Designing infographics/visual icons of social network by referencing to the design concept of ancient Oracle Bone characters

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Abstract— **This paper introduces the use of pictogram design concept in ancient China for the development of a set of today's "graphic icons" or "infographics" in modern social network visualization systems. These graphic icons should be close to sensory symbols that derive their expressive power from their ability to use the perceptual processing power of the brain without learning. Therefore, with the use of such a set of "sensory symbols" we aim to achieve the identification of corresponding physical objects (or their attributes) to be performed close to the pre-attentive time.**

Keywords— graphic icons, data visualization, information visualization, infographics, pictogram, social network, Oracle Bone characters

I. INTRODUCTION

Data Visualization is a general term that describes any effort to help people understand the "significance" of data by placing it in a visual context. Patterns, Trends and Correlations that might go undetected (or not be easily detected) in text-based data can be exposed and recognized easier with data visualization software. The traditional data visualization are focusing on three different graphic representation problems: the value pattern of data attributes, the behavior of data and the structure of data relationships. Therefore, it was naturally divided into three different corresponding sub-fields of research: 1) Attributed (or High Dimensional) Data Visualization [1, 2], 2) Graph Visualization [3] and 3) Trajectory Data Visualization [4].

The Computer Icons, especially those with well graphic designed icons (or called *infographics*) can be used as visual carriers to carry and represent information and data attributes. However, the formal name of these icons are called "*pictograms*" [5]. In Wikipedia or Dictionary: we found that a *pictogram*, also called a *pictogramme, pictograph*, or simply *picto*, and in computer usage an icon, is an ideogram that conveys its meaning through its pictorial resemblance to the physical object. A pictogram may also be used in subjects such as leisure, tourism, and geography. In ancient time, the early written symbols were based on *pictographs* (pictures which resemble what they signify) and *ideograms* (symbols which represent ideas). Ancient Sumerian, Egyptian, and Chinese civilizations began to adapt such symbols to represent concepts, objects and other information, see Fig 1.

Fig. 1. The Shang used oracle bones to "tell the future." They wrote on the bone, usually asking a question, and then poked a hot needle in the back.

Today, pictographs are often used in writing and graphic systems in which the characters are to a considerable extent pictorial in appearance. They are still in use as the main medium of written communication in some non-literate cultures in Africa, the Americas, and Oceania. Pictographs are often used as simple, pictorial, representational symbols by most contemporary cultures.

"*A pictogram is a type of graphic symbol in which meaning is conveyed through the use of a form expressing its meaning*" (Yukio Ota, 1939).

An early modern example of the extensive use of pictographs may be seen in the map in the London suburban timetables of the London and North Eastern Railway, 1936-1947, designed by *George Dow*, in which a variety of pictograms was used to indicate facilities available at or near each station, see Fig 2.

Ever since 1964 when pictograms were used for signs and events in Tokyo Olympics Games under the art director *Masaru Katzumie*, the effectiveness of pictogram gained a high evaluation and have been used at every venue where people gather from around the world, see Fig 3.
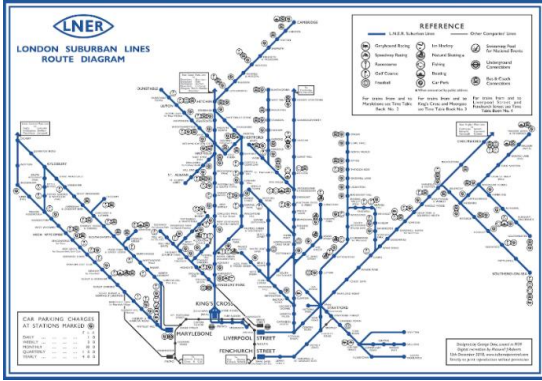
Fig. 2. The map of the London & North Eastern Railway, designed by George Dow in 1936, in which a variety of pictograms was used to indicate facilities available at or near each station.

Fig. 3. The pictogram used for the sign of Tokyo Olympics Games, designed by the art director Masaru Katzumie.

In Japan, the definition of pictogram is always described as "A pictogram is a type of graphic symbol; it is a symbol which makes people understand its meaning through use of form expressing its meaning." Simply stated, the feature of the pictogram is its "transmission effect which can be understood immediately and internationally without prior study."

The Japanese translation of pictogram is "e-moji" (絵文字, picture word) or "e-kotoba"(絵言葉, picture language). E-moji represents each element, and e-kotoba refers its structural system, that is, the text and the character.

