Mathematical Knot Semantic Logic: Theory and Example in Surah Al-Kahf

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Abstract. Start your abstract here Knot semantic logic theory is a new idea to explain the symmetry structure of a literature. The methodology used in this research is the combination of Theme-Rheme framework, Paltridge’s classification of thematic progression and symmetry diagram mapping. The results of this research are the establishment of knot semantic logic theory and the application to analyze the symmetrical structure in Surah Al-Kahf. After applying this theory to Surah Al-Kahf resulting that the chapter contains 9 groups form symmetrical structure. The first theme on this Surah is about Believers, non-believers and consequences connected to the last group with the similar theme. The theme of the second group is about self-quarantine mirrors to the second to the last group about lockdown. The third theme is about Patience and its reward related to the seventh group. The test of wealthiness the theme of the fourth group which mirrors to the sixth group talking about provision as a sign. Finally, the fifth group as the central of this chapter states that Quran has provided many lessons and guidance for human beings. Surah Al-Kahf is knot chapter with a mathematical symbol:

\[
\mathcal{Z}_1^1 \left( \mathcal{T}_1 (\mathcal{F}_1 (4)), \mathcal{T}_2 (\mathcal{R}_1 (3)), \mathcal{T}_2 (\mathcal{F}_1 (\varphi)), \mathcal{T}_2 (\mathcal{R}_1 (\varphi)), \mathcal{T}_2 (\mathcal{R}_1 (3)), \mathcal{T}_2 (\mathcal{F}_1 (\varphi)), \mathcal{T}_2 (\mathcal{R}_1 (3)), \mathcal{T}_2 (\mathcal{F}_1 (\varphi)) \right)
\]

1. Introduction

Logic is a natural language concerned with some cognitive performances as a proposition, a predicate, a model etc which is used to make some deductive or inferences that arguable that is logic or not, well synchronized therewith or not.

There are some examples in our daily life that can be analysed by mathematics. Generally, people know that people logic in their conversation by using logical thinking and they can also make some conclusion based on some logical sentences.

However, it is rarely found that person think about the whole logical pattern of what other person is thinking about. When a person is speaking, we will be able to conclude that he/she has a good pattern.

Holy book of religion books are the most important books in this world. It is because These books are the guidance for their followers.
In this scientific era, mathematics is one of the tools to calculate and something to evaluate the logical structure of things. So, in order to make objective evaluation of every holy book, we should make the basic/objective tool to make the mathematical idea which can be used consistently for every scripture.

In evaluating this tool, we can use it to identify some structure in Quran. Why Quran? This is because only the Quran among the holy books which claims that “it” is holy book without any single mistakes, any contradiction and preserves from the beginning Quran revealed to Prophet Muhammad Peace be Upon to Him until nowadays. Furthermore, only Quran gives challenge to all human being to make the similar of Quran, that many people from the era of Prophet (PBUH) until now had tried to break the challenge, but all of them failed.

This tool will also give an objective position of two different groups of Non-Muslim scholars about Quran.

One group of scholars and missionaries have asked about the beauty of Quran and could not see the miracle of the arrangement of Quran that made them have negative opinion of Quran. The historian Thomas Carlyle (1840) said that Quran “Just like the hard reading I have one, A wearisome confused jumble.” [1, pp. 64-67]. French Philosopher, Voltaire (1694-1778) stated, “The Quran is a rhapsody with no contact, no hierarchy, and no art. By calling it, it means that this boring book is very beautiful-I mean Arab, pretending to be an elegant and pure book, and no one has ever touched it.” [2][3]. Other scholars and Missionaries such as Hartwig Hirschfeld [4] thought that the Qur’an “indescribably tedious”. Richard Bell [5] criticize arrangement of Surah in Quran.

On the other hand, there are some Scholars has found the beautiful arrangement of Quran. Such as Angelika Neuwirth Neal Robinson [6], Yasir Qadhi [7] and important finding from research Abd al-Hamid al-Farahi (died 1930) [8] and Amin Islahi (died 1997) [9], Muhammad Tabababay (died 1981) and Said Qutb (died 1966) about the structure of Quran. They found the beautiful arrangement of every part of Quran in extraordinary design.

We have to give a credit to Al-Biqa’i whose full name is Ibrahim bin Umar bin Hasan ar-Ribat bin Ali bin Abi Bakr asy-Shafi’i al-Biqa’I, for he was the first Scholar who managed to find a method of harmony verse by verse even word for word in Quran in his impressive multivolume exegesis, The Arrangement of Pearls: An explanation of the Interconnection of Verses and Chapters. The statement was summarized by the Andalusi judge, Abu Bakr ibn al-‘Arabi (d. 543/1148): “The verses of the Qur’an are joined together in such manner that they are like a single word, associated harmoniously [10].

