Development of Interactive Arabic Proverbs Knowledge-based Systems

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Summary
Arabic proverbs are well known as one of the sources for understanding Arabic life and culture. These proverbs rich with life values and wisdom, which one could create useful knowledge from them. Having a system that allows people to access these knowledge is desirable. Despite there are many existing knowledge-based systems for various domains, to the best of our knowledge, none attempt has been made to develop a knowledge-based system for Arabic proverbs. One of complexities in understanding Arabic proverbs is to understand its semantics. Literal understanding is not able to convey its values and wisdom. The aim of this research is to generate a methodology for developing an interactive knowledge-based system for Arabic proverbs based on its semantics. A prototype system had been developed to test the methodology. The prototype was validated by a human expert, while human users were used to evaluate the success of the system based on a satisfaction criterion. Results from the expert and users' assessment show that the proposed methodology is successful.

Key words:
Knowledge-based system, knowledge visualization, Arabic proverbs.

1. Introduction

The Arabic language is spoken by 420 million of people across the world, in countries like Saudi Arabia, Jordan, Sudan, Iraq, Algeria, Egypt, Ethiopia, and dozens of others. Modern Standard Arabic is a descendant of Classical Arabic, a language from the 6th century. Its written alphabet is the Arabic alphabet, read from the right to the left. Arabic is an ancient language and an ancient, rich culture, with an equally rich bank of proverbs and sayings.

There are different definitions of a proverb, such as "a short popular saying, usually of unknown and ancient origin, that expresses effectively some commonplace truth or useful thought (www.dictionary.com)", or "short, well-known pithy saying, stating a general truth or piece of advice (oxforddictionaries.com)". Other definitions view a proverb as a brief saying presenting a well-known truth that is popular and familiar to all [1]. Proverbs are words which have been used as a society's ways to guide its members on how to act in a difficult given situation and to provide advice for problem solving. These words have a strong power, sometimes they can save life, and sometimes they can cause death. Proverbs manifest themselves in many different forms and can be applied to many different circumstances. They are varied in content, age, form, structure, kind, and origin.

Some proverbs can apply to many people and many places; thus they are common to many cultures, and have endured for a long time. Others that deal with aspects of daily life are applicable only to a given region or to a given situation or time. Proverbs make up and reflect the cultural identity of a specific society, and despite the uniqueness of languages and the profound differences between cultures, there are proverbs that shed light on universal truths of human life, common traditions and beliefs, and such shared values as ambition, virtue, generosity, patience, friendship, loyalty, and family ties.

Understanding the foreign culture and developing intercultural competence comes from a variety of sources such as one's own cultural background, religion and life experience, and their proverbs [2, 3]. Such proverbs have bridged linguistic and cultural barriers throughout human history. For example, the idea that the words a person chooses to articulate his or her thoughts can be crucial to his or her well-being. This idea is shared by different cultures and is expressed through proverbs using different culturally based metaphors. Let us consider this Arabic proverb that compares the tongue to a horse: "Your tongue is your horse. If you keep it, it keeps you, and if you betray it, it betrays you". This proverb makes a relationship between a human tongue and a horse, indicating how horse is very much appreciated in the Arabic culture. By having an understanding about the proverb, it might help outsider to immediately grasp the cultural significance of the proverb, without knowing its original context [5]. Reference [5] reported the use of Arabic proverbs in a classroom to facilitate new understanding and insights into the Arabic cultural concept. The study has revealed that engaging students with the Arabic culture through proverbs was proved to be a powerful educational technique for enhancing the development of intercultural competence.

Understanding its original context needs a person to have three pieces of knowledge;

- knowledge in Arabic language,
- knowledge about the Arabic history

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- knowledge about Arabic cultural circumstances where the proverbs are used.

The only solution for the mentioned problem is to store the human knowledge about Arabic proverbs and their semantics in a computerized system so called a knowledge-based system [6]. By having a knowledge-based system a layman who does not know the Arabic language and does not have knowledge about Arabic history and its cultures, can grasp semantics of the Arabic proverbs. To the best our knowledge, none such system has ever existed. The purpose of this research is to generate a methodology for developing an interactive knowledge-based system for Arabic proverbs.