LoCos is a pictorial language (or visual language) developed by *Prof Yukio Ota* in 1964. It was meant as a method of communication for the deaf and mute as well as for the illiterate. He said: "*It should emphasize the importance of communication among all the people of all the countries of the world.*" A pictogram designed by Yukio became the global standard for "*exit*" sign, see Fig 4.

A visual (or graphic) icon is an image depicted by a form in the shape representing the whole or part of a meaningful object. On computer displays, a computer icon (or simply an icon) is a small pictogram. At present, icon is a general term for the small, on-screen, graphic element that represents an application, file or hardware resource. Clicking an icon or touching it with the finger or stylus selects the item that the icon references.

In modern design, pictograms are serving as pictorial, representational signs, instructions, or statistical diagrams. Because of their graphic nature and fairly realistic style, pictograms are perspicuous and easy to understand. As pictogram express the commonness of diversity, they can

cover the barriers of language and are widely used to all over the world nowadays.

In current social network software applications, icons are commonly used to represent their functions, menu items and associated apps. Fig 5 shows the market figure of 15 most popular social networks, including Facebook and YouTube. They are all in use of graphic icons.

However, each social network designed a set of their own icons and there is no agreed design scheme. So that the question are that 1) *what're the design rules*, 2) *are they Sensory Symbols* and 3) *did these icons consider the human cognition cost in perceiving information?*
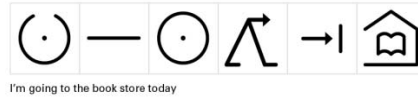

Fig. 4. In LoCos language the above sequence of pictograms represents the English sentence "*I'm going to the book store today*".

For example, suppose that there is a social network in which uses an "icon" to represent people. We then can compare four different visual representations of a "person" in Fig 6.

a. Use a "square" image (A) to represent a "person", then since there is no similarity between physical images of square and person, extra cognitive cost is required for learning. Obviously, it does not qualifies as "pre-attentive" identifying process.

b. Use the Icon shown in image (B) to represent a "person", then since the icon has high similarity to human outer silhouette. The identifying can be done quickly and it qualifies as "pre-attentive".

c. Use the Icon shown in image (C) which is a "character" collected from *Oracle Bones* to represent "persons". It has a high similarity to the side view of human outer silhouette. It qualifies as "pre-attentive".

d. The Icon shown in image (D) is a "*Cartoon Icon of a person*", which is specifically designed to represent an old person containing several attributes, including *gender, wearing a glass and hairstyle, etc*. This kind of icons, of course, has a high similarity to human and it qualifies as "pre-attentive". However, the creation of such icons requires extra Art and Graphic design. Also, it will increase significantly the visual complexity of the visualization. Therefore, the design and use of such icons are beyond the scope of this project.

As shown in Fig 6, for an object "Person" there are many different designs of infographics/icons. So far, there is no formal recommendation of a set of optimized standard graphic icons can be used for the general design purpose. We believe that the desirable "graphic icons" and "infographics" should be (or close to) sensory symbol(s) that derive their expressive power from their ability to use the perceptual processing power of the brain without learning. Therefore, the tasks of identification of corresponding physical objects or attributes' value through the "infographics" should be performed within pre-attentive time limit that is between 200ms to 250ms.

In order to achieve quick identification of corresponding physical objects and their attributes through the infographic "icons", we may refer to the "Oracle Bones" Characters designed 3500 years ago by the Chinese's ancestors, 3500 years ago, our ancestors did not have today's pencils and pens. They could only use sharp knives or stone carved these Oracle characters on the shoulder bones of the cow and the shell of the turtle.

So that the basic design principles of these Oracle characters are to be "simple" and "similar". These principles are exactly matched to our principles for the design of infographics and "icons" which require low visual complexity and low cognitive costs.

Fig. 5. A list of most popular social networks.

Therefore, the aim of this research is to design a set of optimized graphic "icons" that covers the representation of most commonly appeared physical objects, attributes, motions and adjectives in the social networks, such as *"men", "child", "email", "router", "IoT", "iPhone", "DDoS"*, etc. We will learn and refer to the design principles of our ancestors' Oracle characters.
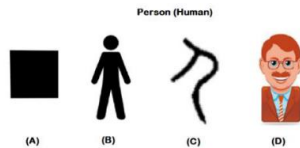

Fig. 6. Four visual representations of a "Person"

II. THE PICTORIAL SYMBOL SYSTEMS

Advances in science & technology have allowed people to see old things in new ways. *Telescopes & Microscopes* are typical instrument examples. Maps, diagrams, and PERT charts are examples of using visual representations to see things. A good picture is worth ten thousand words. Today, computers help people to see and understand abstract data through pictures.