Their efforts bore fruit most notably in the impressive multivolume exegesis of al-Biqa’i, The Arrangement of Pearls: An explanation of the Interconnection of Verses and Chapters. Overall, their findings might be summarized in this statement by the Andalusi judge, Abu Bakr ibn al-‘Arabi (d. 543/1148): “The verses of the Qur’an are joined together in such manner that they are like a single word, harmoniously associated, structurally even.” [11]

In order to make objective judgment we can make the tool that all the holy books, even the modern literature book can be analyzed, this article will establish the theory of Knot semantic logic. Knot semantic logic is one idea to analyse the pattern of the whole of one sentence or pattern of some literature. The theme, sentence, or words of the literature will be analyze the theory of this pattern. The knot semantic logic inspired by the knot theory. This mathematical field existed in the 19th century. Peter Guthrie and Sir William Thomson (Lord Kelvin) use this theory to propose the model of the atom. Although these atom models were rejected later and scientists lost their interest in knot theory almost about 100 years, this theory then became a vibrant field of mathematics when the Vaughan Jones discovered a new polynomial invariant of knots [12] which helped to classify knots and lead an astonishing connection between knot theory and chemistry and other diverse disciplines.

Some phenomena can be studied from the knot theory point of view, such as surgical sutures, entangled earphones, and tying shoelaces. Some events can form a knot that is a spontaneous moment, such as electrical cable, headphones, and garden pipes. Other knot phenomena during human pregnancy called umbilical knot that caused by the obstruction of blood circulation to the fetus [13].
Furthermore, some phenomena in our world and space can be represented in the knot diagram. For example, the orbit of planets in the solar system also forms in linking knot and atom diagram form regular knot.

In this article, beside establishing knot semantic logic, it will also be used to find the existence of symmetry in words, sentences, verses, chapter of surah Al-Kahf.

2. The Analytical Framework and Methodology

The methodology used in the analysis has three main procedures.

- Construct the mathematical theory of Knot Semantic logic. Data was taken from Quran translation Sahih International and the clean Quran by Mustafa Khattab [14] and validly by the original language (Arabic language). Theme-Rheme framework is modified to determine the thematic structures in the data [15]. The applications of this procedure are: (1) the division of the verse into clauses and (2) the clauses are then divided into themes and similar focusing on the different types of theme.
- Paltridge’s classification of thematic progression is used to analyse thematic progression. Paltridge [16] pointed out that topic development refers to the way in which the topic of a clause or word can repeat the meaning of the previous topic or word. This method can identify the similar or repeating theme or similar word, Zigzag/linear theme pattern, multiple theme.
- Identify the connection between chapter/sentence by mapping the theme or similar worlds in symmetry diagram.

3. Result and Discussion

3.1. Knot Semantic Logic

Knot semantic logic inspired by the abstraction of some phenomena of symmetry in universe and applied in sentence. The law symmetry can be expressed in parallelism, chiasm and concentric ([17, 11, 18, 19]).

3.1.1. Basic Concepts:

Symmetric law in knot semantic logic can be identified by the parallelism of character, world, sentence or theme and defined as knot point. The parallelism in knot point can be expressed in Synonyms, Antonym, similar meaning or similar theme. Below is the explanation of the part of knot semantic logic.

- Knot word (symbol \wp) is the sentence that has micro symmetry compositing which means the character in the word form parallelism, chiasm and concentricism. We can define the sentence or word as Knot word if a sentence or a word has meaning, and the meaning explain the word of itself or explain the sentence in the world itself (microstructure). Knot point in logic point is characters.
- Knot sentence (symbol: \lm) is sentence which contains word/sentence and forms parallel composition, or chiasm structure or concentric/ring structure (ring composition). Knot point in Knot sentence is words
- Knot theme (symbol: \daleth) is a group sentence that has symmetrical law. Knot point in logic theme is words in sentences.
- Knot chapter (symbol: \bet) is chapter contains group sentences (themes) form that has symmetric structure.

The characteristics of the sentences or essay that can be categorized as knot semantic logic are: (a) it is a structure in mirror image or parallel image; (b) the first half will reflect the second half. The interior sections correspond to each other’s. The middle section accords with the beginning or the end. (c) The parallelism between correspondent part can be the repetition of striking or evident words or phrase and present complete circle and provide closure.
All the concepts of this knot semantic logic are divided into four types of symmetry structure, named Type 1, type 2, type 3, and type 4. Every type is defined as follows.

