LINGUISTIC BIAS OF CONCEPT MAPPING: IS WORD ORDER A MATTER?

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Abstract. This paper investigates linguistic limitation of concept mapping (CM) where word order is different with English sentence structure: Subject-Object-Verb. One of the main distinctions between CM and other knowledge representative techniques is adoption of proposition, as the smallest linguistic unit, for developing a concept map (node-link-node). Consequently, a concept map, which is developed in English, can be read as same as a sentence presented in a text. But this distinction causes confusion and creates learning problems when a concept map drawn in languages with different word order, such as Subject-Verb-Object languages. This paper briefly reviews the related literature and suggests some solutions for solving the problem.

1   Introduction

Although there are a variety of knowledge representative techniques (such as semantic network and mind map), concept mapping (CM) is the most popular of them, especially in academic and educational situations. The most important reason for CM popularity is enormous body of research showed its effectiveness for several purposes in different subject matters (see for example, Cañas & Novak, 2006). Although more than three decades have passed since its establishment, there are still many researchers and educators who are interested on the application of CM as an effective learning technique; Concept Mapping Conference (CMC) and many journal papers (378 journal papers was retrieved in ERIC database about "concept mapping" between 2000 and April 2008) are reflected this interest.

CM technique was established on the basis of English sentence structure, Subject-Verb-Object (SVO), and the main distinction, which differentiates CM from other techniques, is the application of proposition, as the smallest linguistic unit. For developing a concept map, two concept or nodes is related by a link, which in most cases is a verb (node-link-node). Thus a concept map, that is generated in English or other SVO languages, can be read as same as its related sentence in a text.

However, this unique characteristic of CM causes a limitation for developing concept map in some languages. Many people around the word are speaking and studying with languages that their word order is not SVO. For example, some languages, such as Korean Turkish, Arabic, Persian and Japanese, have Subject-Object-Verb (SOV) word order. In SOV languages, the link (verb) between two concepts comes at the end of the sentence. When a concept map is developed in a SOV language, it cannot be read as same as its related sentence presented in the text. Users of CM technique, whom their formal language does not have SVO word order, would experience confusion and problems, or at least inconvenience, for developing a concept map (see for example, Kilic, 2003; Lee, 1999). In this situation, CM technique might be accused of linguistic bias. In addition, it might question the application of CM as a worldwide technique and forces educators and learners to use other techniques. It seems research is needed to investigate: "how should CM technique be used in SOV languages or, in general, languages with word order other than SVO?"

2   CM versus other visual knowledge representative tools

First, the main difference between CM and other knowledge representative techniques should be addressed. There are many words that seem to be synonymous with or related to CM, including, mind map, semantic map, semantic net (or networking), cognitive map, roundhouse diagram, concept circle and flowchart. Some of these terms are sometimes used interchangeably. However there are some elegant and theoretical differences between them. Semantic network is the most popular term that is usually used instead of CM and some authors prefer to use it (e.g., Jonassen, Peck & Wilson, 1999). The exact definitions of these terms are presented in table one.

Although researchers have presented many definitions for CM and a clear distinction among these definitions would be difficult, most of them are common in the application of few words: <u>node</u> (concept, point, or vertices), <u>link</u> (line, arc), proposition and graphical or visual representation. Reader and Hammond (1994) suggested a simple definition for concept map as "a graphical representation of domain material generated by the learner in which nodes are used to represent domain key concepts and link between them denote the relationship between these concepts" (p. 52). The proposition refers to the combination of two nodes (concepts)

and a link that joins them (Ruiz-Primo & Shavelson, 1996). According to Anderson (2005), a proposition is the smallest linguistic unit that carries meaning.

Name	Definition
Mind map	This technique invented by Tony Buzan. Its primary role is as a note technique that helps learners to take note during a lecture or reading learning materials. It has only one main or central concept (word). Around this central concept there are 5 to 10 main ideas that relate to that word. Each of these child words can be taken and as a main word and 5 to 10 related words is drawn. Mind map can be represented as a tree.
Flow chart	Flowchart is graphical representation of a process which depicts through the steps of the process in sequential order.
Semantic network	Semantic network is the most popular term that usually are used instead of CM and some authors prefer to use it.
Concept map	A technique invented by Novak as an educational tool. It can be use to explore prior knowledge and misconceptions, encourage meaningful learning to improve students' achievement and measure concept understanding. A concept map may have several main concepts and can be represented as a network. CM is based on a logical and graphical organization of concepts.