Our Ancestors used pictures (pictorial symbols) to remember and communication things (objects or events). The earliest pictorial symbol systems are Hieroglyphs & Oracle Bones. They are the wisdom of the Egyptian and Chinese and it is the way that they ancestors used for recording of the original tracing things heritage, is the world's first text, the image is the most evolved far the best preserved a Chinese character font. The use of object's physical pattern to create 'text' and 'characters'.

A. Hieroglyphics

A hieroglyph (Greek for "sacred carvings") was a character of the ancient Egyptian writing system. Logographic scripts that are pictographic in form in a way reminiscent of ancient Egyptian are also sometimes called "hieroglyphs" [6].

The Egyptians invented the pictorial script. The appearance of these distinctive figures in 3000 BCE marked the beginning of Egyptian civilization. Though based on images, Egyptian script was more than a sophisticated form of picture-writing. Each picture/glyph served one of three functions: (1) to represent the image of a thing or action, (2) to stand for a sound or the sounds of one to as many as three syllables, or (3) to clarify the precise meaning of adjoining glyphs.

The most famous way the Ancient Egyptians wrote down their Hieroglyphics was using Papyrus paper, see Fig 7. The Papyrus paper was made from the Papyrus reed found in the Nile River. Papyrus paper was used throughout the time of the Pharaohs and used for record keeping, funeral texts and art. The Ancient Egyptians often used charcoal or soot to write down their Hieroglyphics on the papyrus paper.

B. Oracle Bones Characters

Oracle Bones [7], see Fig 1, is the way that Chinese ancestors used for recording of the original tracing things heritage, is the world's first text, the image is the most evolved far the best preserved a Chinese character font.

Fig. 7. Ancient Egyptians wrote down their Hieroglyphics on the Papyrus paper.

Through 3000 years, Chinese ancestors used their wisdom to remember the information they wanted to remember by carving some simple "pictograms" using 'sharp' stones (see Fig 8) on the shoulder bones of the cow and the back of the turtle. These simple pictograms or symbols have been now evolved into today's graphic icons or infographics which are a type of the data visualization elements.
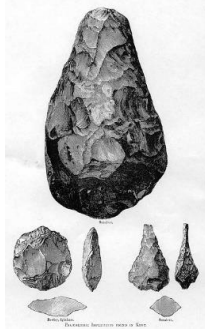
Fig. 8. Tools used by ancient Chinese to carve Oracle Bones characters on the shoulder bones of the cow and the back of the turtle.

Today's modern Chinese characters are evolved step by step from ancient *Oracle bones*. 3500 years ago, our ancestors did not have today's writing tools, such as pencils and pens. To be able to remember and communicate information, they could only use sharp knives or stone carved some symbols (Oracle Bones characters) on the shoulder bones of the cow and the shell of the turtle. Therefore, our ancestors conceptually used two writing principles:

1) Minimize the complexity of fonts and the number of stokes. This is because that it is too hard to use sharp stone as a tool to carve these symbols,

2) Maximize the similarity between the Symbol and the corresponding physical object what the symbol is representing. This could significantly reduce our ancestors' cognitive costs for quickly and accurately identify the physical objects or other information they want to communicate identify the physical objects or other information they want to communicate.

These principles are exactly matched with our principles for the design of infographics & "icons" which requires both low visual complexity and low cognitive costs.

C. Sensory Symbols vs. Arbitrary Symbols [8]

The reason why these principles of designing pictogram are common to modern people and our ancestors is that we have the same brain structure. Our ancestors and modern people who are all having the primary "visual cortex" in the brain for processing visual information (or pictorial symbols).

The visual cortex of the brain is that part of the cerebral cortex which processes visual information. It is located in the occipital lobe. Visual nerves run straight from the eye to the primary visual cortex to the visual association cortex, see Fig 9.

The visual cortex of the brain contains mechanisms specifically designed to seek out continuous contours. Since some *pictorial symbols*, such as *Oracle Bones* and *Hieroglyphics* are designed based on the similarity of physical object's continuous contours. Therefore, our brain will be able to directly identify the object or understand certain pictures without learning.

We call these *pictorial symbols* are *sensory symbols* (or language) because that there are similarities between these symbols and the things that they represent.
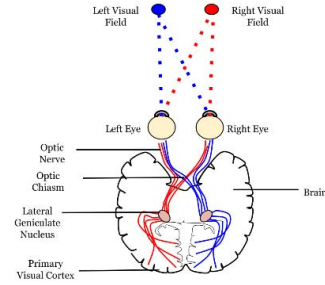

Fig. 9. Our ancestors & modern people have the same brain structure, containing a primary visual cortex.