2. Related Work

2.1 Knowledge-based Systems (KBSs)

From the Artificial Intelligence perspective, KBSs are systems based on methods and techniques of Artificial Intelligence. As knowledge-based systems became more complex the techniques used to represent the knowledge base became more sophisticated [7]. During the last few years, several conceptual and formal specification techniques for knowledge-based systems have been developed. The main advantage of these modelling or specification techniques is that they enable the description of a knowledge-based system independent of its implementation.

In many literatures, KBS has been defined as a system which focuses on the use knowledge-based techniques to support human decision-making. KBSs implement heuristic human reasoning through specific techniques, procedures, and mechanisms, in order to solve problems that do not have a traditional algorithmic solution [7]. Research on this topic is being conducted by various research communities around the world for different kind of problems.

Despite there are quite a wide range of opinions on what should and what should not be considered as knowledge-based system [8], the main source of KBS is the knowledge of the domain. A knowledge based system has three main components: a knowledge base, a user interface and an inference engine. The knowledge base and the inference components are separated concepts. Early knowledge-based systems were primarily expert systems, and in fact the systems are always known as expert systems [9]. It is no doubt that human expert is required in any type of knowledge based systems. KBSs collect small fragments of human know-how into a knowledge-base which is used to reason through a problem, using the knowledge that is appropriate. Anyone can be considered as a domain expert if he or she has deep tacit knowledge of both facts and rules and strong practical experience in a particular domain. One of the most important process in building a knowledge based system is knowledge acquisition; a process to capture the expert knowledge and represent it in a way that is suitable for processing. The actual structure of a KBS does not need to be system specific – it should not “mimic” or model the structure of the real-world problem and the KBS should capture and contain the knowledge about the real-world system. The task of the programmers is to develop processing facilities for the knowledge representation [10]. KBSs have been applied in various fields including medical [11, 12], engineering [13, 14, 15], management [16, 17], agriculture [18] and Arabic language [19, 20]. The rule-based systems have been used in [19] and [20] for the Arabic language processing which focused on morphology aspects only.

2.2 Visualization

Visualization has been seen as a method to assist in creating a new piece of knowledge. It is a very interdisciplinary which requires significant knowledge in various field such as data management, computer graphics, perceptual psychology and visual art [21].

Meyer [22] described knowledge visualization as a field of study that investigates the power of visual formats to represent knowledge". The aim of knowledge visualization is to support cognitive processes in generating, structuring, and using the knowledge. The working memory of a single person is limited. Visualization may help to reduce cognitive load and enhance the processing abilities by visualizing abstract relationships [21]. Information and knowledge visualization are both based on the human abilities to perceive and interpret objects and its surrounding. A human perceives things or objects based on a certain clue. The process is very fast. However, this ability is differing from one discipline to another. According to [23], there are seven types of knowledge visualization. These include, sketches, diagram, map, images, objects, interactive visualization, and stories or visions. Sketches are simple drawing that help to visualize the key features and the main idea quickly. Diagrams are schematic representation which are used to display, explore and explain relationships. Maps are the architectural context used to present entities on a different scale. Images can be rendering, photographs or paintings that may represent reality but can also be artistic. Physical models are used as objects to show projects from different perspective. Visions or stories are non-physical, imaginary mental visualization which help to transfer knowledge

across time and space. Interactive visualization is referred to computer-based interactive visualization which allow to users to access, control, explore, combine and manipulate different types of complex data, information and knowledge.

The use of colour in information visualization is a prior step of knowledge visualization. According to [24], information visualization application is emerging as researchers identify its importance in narrative, problem solving, and contextual framing. Color is not merely an aesthetic choice, but also can be used as a tool to convey quantitative or qualitative information. Color palettes can be used to visualize for mapping categorical attributes and identification. Affective visualization uses visual features to evoke a mood, feeling and impression.

3. Proposed Methodology

This research is conducted in five phases: knowledge acquisition, knowledge creation and validation, knowledge representation, system development, and system testing. The proposed methodology consists of a collection of steps that occur in those mentioned phases (see Fig 1).

