.] Kathur Suhardi, *Ar-Rûh li Ibnil-Qayyim* (Pustaka Al Khauthar. Jakarta, 1999), 341.

him of My spirit, fall ye down in obeisance unto him.” (38 Shad: 71-72)¹⁹.

It is the valid argument that God created the physical of Adam before breathed into him of My spirit. Ibnu Qayyim also rejected the narration chain of a Hadith that stated “God created ج و ح of His slaves before the creation of the slaves since two thousand years before”, based on the opinion of Ad-Daruquthny²⁰ and Ibnu Ady²¹. His other important argument on this matter is while the creation of Adam AS was included during the six days of creation, there was no proof from the Qur'an or Hadith that stated the spirit was created during that period. Therefore the creation of spirit was a subsequent process with the creation of Adam AS²². He asserted that all spirits of human beings including the one that was with Adam AS and Jesus AS is something new and being created.²³

He further discussed the difference between the soul and the spirit. His explanation include human as physics and this physics could either be the body or the physics associated with the body. Thus according to him, the human spirit is an expression of the physic situated outside the body.

¹⁹ Abdullah Yusuf Ali, [trans] 1176.

²⁰ Ad Daruquthny (d. 385 H) His given name is Ali bin Umar bin Ahmad bin Maddy, a hadith scholar and hafidhul Qur'an. Wrote Al-Ilzamat, book of al- Istidrak for Shahih al-Bukhary and Shahih Muslim. Abu Jauzy describe him as master in hadiths, Qira'at, Nahwo, Fiqh and Siar, as well as a Tsiqah. Taken from Riwayatadh Daruquthny in Tarikh Ibnu Katsir, 11.

²¹ Ibn `Adi (d. 365) His given name is Abu Ahmad `Abd Allah ibn `Adi ibn `Abd Allah ibn Muhammad ibn Mubarak ibn al-Qattan al-Jurjani. A hadith scholar. Author of al-Kamilfil-Jarhwal-Ta`dil in five large volumes where he applied the method of mentioning every narrator that was ever criticized, rightly or wrongly. He specialized in narrator-criticism, hadith authentication and criticism, until he became a foremost expert in this science despite weakness in his grammar as one can gather from reading him. Al-Daruquthni praised his book as sufficient for knowledge of the weak narrators. Taken from http://www.sunnah.org/history/Scholars/ibn_adi.htm.

²² Ibnu Qayyim discussed this issue in a great length, taking both opinions of the body was created first and it's contrary. His conclusion to this issue is the dialogue that took place between God and Angels after the body of Adam was created.

²³ Ibnu Qayyim referred to the argument of Ibnu Taimiyah on the Qura'nic phrase, “Be! And it is!” against the people who said Jesus was like a torn cloth originated from a complete piece of cloth.

On the other hand the soul has a character of leaving and entering the body. Referring to the Qur'anic verses²⁴, the soul is subject to punishment, being taken by the angel, being held while the body is asleep and returned to the body when it is awake as well the soul being presence in front of God. Moreover there are verses which described the soul in three different states.

i. Blessedness

(To the righteous soul will be said;) “O (thou) soul, in (complete) rest and satisfaction! Come back thou to thy Lord, – well pleased (thyself), and well-pleasing unto Him!
(Al Fajr 89: 27-28).²⁵

ii. Self-reproaching

I do call to witness the Resurrection Day; And I do call to witness the self-reproaching spirit: (Eschew Evil). (Al Qiyamah 75: 1-2).²⁶

iii. Prone to evil

Nor do I Absolve my own self (of blame): the (human) soul is certainly prone to evil. Unless my Lord do bestow His Mercy: but surely my Lord is Oft-forgiving, Most Merciful.” (Yusuf 12: 53).²⁷

Contemporary Muslim scholar Osman Bakar in his *Classification of Knowledge* in Islam, concluding the classification of soul according to Al Farabi, divided the soul into four levels; the vegetal, the animal, the human and the angelic soul. Each level expresses the characteristic of the soul within the limitation of the particular level.

i. The first level, vegetal, expresses the nutrition, growth and reproduction.

²⁴ It is Allah that takes the souls (of men) at death; and those that die not (he takes) during their sleep: those on whom He has passed the decree of death, He keeps back (from returning to life), but the rest He sends (to their bodies) for a term appointed verily in this are Signs for those who reflect.
As-Saffât 39: 42

²⁵ Abdullah Yusof Ali [trans], 1648.

²⁶ Ibid. 1565.

²⁷ Ibid. 564.

- ii. The second level, animal soul, is being expressed in two dimensions of motive and perspective. Motive contained the appetitive elements of attractive and repulsive as well as the efficient elements in the brain activities. Meanwhile the dimension of perspective also contains two elements of external and internal. The external elements are the five senses of hearing, seeing, feeling (by touching), tasting and smelling, while the internal elements are formative, common sense, cognitive, memory and estimation.
- iii. The third level of the soul which is the human soul is divided into two types of intelligence of active and speculation. The speculative intelligence is the potentiality of knowledge, axiomatic knowledge and the intellect on intelligible. The highest level of the soul is angelic where it is in the state of perfection, as angel only does what they are told to do by God.²⁸

Nevertheless, as terminologies of soul and spirit could be a lengthy discussion, the intention of this thesis is to justify the term soul in order to discuss its connections and effects to the concept of proportion suggested by *Ikhwân as Şafâ*. Thus after the overview of discussions by various scholars on the subject above, this thesis is inclined to conclude that the translated term soul to be applied in this thesis will be referred as the inner dimension of man, which covers many aspects besides the physical material of human (*jasd*) including:

- i. *Rûh* (Spirit): the substance that gives life to body
- ii. *Nafs* (Soul): the desire (instinct)
- iii. *Qalb* (Heart): the origin of the desire – where intention begins
- iv. *Aql* (Mind): the analytical force behind the desire. It is the deciding factor of whether to do or not to do what the heart intended.