In human's communication or interaction, two types of symbols are commonly used:

1) <u>Sensory Symbols</u>: The word refers to symbols and aspects of visualization that derive their expressive power from their ability to use the perceptual processing power of the brain (direct perceive information by visual cortex) without learning. Sensory representations are effective because they are well matched to the early stage of neural processing (visual cortex). They tend to be stable across individuals and cultures and time.

2) <u>Arbitrary Symbols</u>: The word refers to aspects of representation that must be learned, having no perceptual basis. E.g. the written word "dog" bears no perceptual relationship to any actual animal. Arbitrary conventions derive their power from culture and are therefore dependent on the particular cultural milieu or an individual.

For those sensory symbols, we can achieve the pre-attentive neural processing in perceiving information or identifying object through these visual symbols. Particularly, the identifying (or detection) tasks can be performed with < 200 - 250ms, in which the eye movements take at least 200ms yet certain processing can be done very quickly, implying low-level processing in parallel.

Given the above, it is very clear that the aim of research is to design a set graphic "icons" that are or close to sensory symbols allowing viewers to perceiving information or identifying objects in pre-attentive manner without learning.

III. ORACLE BONES STYLED ICONS IN WECHAT

Now I am showing you some preliminary design of the new icons base on the Oracle Bones style for one of the most popular social networks: *WeChat*.

WeChat currently consists of four top-level interfaces: 1) *Chats*, 2) *Contacts*, 3) *Discover* and 4) *me*. The "me" interface contains 10 icons representing 6 function categories & 4 interfaces. These are "*Wechat Pay*", "*Favorites*", "*My Posts*", "*Cards&Offers*", "*Sticker Gallery*", "*Settings*", "*Chats*", "*Contacts*", "*Discover*" and "*me*".

Fig 10 shows the original "me" interface with 10 current design of icons. Fig 11 shows a modified "me" interface with 10 Oracle Bones styled design of icons.

- Redesign the "*Discover*" and the "*Me*" icons. Fig 12 shows the evolution process (from the left to the right) of using some Oracle Bones elements to redesign the "*Discover*" and the "Me" icons in WeChat.

- Redesign the "*WeChat Pay*" icon. Fig 13 shows the evolution process (from top down) of using some Oracle Bones elements to redesign the "*WeChat Pay*" icon in WeChat.
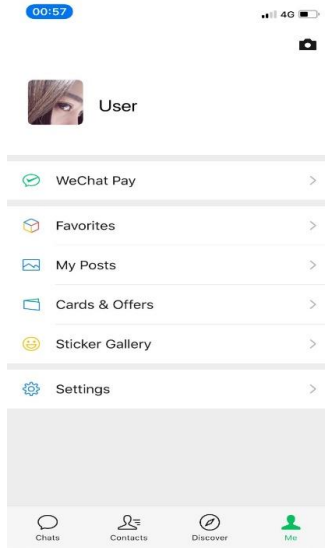
- Redesign the *"Favorite"* icon. Fig 14 shows the evolution process (from top down) of using some Oracle Bones elements to redesign the "*Favorite*" icon in WeChat.

- Redesign the *"My Posts"* icon. Fig 15 shows the evolution process (from top down) of using some Oracle Bones elements to redesign the "*My Posts*" icon in WeChat.
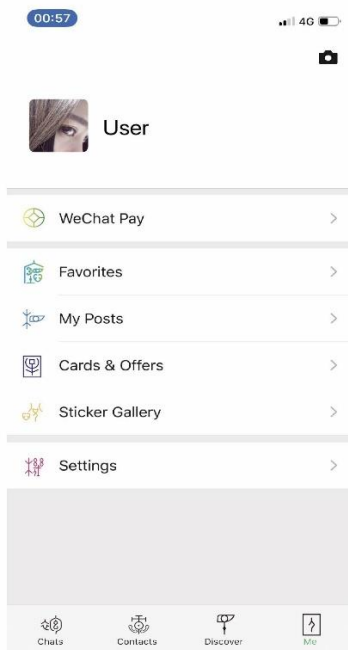

Fig. 10. The original "me" interface in Wechat.

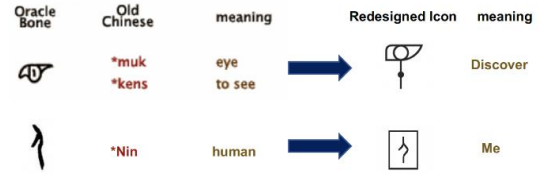Fig. 11. A modified "me" interface of WeChat with 10 Oracle Bones styled design of icons.