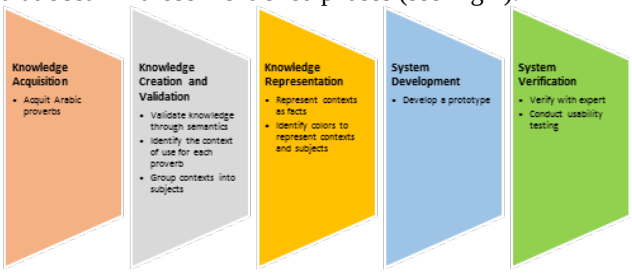

Fig.1 Phases and related steps in the proposed methodology

Step 1: Acquit Arabic proverbs

Knowledge about Arabic proverbs is normally stored as tacit and explicit knowledge. In this phase, the tacit knowledge of the Arabic proverbs is obtained through formal and informal conversations with various Arab native speakers. Their knowledge about the proverbs were recorded. We also identified the Internet as the best resource to obtain explicit knowledge of Arabic proverbs. Google search engine had been used to retrieve the Arabic proverbs. We have identified and recorded four hundred proverbs from the sources.

Step 2: Validate knowledge through semantics

It is very difficult to translate Arabic proverbs into English language, because a direct lexical translation may cause a weird, funny and less meaningful meaning of the proverbs. Thus, authors of this paper have translated the proverbs based on its semantics. One of the authors of this research paper who is a native Arabic speaking, use his personal background to create or verify a semantic of each proverb in English language. Out of 400 recorded proverbs we managed to get appropriate semantics in English language for 270 proverbs. Table 1 presents a sample of collected proverbs which have been associated with its semantics (see Table 1).

Table 1: The proverbs with its semantics.

Proverbs in Arabic	Semantics of Proverbs
أحضر الناس جوابا من لم يغضب	The best answer will come from the person who is not angry
إنك لا تجني من الشوك العنب	You will never receive something good from bad
أبصر من زرقاء اليمامة	A person who has the wisdom to forecast the future
جوع كلبك يتبعك	A person will follow you if they need you.
على نفسها جنت براقش	A person gets problem from his own course
اتّكلنا منه على حُصنِ الاتحاد قوة	Unity is power
اختر أهون الشرين	Go with the lesser of two evils
إذا تم العقل نقص الكلام	The smarter you are, the less you speak
إذا قصرت يدك عن المكافأة فليصل لسانك بالشكر	If you're unable to reward, then make sure to thank
أشد الفاقة عدم العقل	Lack of intelligence is the greatest poverty.
إصلاح الموجود خير من انتظار المفقود	It's better to fix what you have than wait to get what you don't have
أول الغضب جنون وآخره ندم	Anger begins with madness, but ends in regret
الجيات أحسن من الرايحات	What is coming better than what is gone

Step 3: Identify the context of use for each proverb

Proverbs are normally used within contexts. Each proverb is usually used to describe about a certain life issue or discuss about a certain life concern. Thus the knowledge about a proverb is mainly depends on its contexts of used. A proverb might be used in one or more contexts. Table 2 shows an example of proverbs which have been identified its contexts. In this research tacit knowledge of a human expert has been used in assigning proverbs to its contexts. For an example, proverbs that present about anger is assigned into a context of anger, while hope context is used to represents a proverb which talks about hope.

Table 2: Examples of proverbs with its semantics and subject groups

Semantics of Proverbs	Context	Subjects
The best answer will come from the person who is not angry	Calm	Feelings
A person who has the ability to forecast the future	Intuition	Wisdom
A person will follow you if they need you.	Power	Control
A person gets problem from his own course	Ignorance	Knowledge
Unity is power	Power	Control
The stupid might have	Ignorance	Knowledge

wanted to help you, but ended up hurting you.		
The smarter you are, the less you speak	Intelligence	Knowledge
If you're unable to reward, then make sure to thank	Gratitude	Feelings
Lack of intelligence is the greatest poverty.	Intelligence	Knowledge
Anger begins with madness, but ends in regret	Anger	Feelings
What is coming better than what is gone	Hope	Feelings

Step 4: Group contexts into a subject

Several contexts are grouped into a single subject. A Subject refer to universal truth of human life such as feelings, ambition, virtue, friendship, family ties and so on. In other words, subjects represent a social topic and focus in life, such as feelings, control, wisdom, and so on. As an example, the feelings subject is normally discussed, presented, and evoked in the contexts of *hate*, *love*, *calm*, *gratitude*, *envy*, *anger* and *forgive*, as shown in Fig. 2

