Infographic in relation to the human information-processing system and its effectiveness to deliver complex information

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Abstract. Infographic as a form of presenting information that is designed combining visual with text has become a form that allows the reader easily understand series or complex information. This paper will begin with brief explanation about how the brain processes the information and the history of Infographic that has become part of the visual communication design heritage. Then will be discussed how infographic both on printed and digital media convey comprehensive information that related to the human information-processing system. At the end of the article can be obtained a clearer picture on how infographic with its visual approach makes impacts to the reader, in order to understand complex information.

1. Introduction
The human ability to absorb information related to how the brain processes the information. The brain will process each written letter that basically a symbol (image with certain meaning) to creates word. To read a series of words, the brain firstly needs to match the shape of the letter with symbol that has been stored as memories. The brain then combines a series of letters to form words, words into sentences, sentences into paragraphs and so on. Although the whole process lasted very quickly, the brain still needs more time to understand the sentence, compared to understand the information in a form of image or picture [1].

However, both pictures and words each have strengths that can be combined to become stronger media to deliver message. Some of the strength of picture such as, able to communicate quickly, suitable to a wider audience, not limited to age and location, can be enjoyed repeatedly that might build emotion, memories and experiences, and pictures can be placed in order to produce a sequence. While words are very strong to communicate accurately, and amusing through language and sentences [2]. As an addition, illustration which is basically a picture with a certain message has become the way to deliver information for thousands of years. It has been proven that illustrations are no longer full fills the function of the aesthetic, it has become an important part in delivering the information because of its ability to convey the message, furthermore, able to build the perception in visual language that has been accepted universally.
The ability to translate an image into a certain meaning is related to the human ability in processing the information in visual form. In the human information-processing system that consisting of three main structures: sensory memory, working memory, and long term memory, the data obtained through senses is transformed into meaningful information. All data received through the eyes as external stimulus, such as colour and shape in an image, register in sensory memory. Then passes on to working memory where sensory information is combined with prior knowledge so that images can be interpreted and understood. However, working memory has a limited capacity that affects to the person's cognitive abilities. The new information can be quickly fade away unless the information is manipulated [3]. For example, deliberately memorized or repeated until it stored in long-term memory and can be retrieved by working memory and can be used as a prior knowledge to complement the next new sensory information.

The way delivering information through a particular approach regarding to the human factors can cause more effective results and accepted by the target audience. One of the approach that used to convey information with complex meaning is through an Infographic. The word Infographic is short term for Information graphic is a type of picture that blends data with design, helping individuals and organization concisely communicate messages to their audience. Infographic more formally defined as a visualization of data or ideas that tries to convey complex information to an audience in a manner that can be quickly consumed and easily understood [4]. Base on the definition of Infographic as mention above, it can be identified that Infographic has been applied far before human using written language to communicate. Human has tried to communicate idea or message in the form of image and symbol, seperti yang dapat dilihat pada Hieroglyph from around 3000 BC was made by simplifying certain shape to create symbol that has certain meaning, also in the relief in the tomb of Nakht at Thebes that illustrates their daily activities in that time such hunting, fishing, and depicting process of farming, which combining images and hieroglyph.

In the Renaissance era, circa 1510, Leonardo Da Vinci was creating human anatomy drawing that combined with text as a record to his study that also matches to today’s definition of Infographic. Three hundred years after the Renaissance era, an English nurse, Florence Nightingale, create a combination diagram and text which explain the number of casualties during Crimea war 1855-1856 which presented to the British parliament to suggest the importance of health for British soldier. Her way delivering the information in a visual form defined as a modern editorial Infographic that the principle still applied today [5].

From the brief history above can be recognized that words have strong connection to images. Image and word each has its own strength which if they are combined can even strengthen each other at the same time able to cover each other weakness. In general, the form of Infographics can be distinguished based on its content. All visual forms contained in an Infographic can be including data visualization, process, hierarchy, anatomy, chronology and others, as long as represent the information in a visual. All forms of Infographics require components yang memperhatihan human factor that determine the success of delivering the messages which are “appeal”, which Infographic should attract the audience attention, “comprehension” which means the information or messages should be conveyed clearly so that it can be easily understood by audience, and “Retention” which means the message or information delivered should be easily remembered by the audience. One component can be more dominant than others, depends on the purpose of the infographic itself [6].

Regarding to the human factor in order to make information received by working memory to be stored in long term memory, the external stimulus, basic element of design including images, colors, and shapes, they should visually appealing and informatively entertains. The role of illustrations to create an appealing image with a visual language, makes illustration has an important role in providing a clearer picture to the audience and to give a clear visual explanation through visual details. Illustration in Infographic is applied to communicating a specific contextualized message to an audience. Certain visual language applied to manipulate emotions, feelings and behavior of the viewer through numerous creative possibilities. The visual Language comprised conceptual illustration that
described as metaphorical applications to the subject or visual depictions of ideas, and literal representation language to visualizing reality or pictorial truth [7].