Table 1. *Definitions* of concept map and some familiar terms

The use of the proposition for developing a concept map is the main point which differentiates CM from other knowledge representative technique. In most of other techniques, the concepts are linked by a line that is usually not labeled. Thus, if this distinction is ignored, there won't be any specific difference between CM and other techniques. Some research, which is conducted in SOV languages, does not pay attention to this distinction and, incorrectly, use other techniques instead of CM (see for example, Takeya, Yasugi, Funabashi & Nogaoka, 2006).

3 Word order in language

A question might arise here that "how many languages are there with word order other than SVO?" and "is it worth to discuss this problem?" Word order typology is a linguistic subject. It investigates the different ways in which languages arrange the constituents of the sentences. Although some languages allow flexibility, most languages however have preferred word order which is used most frequently (Tomlin, 1986).

It is possible, for most languages, to define a basic word order. There are six possible word orders for the subject, verb and object: subject verb object (SVO), subject object verb (SOV), verb subject object (VSO), verb object subject (VOS), object subject verb (OSV) and object verb subject (OVS). However, the majority of the world's languages are either SVO or SOV (Dryer, 1991). These are in the order of most common to rarest as below (Wikipedia Encyclopedia, 2008):

- SOV languages: For example, Japanese, Turkish, Korean, Persian, the Indo-Aryan languages and the Dravidian languages;
- SVO languages: For example, English, Portuguese, French, Chinese, Bulgarian, and Swahili;
- VSO languages: For example, Classical Arabic, the Insular Celtic languages and Hawaiian;
- VOS languages: For example Fijian and Malagasy;
- OSV languages: For example Xavante;
- OVS languages: For example Hixkaryana.

Table two shows some of the most common languages in the world (summarized from information presented at UCLA Language Material Project, 2008). Among most common languages (with more than 200 millions speaker), Arabic and Bengalia have SOV word order. It shows millions of people around the world are speaking with SOV languages (especially in Asia) and this large population cannot be ignored.

4 Different between SVO and SOV languages in developing a concept map

In SVO languages, the relationship between two words (concepts) is expressed by a verb or a preposition. In consequence, a concept map is read as same as a correct sentence in its related text. In contrast, in SOV languages, objects precede the verb and so when a concept map is read, it does not make a complete and meaningful sentence. Figures one to three show three simple concept maps and their related sentences, in one SVO language (English) and two different SOV languages (Turkish and Persian).

Continent	Language	Population (Million)	Dominant word order	Continent	Language	Population (Million)	Dominant word order
Asia	Burmese	30	SOV	Europe	Albanian	5	SVO
	Nepalia	16	SOV		Dutch	20	SVO
	Assamese	15	SOV		Bosnian	2	SVO
	Marathi	70	SOV		Serbian	11	SVO
	Sinhalese	13.2	SOV		Croatian	6	SVO
	Tamil	66	SOV		Bulgarian	9	SVO
	Telugu	69	SOV		Danish	5.5	SVO
	Sindhi	21.5	SOV		Finland	6	SVO
	Maithili	25	SOV		Belarusian	10	SVO
	Kashmiri	6.6	SOV		Chez	12	SVO
	Bhojpuri	25 to 30	SOV		Estonian	1.5	SVO
	Oriya	N/A	SOV		Hungarian	14.5	SVO
	Urdu	60	SOV		Latvian	2	SVO
	Punjabi	104	SOV		Lithuanian	3.5	SVO
	Gujarati	46	SOV		Romanian	25	SVO
	Hindi	180	SOV		Polish	43	SVO
	Kannada	35	SOV		Tatar	6 to 57	SOV
	Malayalam	36	SOV		Buriat	.450	SOV
	Baluchi	7	SOV		Chechen	1.2	SOV
	Brahui	2.2	SOV		Bashkir	2	SVO
	Uzbek	15	SOV		Slovak	5.5	SVO
	Cantonese	64	N/A		Ukrainian	46	SVO
	Hmong	3	SOV		Swedish	8	SVO
	Tibetan	3 to 7	SOV		Basque	.580	SOV
	Uighur	7.5	SOV		Icelandish	.280	SOV
	Korean	72	SOV		Macedonian	2	SVO
	Japanese	121	SOV		Catalan	7	SVO
	Mongolian	6	SOV		Maltese	.500	SVO
	Armenian	6	SVO		Norwegian	4.5	SVO
	Azerbaijani	7	SOV		Welsh	N/A	SVO
	Greek	12	SVO	Africa	Fula	12 to 15	SVO
	Turkish	56	SOV		Bambara	3	SOV
	Arabic	N/A	SOV		Hausa	22	SVO
	Georgian	4	SOV, SVO		Yoruba	22	SVO
	Kurdish	13	SOV		Lingala	10	SVO
	Persian: Farsi	23	SOV		Wolof	7	SVO
	Hebrew	5.3	SOV		Ewe	3 to 5	SVO
Most Common Languages (with more than 200 million speakers)	English		SVO		Igbo	18	SVO
	French		SVO		Mende	1.5	SOV
	Spanish		SVO		Sotho	10	SVO
	Germany		SVO		Malagsay	13	VOS & SVO
	Russia		SVO		Afrikaans	6	SVO & SOV
	Portuguese		SVO	America	Quechua	8	SOV
	Arabic		SOV		Navajo	.148	SOV
	Mandarin		|SVO		Haitian	6	SVO
	Bengalia		SOV				