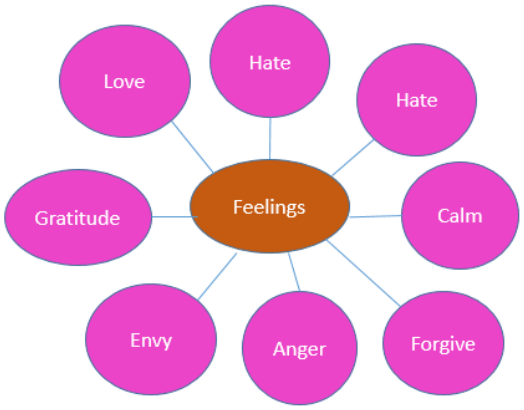

Fig. 2 Examples of contexts in the feelings subject

Step 5: Represent contexts as facts

Contexts are represented and stored as facts in the knowledge based system. Users can query any desired proverbs through the contexts displayed on the interface of the system.

Step 6: Identify colors to represent contexts and subjects

Color selection is considered as an important feature in the graphical user interface. In the proposed system, colors are used to convey meanings of contexts and their relationships with life values. Various contexts within the same subjects use the same color scheme as shown in Fig1. Subjects however is abstract to users. Users will generate cognitive relationships among the displayed contexts.

Step 7: Develop a prototype

The proposed system has been developed using a visual programming C# as it facilitates windows and interactive environment. The development of interactive knowledge-based system for Arabic proverbs is involved with the development of 3 main components of knowledge-based system; user interface, inference engine and knowledge (Fig. 3). A user makes a query and receives a response through an interface.

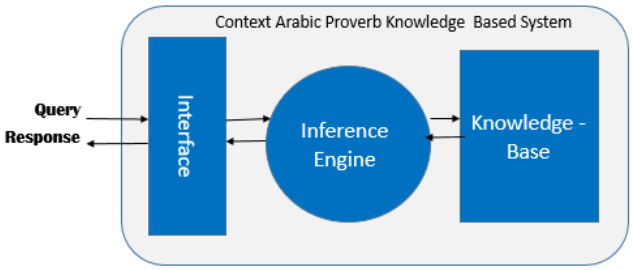

Fig. 3 Components of Context Arabic Proverb Knowledge-Based System

Our proposed system consists of several interfaces which allow users to have interactive interaction with the system. The main page (Fig.4) of the interfaces display information about the system description.

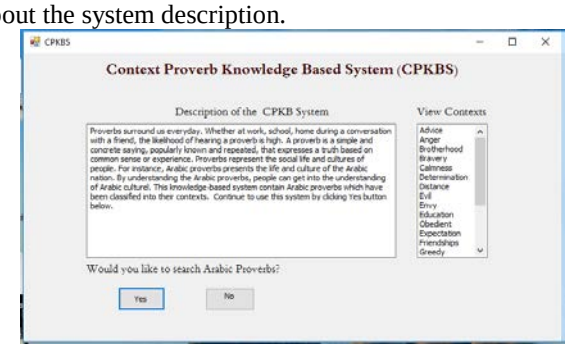

Fig. 4 Main interface of the system

On this interface page a user can have a brief knowledge about the system. For example, life contexts are displayed on the first page. User can view the list of contexts before proceed a further interaction with the system. If the user decides to search Arabic proverbs, the second page of interfaces will be displayed to a user (Fig 5.). This interface consists of a collection of facts (contexts) which a user can make a query by selecting and clicking any one of the desired contexts.

Traditionally, the inference engine is a control program that applies logical rules to decide what information should be deduced. In this system, the inference engine is a component concept which responsible to retrieve and display a proverb and its semantic based on a selected context. Because it is an interactive system, the function of

the inference engine is technically making a decision which interface window should be displayed to the user.

The knowledge-based is basically a window interface which contain a list of proverbs with its semantics that had been categorized according to a specific context of use.