Table 1. Types of symmetry structure

| Type                      | Structure                                                                 |
|---------------------------|---------------------------------------------------------------------------|
| Concentric/ring composition (Douglas, 2007) | A contraction of parallelism that is connected or goes back to the beginning: A or A/B/C or AB/C/B’A’ or in general: \( A_1, A_2, A_3, ..., A_n, A_{n+1}, A'_n, ..., A'_3, A'_2, A'_1; n \in \mathbb{N} \) |
| Chiasm                    | The structure takes the form A/A’ or AB/A’B’ or in general: \( A_1, A_2, A_3, ..., A_n, A'_1, A'_2, A'_3, ..., A'_n; n \in \mathbb{N} \) |
| Parallelism               | The structure takes the form A/A’ or AB/A’B’ or in general: \( A_1, A_2, A_3, ..., A_n, A_{n+1}, A'_n, A'_1, A'_2, A'_3, ..., A'_n; n \in \mathbb{N} \) |
| Parallelism with centre   | The structure takes the form AB/CC’/A’B’ or in general: \( A_1, A_2, A_3, ..., A_n, A_{n+1}, A'_n, A'_1, A'_2, A'_3, ..., A'_n; n \in \mathbb{N} \) |

In order to understand easily the whole model of this concept of the knot semantic logic, we will define the mathematical symbol of Knot semantic logic as follows:

**General mathematical symbol of knot semantic logic is** \( Q_{\alpha}(t) \), **where** \( \alpha \) **is the number of logic point**, \( \beta \) **is the type of symmetric law and** \( t \) **is the position number of the knot point**, \( \beta = 1, 2, 3, 4 \) **and** \( \alpha, t \) **are any natural number**

\[
Q_{\alpha}(\beta) = Q_{\alpha}(t)
\]  

In detail the symbols of knot chapter, Knot theme, Knot sentence, Knot word are \( \alpha(t); \beta(3); \phi_{\alpha}(\beta); \phi_{\alpha}(t) \), respectively. If knot chapter contains Knot theme and the Knot theme contains Knot sentence and Knot sentence contains knot word, so the general symbol of knot semantic logic will become

\[
Q_{\alpha}(\beta)(\phi_{\alpha}(t)) \]

3.2. Analyzing the knot semantic logic in surah Al-Kahf.

Al-Kahf[1] (Arabic: الكهف, "The Cave") is the 18th chapter (sūrah) of the Quran with 110 verses (āyāt). This surah was revealed to answer the question of Rabbi that asked by the Quraish to prove that Prophet Muhammad (PBUH) is the true messenger of Allah. The question is: (1) about some young men in ancient times (ashabul kahfi), what was their story for theirs is a strange and wondrous tale. (2) about a man who travelled a great deal and reached the east and the west of the earth (3) about the Ruh (soul or spirit). This chapter was revealed when Prophet Muhammad (PBUH) in Mecca [20]

We will explore surah Al-Kahf by analyzing the theme of group of verses

3.2.1. Verses 1-8

Diagram 1: verses 1-8
Diagram 1 presents the symmetrical law of the first group. The verse 1 about Quran is mirror to the verse 6 about message from Allah. The verse 2 is about after life that mirrors in the verse 7 that talking about the test in the earth. Similarly, the verse 3 is mirroring verse 8 that taking about forever (afterlife) and verse 8 is about temporary (in this world). Verse 4 and 5 is the central of this group that reveal the warming to disbeliever. Generally, the theme of this group of chapter is about Believers and disbelievers and the consequences.

The structure of this first section is Parallelism \( (A_1,A_2,A_3,A_4,A_5,A_6,A_7,A_8) \)

Based on the structure, the first section is categorized as knot theme. With 4 knot point. This group has an unique logic theme, because in the middle has symmetric structure that can be symbolized . This group forms logic theme type 4 with 8 knot points and the centre (the 4th knot point) forms knot sentence type 2 with 6 knot points. The mathematical symbol for this group is

\[
\overline{7}_{8}^{(3)}\overline{6}^{(4)} (3)
\]

3.2.2. Verses 9-27 : Self-Quarantine (the story of the people of the Cave)

Diagram 2 shows the whole story of Ashabul Khafi (the companion of cave) who did self-quarantine in the cave. This story is presented in verses 9-27. The verse 9-10 has similar theme with verses 27 about signs which revealed in Quran. The verse 11 is the duration time of the youth sleeping in the cave and this is similar with the verse 26. Similarly, the verse 12 connects to verse 25 that mention about the calculation of the duration of time. We can see Other similar connection Verse 13 and verse 23-24 (about guidance); verses 15 and verses 21 (about believers and nonbelievers), verses 16 and verses 19-20 (about return-refuge and accommodation /provision). The center of this group also mention about the signs of Allah in natura (sun) and the way Allah turned the Ashabul kahfi and similar words that used (the right and the left).