As this thesis recognizes the existence of the soul, it is important to state at this point that the term soul applied here comes with certain dimensions and form. However, the dimension is unknown and will not be investigated further. The form although exist but not in a homogenous and recognizable formation as other objects

²⁸ Osman Bakar, *Classification of Knowledge* (International Institute of Islamic Thought and Civilization (ISTAC) International University of Malaysia (IIUM).Kuala Lumpur, 2006), 72.

familiar to our senses. Therefore the phrase Patterns of the Soul, which is the title of this thesis, is referring to the behaviour of a person and the influences and effects brought forth by the proportions in geometrical principles.

Geometry through Mathematics

The next fundamental question which needs justification in this section before moving on further to the analysis of the *Rasa'il* would be the definition of geometry. The term might not be as complex as the term soul discussed above but its general technicality and elements which cover the domain of geometry are still necessary to be introduced in order for the comparison of definitions by *Ikhwân as Şafâ* to take place. Since the subject of geometry is being referred as a branch of mathematics, therefore it is essential to recount its historical narration as much of it will be the referred to throughout this thesis. Historically, mathematic is a field of study which consists of arithmetic, geometry, astronomy and music, however in the history of Islamic science, there were traces of other related branches including trigonometry, optics and engineering. Nevertheless all of which are concerned with numbers, shapes and figures.²⁹

The modern interpretation of mathematics today is “the science dealing with quantities, forms etc. and their relationship by the use of numbers and symbols,” or / and “abstract science which investigates deductively the conclusions implicit in the elementary conceptions of spatial and numerical relations.” Mathematics today is classified between pure and applied mathematics which includes arithmetic, geometry, trigonometry, algebra, logic, number theory, computing, probability and statistic, and more. Music and optics which used to be considered as branches of mathematics are

²⁹ Osman Bakar in a lecture, *the Qur'anic Foundation of Islamic Science*, 22nd October 2010. International Institute of Islamic Thought and Civilisation.

now grouped under a specific subject of its own. The differences in definition of the past and current is due to the development of education system which compartmentalize fields of studies differently; however a discussion regarding this will be unnecessary here as it will take away the focus of this research.

Nevertheless the importance of understanding what mathematics is all about is compelling as it path the way to understand how it began. There are two divergent opinions which one opt for taking mathematics as an activity of human being, started as early as the existence of human or when human starts to communicate while the other considers the evidence of mathematical existence as the beginning of mathematic, which began instantaneously as early as the beginning of universe.³⁰Smith in *History of Mathematics* argued mathematics appear first in the Cosmic Figures, then in the minerals world, the vegetal and plant, the animal and finally in man³¹. This followed by man's expression; counting, decorating, rituals, mysticism and so on, all are in conformity with mathematical principles. The mathematical activities began with arithmetic. It is the knowledge of numbers which to be found in great part of high school mathematic today. The very basic of it is about counting one before two. However historians are yet to determined whether mathematical activities of human began with cardinal numbers (one, two, three, four, five, six, seven...) or ordinal numbers (first, second, third, fourth, fifth, sixth, seventh...) but it is well agreed and understood the activities must have begun with simple counting like number of personal belongings, number of days, and progression and orders while performing activities and rituals. The earliest archaeological evidence found was estimated to be circa the year of 35,000 BC from Lembedo

³⁰ This statement also further argues that the creation of the universe itself is based on mathematical principles. See Livino: *The Golden Ratio* chapter 7, with the heading "Is God A Mathematician ?"

³¹ D. E. Smith, *History of Mathematics* (Gin and Company. Boston, 1923), 1-5.

Mountain, Africa and it was believed to be a form of bookkeeping).³²As the advancement of human activities from hunting and gathering plant to a more systematic agriculture during the Agricultural Revolution circa 10,000 to 4,000 BC, or specifically during the few first human civilizations – which founded near rivers for the agricultural activities – such as Mesopotamia, Egypt, India and China, the requirement to support daily activities such as trading and wage for workers has developed mathematics to more advanced calculations.

The other important factor in the history of mathematics that is worth mentioning here is the system of numbers. The system which in use today, that is the multiple of ten becomes the international standard through the development of Indian and Muslim mathematics. The Muslim during the time of Caliph Al-Mamun in Baghdad circa 809 – 833 who further developed the translation institute, the House of Wisdom (*Bait ul Hikmah*) started by his father, Harun al Rashid, invited two Indian mathematicians as court mathematicians to teach and translated the Indian mathematics into Arabic. As the trading advances to cross countries and nations, the Western world adapted the base ten numbers from the Arabs and called it the Arabic numerals. Smith argued the multiple of ten as accepted and practised today was due to the practical reason, as it is inconformity with the number of human fingers³³. Before the Arabs numerals become universal, the base numbers were varied in different civilizations. Babylonian and Sumerian (Mesopotamia) for instance used sixty as their base while the Inuit, French, Irish and Danish used twenty.³⁴

³² M. Livino, *The Golden Ratio, The Story of Phi, The World's Most Astonishing Number* (Broadway Books. New York, 2002), 16.

³³ Smith. 19.

³⁴ Smith. 18.