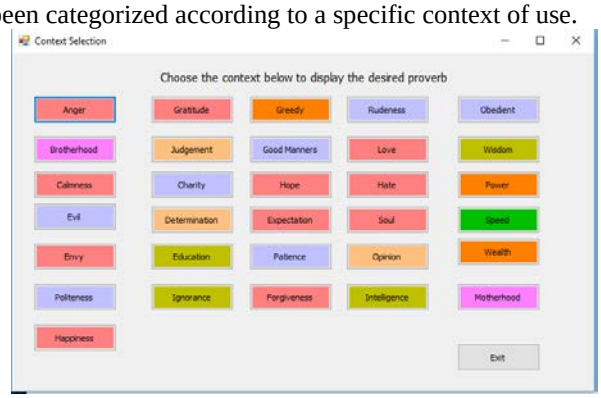

Fig. 5 Contexts interface of the system

The knowledge proverbs are stored in the forms of original scripts which are written in Arabic alphabets, while its semantics are presented in English language. Fig. 6 illustrates four types of proverbs used in the context of intelligence. Each proverb is augmented with an explanation in a simpler language, to enable users to grasp the insight of the proverb. This augmentation is displayed to the user in a message dialog form.

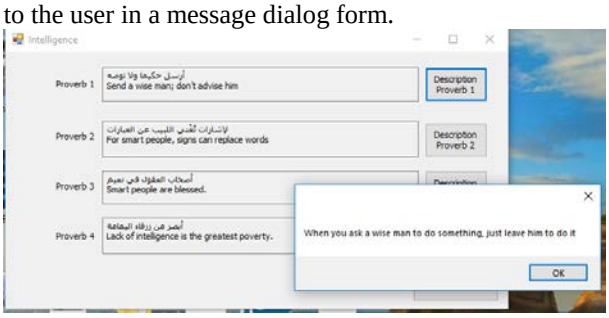

Fig. 6 An interactive page of proverb within a specific context.

Step 8: Verify with expert

A developed prototype system is verified with Arabic native speakers who have tacit knowledge about the proverbs, and the contexts of its use.

Step 9: Conduct usability testing

Usability is an important quality attribute of a user's experience when interacting with a system or tool. ISO 9241 defines usability as effectiveness, efficiency and satisfaction with which users accomplish tasks [25]. We had conducted usability testing on the developed knowledge-based system. Fifteen non Arabic speakers had voluntarily participated in the usability testing. The purpose of this evaluation is to identify users' satisfaction towards the system. Table 3 shows 9 questions used to evaluate users' satisfaction in using the system. Users have to answer the questions with 5 options; Strongly Agree (SA), Agree (A), neutral (N), disagree (D), strongly disagree (SD).

Table 3: Questions related to satisfactions and the frequency of responses.

Questions	Frequency Responses				
	SA	A	N	D	SD
1. I have a great experience with the system?	90%	10%			
2. I am able to use the system successfully	100%				
3. The system provides a clear information	85%	5%	5%		
5. I am feeling discomfort while using the system				70%	30%
6. The system helps me to get an insight of Arabic life and culture	90%	9%	1%		
7. The use of color is appropriate and pleasing to my eyes.	95%	5%			
8. The use of color help me to make a cognitive relationship between the contexts and subjects of life.	85%	15%			
9. The system is easy to use	100%				

The statistical results indicate that 90% of users are strongly agree that the system is able to help them to get an insight into Arabic cultures through the system. Furthermore, the use of color is a value-added feature which helps users to cognitively classifying contexts to similar subjects discussed in life.

4. Conclusion

This research had propose a methodology for developing an interactive knowledge-based system for Arabic proverbs. This system is intended to be used by people who do not have knowledge about Arabic language and culture. The complexity in understanding these proverbs is literal translation is not able to convey appropriate values. It is necessary to obtain the semantic of the proverb and store the proverb with its semantic in the knowledge based system. The process of knowledge acquisition is involved with gathering tacit and explicit knowledge of Arabic proverbs. The proposed methodology has been implemented as a prototype system. The system has been assessed by a human expert and human users. The results from the human evaluation indicate that the proposed methodology is successful.

The challenging issue in this research is to obtain tacit knowledge about the proverbs from human experts. Classifying proverbs into identified contexts are also

critical. The future work of this research is to obtain more Arabic proverbs and increase the size of stored knowledge.

Acknowledgments

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