2. Method
This research using a qualitative research approach which analyzed the human factors about how complex information processed and interpreted so can be obtained a clearer picture about how Infographics conveying certain complex information in order to to give understanding to wider range of audiences.

3. Results and Discussions
The information presented visually or defined as an Infographic to provide convenience and a way out of the delivery of complex content in a message or information into a form that easier to digest and easily understood. Information with complexity on the one hand can attract the attention of the audience, however audiences curiosity may decrease when the information presented is extremly complex and it is ultimately avoided by the audience itself. This is something to do with the human factor which capacity on working memory became a constraints, so to avoid the situation, the complex information need to be arranged. A Complex explaination requires a visually complex graphic which is also information rich that relates to the level of detail, shape, color, and all the elements that make up the image as an external stimulus. Complexity of the information conveyed through images on infographics often can not be reduced because it may also reduce the essence of the information itself so it is most effective by use techniques to carify rather than to simplify.

To reduce the amount of information that must be processed by working memory at a time, complex content can be parsed into several segments or delivered in sequence steps. Looking at the human capability to digesting information in a human information-processing system, received information that registered in sensory memory, passes on to working memory where sensory information is combined with prior knowledge so that images can be interpreted and understood before being given further information. By parsing complex information into several segments or delivered in sequential steps will helpful when explaining the stages from certain process or explaining a chronological event, for example to convey timelines related to history or explanation of a certain process related to both natural and man-made work. Regarding to the human factors about the limitation of working memory in terms of storing information, to make each segment not quickly fade away because the information relates to other segments, the information submitted needs to be supported with a clear and appealing visualization. This effort as an attempt to manipulate information so that it can be stored as a long-term memory that can be recovered by working memory and can be used as a prior knowledge to complement the next new sensory information.

Visual appeal not only to fulfill an aesthetic function but also can make the audience has an emotional connection with the information submitted so that the delivered message will be remembered and understood. This is related to the human factor where the information can be easily remembered and stored in long term memory if the sensory information that passes on to working memory is in an appealing form. Visual langage is needed to create an appealing external stimulus, conceptual illustration can be applied to visualize symbolic idea or visual reconstruction such as to illustrating a process or sequence of certain event that cannot be reached through photography. This kind of illustration commonly found to explain a certain process or describing certain detail from an object. The object that illustrated often simplified and focused on clarity in delivering the message since illustration become part of the message itself. Visual metaphor in Infographic might illustrate an image that containing element of reality, but as a whole take a different form of being.

Illustration in this visual language is commonly found in the science or education material, usually to show the invisible parts of an object such as the cross section of the plant, the cross-section of the earth, even the cross section of the machine or something mechanical. However, Illustrations in visual
metaphor are not limited to use in learning media or related to science, can also be found and appropriate to explain popular information or placed on editorial media. Cross section diagram is applied to visualize the certain part that need to be exposed and it is appears to be the best way to shows details that cannot be seen from the surface, and visualize the certain condition when the event occurred. Although the visualistion are not like those in the actual world, the external stimulus which are passes on to working memory where the information combined with prior knowledge makes the images in visual metaphor still can be interpreted and understood. To makes those process works to the audiences, it is required a certain image vocabulary and cognitive level to understand and makes the information become meaningful.

Other visual language on illustration that suitable for Infographic is Literal Representation or visualizing an object as its form of being to accurately visualizing a certain object or describing an event or process as the actual situation. Illustrations in visual language are commonly used as a visual guidance or to explain a work flow of a certain process that can also be presented in *Hyperrealism* illustration style which recreated pictorial compositions for intense detail and reality. The illustration also applied understanding of visual representation from the use of perspective, scale and proportion. *Hyperrealism* also creates a realistic looks that make the whole illustration become more dramatic. Furthermore this style illustration has an ability to visually explain complex subject or to make it looks more popular and easier to convey by target audience. To convey information in detail, presenting image as the actual object, combination of text and picture in photographic can also be applied, furthermore, photographic approach could be more confincing to the audience because its ability to presenting an object more acurately, at the same time, the image has become part of the information itself.

4. Conclusions
Infographic is short term for Information graphic is a type of picture that blends data with design, helping individuals and organization concisely communicate messages to their audience. Infographic has been used to communicate or conveying information in order to make it more appealing and easier to understand so that the information can be stored in long term memory in human information-processing systems. Infographic has also become a media to deliver educational content, on academic and editorial, both on printed and digital media. In order to provide convenience and a way out to transform a complex content of a message or information into a form that easier to digest and easily understood as mentioned above, Infographic has become one of solutions to delivering knowledge, in contribution to provide quality education, to improving people’s lives and sustainable development

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