The structure of this second group is chiasm \( (A_1,A_2,A_3,A_4,A_5,A_6,A_7,A_8,A_9,A_10,A_11,A_12,A_13,A_14,A_15,A_16) \). This second group is categorized as knot theme type 2 with 16 knot points . The mathematical symbol for this group is

\[
\overline{7}_{16}^{(3)}\]
3.2.3. Be Patient and Reward

Diagram 3 shows the simple connection between the verses in the third group. It is clear to see that the verse 28 connects to the verse 31-32 about a good deed (patient) and it is reward. On the other hand, the verse 29 taking about people who do the wrongdoers will have a serious consequence (hellfire). Generally, the central theme of this group is be patient and its reward.

The structure of this third group is concentric \((A_1, A_2, A'_1)\). Based on the structure, this second group is categorized as knot theme type 1 with 3 knot points. The center of this group form knot sentence type 1 and 1 knot point. The mathematical symbol for this group is \(\tau_1^1\left(\mathcal{S}_1(\rho)\right)\)

3.2.4. The test of Wealth (the story of Two Companions)

Diagram 4 illustrates story of two companions. The connection between the beginning and the end of the group chapter is clear mentioned in every verse. Some group of verses connects to one verse such as verses 34-36 and verse 45. Other verses is similar in terms of the substance such as in verse 37 and verses 40-41. The central of this group is about authority /power only from Allah and also the best Reward only form Allah.

The structure of this fourth group is Parallelism with centre \((A_1, A_2, (A_3, A_4, A_5, A'_3, A'_4, A'_5), (A'_1, A'_2))\). Based on the structure, this fourth group is categorized as knot theme type 4 with 3 knot points. The centre of this group form knot sentence type 4 and 6 knot points. So The mathematical symbol for this group is \(\tau_1^1\left(\mathcal{S}_1(\rho)\right)\)

3.2.5. Set Forth in Quran every kind of lesson for Humankinds

This group of verses is that Allah has give many examples as lessons for human beings. The symmetrical law in this group is presented in diagram 5
Diagram 5. Presents four mains themes.

The first is in the verses 47 and 59 about the destruction of the earth / city and the time of everything. Verse 49 and 58 Allah is the forgiving, full of mercy, Justice and knows everything. The next in verse 50-52 and 56-57 are about Messengers/Adam, disbelieves/ devil, and why the misguidance and disbelievers could not respond. While the last verses are 54 and 55 as the central of this group is about Quran has provided many lessons and guidance.

The structure of this fifth group is chiastic that forms $A_1, A_2, A_3, A_4, A'_4, A'_2, A'_1$. Based on the structure, this fourth group is categorized as knot theme type 2 with 8 knot points.

$$\tau_8(3)$$

3.2.6. Provision as a guidance (the story of Prophet Moses and His servant)

The ring composition of this group of verse is presented in diagram 6

Diagram 6. Verses 60-65

Diagram 6 illustrates the unique connection among the verses in this group. Verse 60 mentions about the servants and traveling that mirrors in the verses 64-65. Similar connection happens in verse 61 and 63 about their meal/fish (provision) and its miracles. Finally the key point of this groups is in verse 62 that reveals the connection between the meal and the destination

The structure of this sixth group is a ring composition $(A_1, A_2, A_3, A'_2, A'_1)$. Based on the structure, this fourth group is categorized as knot theme type 1 with 5 knot points. The centre of this theme also forms chiastic with 1 knot point. The mathematical symbol for this group is

$$\tau_5(3^1(\rho))$$

3.2.7. Patients, knowledge as reward (The story of Prophet Moses Peace be upon to Him (PBUH) and Prophet Kha lidir (PBUH))

This group of verses tell us about the story of Prophet Moses (PBUH) learned from Prophet Kha lidir (PBUH). Below are the translations of the verses 66-82. The connection between verses is presented in diagram 7
The diagram 7 presents the connection between the verses. Verses 66-69 about the willing of Prophet Moses (PBUH) to follow Prophet Khaidir (PBUH) and have to be patient. In verse 70, Prophet Khaidir (PBUH) gave lessons to Prophet Moses (PBUH). While Verses 71 till 77 are about Prophet Moses (PBUH) followed Prophet Khaidir (PBUH) and Prophet Moses (PBUH) have to be patient. Finally the verses 78- until 82 about the explanation Prophet Khaidir (PBUH) about the journey of the two servants of Allah. Generally, this group of verses is about patience and some valuable lessons.