Fig. 12. The redesign of Discover" & "Me" icons by merging some Oracle Bones elements.
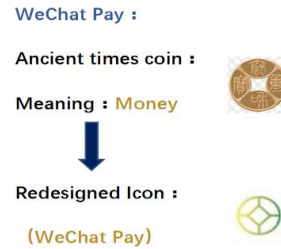

Fig. 13. The redesign of "WeChat Pay" icon by merging some Oracle Bones elements.

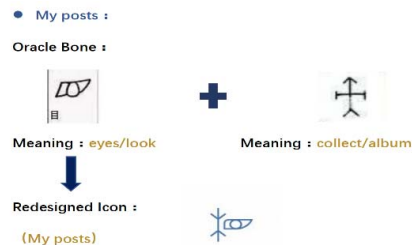Fig. 14. The redesign of "Favorite" icon by merging some Oracle Bones elements.

Fig. 15. The redesign of "My posts" icon by merging some Oracle Bones elements together.

- Redesign the "Cards&Offers" icon. Fig 16 shows the evolution process (from top down) of using some Oracle Bones elements to redesign the "Cards&Offers" icon in WeChat.

- Redesign the "Sticker" icon. Fig 17 shows the evolution process (from top down) of using some Oracle Bone elements to redesign the "Sticker" icon. We were inspired by this Oracle Bone and understand the character of 'Happy' which includes a smiling mouth and there is a man holding the heart. Then we redesigned the icon for the 'sticker' based on the design concept of this Oracle Bone.

In the "*Discover*" interface of WeChat, it contains another six functional icons, they are 1) *Moments*, 2) *Channels*, 3)

Scan, 4) *Search*, 5) *Mini Programs*, and 6) *WeChat out*. We are now showing you some of the new design of these icons.

- Redesign the "Moments" icon. Fig 18 shows the evolution process (from top down) of using some Oracle Bones elements to redesign the "Moments" icon in WeChat. Moments means "friends" and in Oracle Bones, "friends" was initially represented by human hands holding, that is one hand covers another hand. Our new icon was designed based on this idea.

- Redesign the "Search" icon. Fig 19 shows the evolution process (from top down) of using some Oracle Bones elements to redesign the "Search" icon. The initial Oracle Bones character "Search" was evolved from the picture in which there is a torch lighting held by a human hand to light the house for searching something, We were inspired by this Oracle Bone and redesigned the icon for the 'Search'. Our new icon was designed based on this idea.
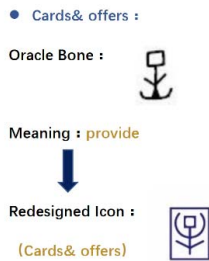

Fig. 16. The redesign of "Cards&Offers" icon by merging some Oracle Bones elements.

Fig. 17. The redesign of "Sticker" icon by merging some Oracle Bones elements.

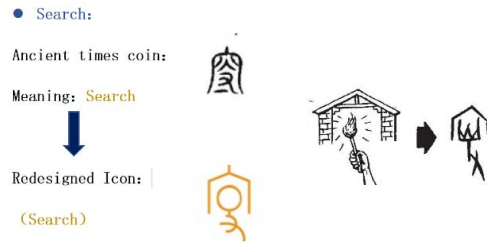Fig. 18. The redesign of "Moments" icon by merging some Oracle Bones elements.

Fig. 19. The redesign of "Search" icon by merging some Oracle Bones elements.

IV. CONCLUSION AND FUTURE WORK

In this research, we first time attempted to use the oracle bones design concepts & styles for designing modern graphic icons used in popular social networks. The work we have done is still in the preliminary stage. We need spend more time to learn more oracle bones & hieroglyphics. Then we could extract more deep design principles from early pictograms designed by ancient Egyptian and Chinese.

The reason why we think that it is worth to conduct such research projects is that because we believe that our ancestors had the same brain structure as we have. Our ancestors and we who all have the primary "visual cortex" in the brain for processing visual information (or pictorial symbols). Our ancestor took advantages of their "visual cortex" system by designing a variety of pictograms, while we can also take the advantages of our "visual cortex" system to design a set of pictorial icons which are very close to those sensory symbols. Thus, we could achieve the pre-attentive neural processing in perceiving information or identifying object through these icons (sensory symbols) without learning.

In the future, we will evaluate a set of redesigned Oracle Bone styled social network icons against the following rules: 1) Pre-attentive perception rules, 2) Cognitive cost rules and conduct several usability studies.

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