Table 1: Most common languages in the world and their word order

The following figure shows a simple concept map in English. The correct and meaningful sentence in the text is: "Children <u>love</u> their mother" and the concept map is read in a similar way: "Children <u>love</u> their mother".
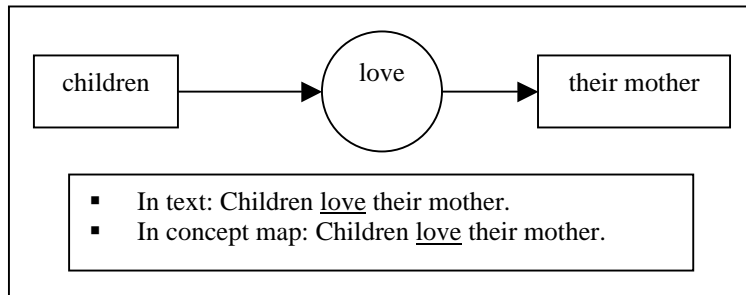
Figure 1. A simple concept map, and its related sentence, in English language

Figure 2 presents a simple concept map in Turkish. Turkish is a SOV language. "Cocuklar" means children, "Anne" means mother and "Sever" means love in Turkish. The correct and meaningful sentence in the text is: "cocuklar anne <u>sever</u>" but the concept map is read: "cocuklar <u>sever</u> anne".
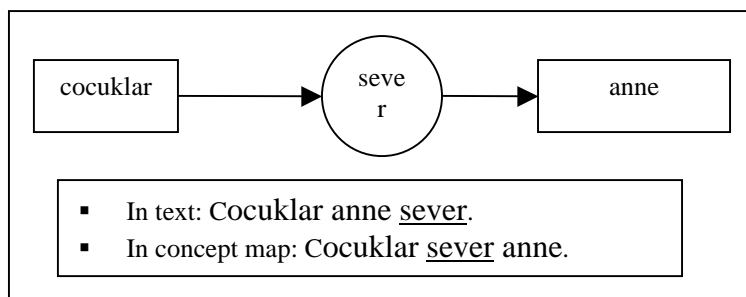

Figure 2. A simple concept map, and its related sentence, in Turkish language

Figure 3 presents a simple concept map in Persian. Persian or Farsi is a SOV language. In Persian (and some Asian languages, such as Arabic) sentence is written from right to left. "   " means children, "   " means mother, "   " means their and "   " means love in Persian. The correct and meaningful sentence in the text is: "   .⇐" but the concept map is read: "   ⇐". It is an incorrect sentence in Persian language because the verb (_____) came before object (   ).
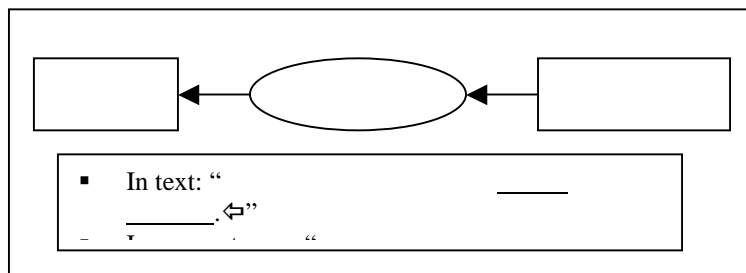

Figure 3. A simple concept map, and its related sentence, in Persian language

5   Research on CM conducted in SOV languages

Although CM was originally developed for use in English, with its unique characteristic in expression of a labeled link among concepts, it was welcomed in other SVO languages as an effective learning tool, such as French and Spanish. Therefore most of research published on CM conducted in the countries where the first languages were SVO. A review of papers presented in the first and second CMC show almost all of the papers reported the research conducted in SVO languages (Cañas & Novak, 2006, & Cañas, Novak & González, 2004). However, there are some papers that presented the results of CM research where the first language was SOV; for example, Turkish (Kilic, 2003), Persian (Mesrabadi, Fathi Azar & Ostovar, 2005), and Korean (Lee, 1999). These researches could be summarized into following categories:

- Using CM in situations where English, or other common SVO languages, is formal educational language (see for example, Kozminsky, Nathan & Vaizberg, 2006; Kharade & Thomas, 2006);
- Using CM for teaching and learning English, or other SVO languages, as the second languages. CM has been used as an effective tool for teaching and learning English as a foreign or second language (see for example, Tumen & Taspinar, 2007; Ojima, 2006; Vakilifard & Armand, 2006; Yamada, 2005);
- Application of CM without considering the distinctive characteristic of CM. In fact, they used other forms of knowledge representative techniques, instead CM. In this case, they did not undertake to connect the concepts by link among them (see for example, Takeya, Yasugi, Funabashi & Nogaoka, 2006; Mesrabadi, Fathi Azar & Ostovar, 2005; Grow-Maienza, Hahn & Joo, 2001).
- Some research investigated how CM could be used in SOV languages (see for example, Kilic, 2003; Lee, 1999).

6   Suggestions for using CM in SOV languages

If the distinguished characteristic of CM is ignored, it will mean CM does not have any priority for representation of knowledge to other techniques. For solving the problem of using CM in SVO, some solutions have been suggested (Kilic, 2003; Lee, 1999). Based on research and practices, a concept map can be developed in SOV languages in one of the following ways (all examples, presented in the figures, are in Persian language):

- Drawing a concept map in the same way as in a SVO language, but its complete and meaningful sentence, in SOV format, is written below the concept map (figure 4).
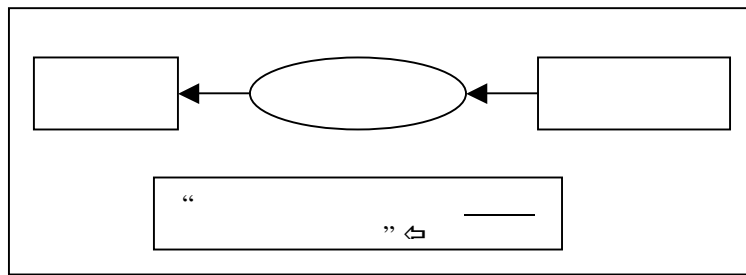

Figure 4. Writing relationships between concepts in a complete and meaningful sentence below the concept map

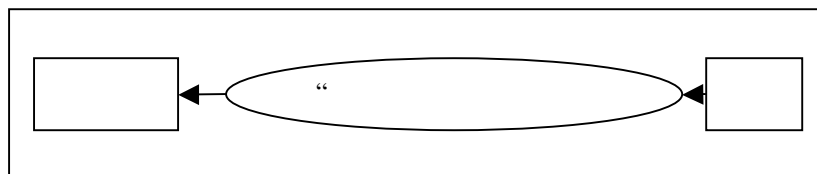- Writing the complete and meaningful sentence in the link between two concepts (figure 5).

Figure 5. Writing complete and meaningful sentence as a link between nodes

- Writing the link (or verb between two concepts) in the second node, following the object (figure 6). When the concept map is read, it will be the correct and meaningful sentence in SOV language. The apparent form of the concept map is as same as other representative techniques but it will give the convenience of drawing concept map to learners.
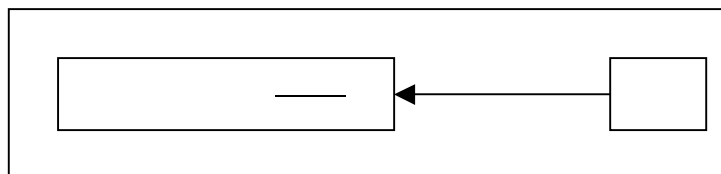

Figure 6. Writing link in the box of the second node

- Another alternative is drawing a concept map in a way which presented in figure 6, but the box of the second node divided by a line, to separate the verb (link) from object.
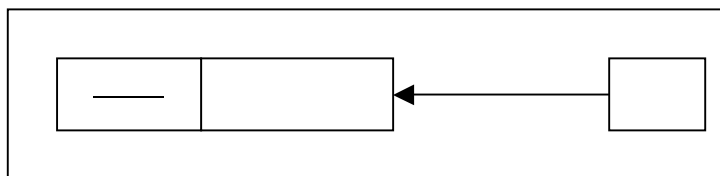
Figure 7. Writing link in the box of the second node separated with a line

- In computer version of CM, using a dialog box in which the proposition presented the SOV language.
- Constructing a concept map in SVO format, but the relationship between the concepts is explained verbally.

7   Summary

Given the way concept maps are currently drawn and constructed, the word order of some languages, that are different with English and other SVO languages, is very difficult to depict in a traditional node-link-node format. When learners in SOV languages construct a concept map, they have to use SVO word order that is different with their first language and makes an incorrect and incomplete sentence. This change can cause confusion and create some problems in learning process. There are some alternative ways to use CM in these languages, but research is needed to investigate which method should be used.

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