The structure of this seventh group is parallelism ($A_1, A_2, A_1', A_2'$). Based on the structure, this group is categorized as knot theme type 3 with 4 knot points. The mathematical symbol of this group is $\frac{1}{3}(8)$

3.2.8. Lockdown (the Story of Dhul-Qarnayn and Gog and Magog).

Verses 9-27 is about story of Dhul-Qarnayn, His Journey and Gog and Magog, the translation of the group of verses is presented below: The connection between verses is presented in diagram 8

Diagram 7. Verses 66-82

Diagram 8. Verses 83-94
make barrier between two mountains. Finally, verses 85-93 are talking about the power that Allah gave to Zul-Qarnayn during his journey to go to anywhere and this mirrors with verses 97-99 that give information that Gog and Magog don not have any way to pass the barrier until the time that Allah have promised.

The structure of this group is chiasctic \((A_1, A_2, A_3, A_4, A_5, A_1')\). Based on the structure, this group is categorized as knot theme type 2 with 6 knot points. The mathematical symbol of this group is

\[
\tau_2^2({\mathfrak{T}}) \tag{9}
\]

### 3.2.9. Believers, nonbelievers

The last part of surah Al-Kahf is similar with the first part of thesis surah. It focuses on believers, nonbelievers, and their consequences and rewards. Below is the verses in this last part. The connection between verses can be seen in the diagram 9.

Diagram 9 presents the symmetrical law of the last group. This group has two big group themes. The first group is talking about disbelievers and the consequences of the verse 106 about disbelief, Hell that mirrors to the verse 100-102 with similar theme. The verse 105 and verses 103 are about who will lose the most deeds. Furthermore, this theme explains more in verse 10 as the centre part of this sub group of verses.

The second part about believer and it is rewards. The verse 107 is talking about believers and its rewards and it mirror with a the last verse that prepares into “good deeds hope meeting with their lord”. The next verse, verse 108 is talking about reward for believer forever in the paradise, and this associated with the verse 109 about the ocean ink is not enough to write the words of Allah.

The structure of this ninth group is chiastic as presented below

\[ A_1, A_2, A_3, A_4, A_5, A_1' / A_4, A_5, A_4', A_5' \]

Based on the structure, this group is categorized as knot theme type 2 with 2 knot points which every knot point contains knot theme. The first Knot theme is type 2 that has 6 knot point while another is parallelism (type 3) with 4 knot points. So the mathematical symbol of this group is

\[
\tau_2^2(\tau_2^6, \tau_4^6) \tag{10}
\]

Based on the explanation in the part B, we can conclude that Surah Al-Kahf is knot chapter with ring composition with 9 theme, in this case 9 knot points. So the mathematical symbol for surah Al-Kahf is

\[
\begin{align*}
\Delta_9^0 \left( \tau_2^6 \left( \mathfrak{T}_6(4) \right), \tau_2^6 \left( \mathfrak{T}_6(3) \right), \tau_2^6 \left( 3 \mathfrak{F}(6) \right), \tau_2^6 \left( \mathfrak{T}_6(3) \right), \tau_2^6 \left( 3 \mathfrak{F}(6) \right), \tau_2^6 \left( \mathfrak{T}_6(3) \right), \tau_2^6 \left( 3 \mathfrak{F}(6) \right), \tau_2^6 \left( \mathfrak{T}_6(3) \right), \tau_2^6 \left( 3 \mathfrak{F}(6) \right) \right)
\end{align*}
\]

the connection of every knot theme is presented in diagram 10.
4. CONCLUSION

This article has established knot semantic logic theory. This theory contains Knot chapter, knot theme, knot sentence and knot world. The mathematical symbol is defined to make simplification of the concepts. The result is that the surah Al-Kahf is knot chapter with a mathematical symbol

\[
\sum_0^n \left( \sum_0^4 \left( \sum_0^3 \left( \sum_0^2 \left( \sum_0^1 \left( \sum_0^0 \right) \right) \right) \right) \right)
\]

This chapter has 9 themes which form symmetrical structure. This chapter begun and ended with Believers, non-beliwevers and consequences, the second layer is started by self-quarantine (the story of People of the Cave) and ends by lockdown (the story of Dhul-Qarnayn). The next layer is begun with the Patient and the reward. The test of wealthy/provision (the story of two companion and two gardens) as the beginning of the fourth layer and provision as a guidance (the story of Prophet Moses and his servant) is the final mark of this layer. In the last layer, as the central of this chapter, started and ended by the statement that the time will come for everything and in the middle of this chapter, Quran has provided many lessons and guidance.

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