Identifying the Technology Trend of Visual Language Researches

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Abstract: - The major developments of visual language enhancement and brain visualize that will change our future knowledge of ecological but also will lead us to a glimpse into the brain, mysterious performance. Knowledge of graphic, drawing, information design, visual communication, visual language, and visual literacy was important for our ability to better produce effective messages. In this study, visual learning would be explored by identifying characteristics of visual language and its converging technology. According to theories of visual perceptual cognitive and visualizes' attributes, text design, representation, image design, graphic design and brain processes were discussed. The goals of visual language and recording brain activity were identified based upon meta-analysis.

Key-Words: - Visual Language, Visual Converging Technology, Brain Technology.

1 Introduction

Throughout history that words and images have occupied separate domains. People have been conditioned to think of themselves as either word people or visual people. Some scholar makes a compelling case for considering visual language, the tight integration of words and visual elements, become new language with the distinct syntax and semantics expected of a language [1][2].

In this information age, visual language cause many great opportunities and related applications. Visual language is one of the more powerful tools to improve human performance for communication and learning. People think visually and language both that meant the brain processing in different distribution distinct but activation simultaneously [3]. Therefore these words and visual elements are closely intertwined, we create something new and we augment our communication intelligence and competency become nature. In the Fig.1 the frame of visual language learning is shown.

People of all ages can seek new information and disseminate their own ideas to others, they can acquire new social ties and discard old ones at will, and they can enhance an existing identity or establish a new one [4]. Present, human work in diverse ways, visual language and converging technology has the potential to integrate our existing knowledge to make them more effective for communicate. With support from developments in information technology, visual language has the potential for increasing human "bandwidth," the capacity to take in, comprehend, and more efficiently synthesize large amounts of new information [5]. This information of external environment and symbol representation of reality world that was large of parts coming from visual cognitive of brain.

An important challenge of current visual language cognitive studies that mankind how to see and identify images, included color, depth, contour, shape, and edges process in visual cognitive of our brain [6]. Furthermore it can penetrate discovering high-order thinking that were three-dimensional (3D) imagery was recovered from two-dimensional (2D) imagery transformation and related mental process [7]. These issues were involving human visual system process history and personal diversity that let us through visual language to understanding brain operation profound . Therefore the visual language and converging technology studies that were improve more effective strategies to promote human learning and communicate performance, and work in new way such as brain technology, nanotechnology and biotechnology…etc.

Information society is multidimensional and artificial, and constitutes the penultimate expression of ‘‘virtual reality.’’ At the same time, it is the very realm of modern society in which social capital is increasingly exchanged [8]. Thus, participation in information society may well become a major means and a primary measure of community belonging and involvement in the 21st century [9].

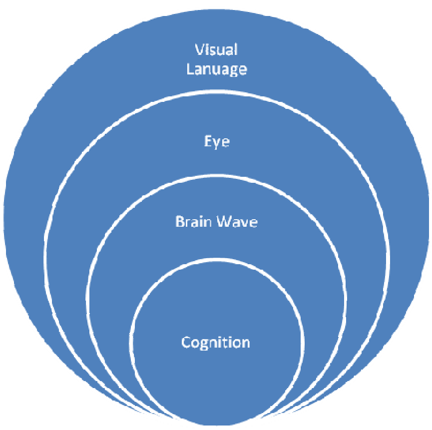


Fig. 1 Frame of Visual Language learning

2. Definition of Visual Language

Visual languages are ubiquitous in human cultures and range from informal sketches to rigorous technical diagrams such as electronic circuit designs[10]. When social networking becomes increasingly important by visual language, it is crucial to examine how converging technology is used our environment and improvement performance of communication. Any technologies will be fervors discussion with this time before people used to it popular, even visual language that was show up with our environment of life.

Visual language is defined as the tight

integration of words and visual elements and as having characteristics that distinguish it from natural languages as a separate communication tool as well as a distinctive subject of research. It has been called visual language although it might well have been called visual-verbal language. In the Fig.2 the sketch map of integration for visual language and converging technology is shown.

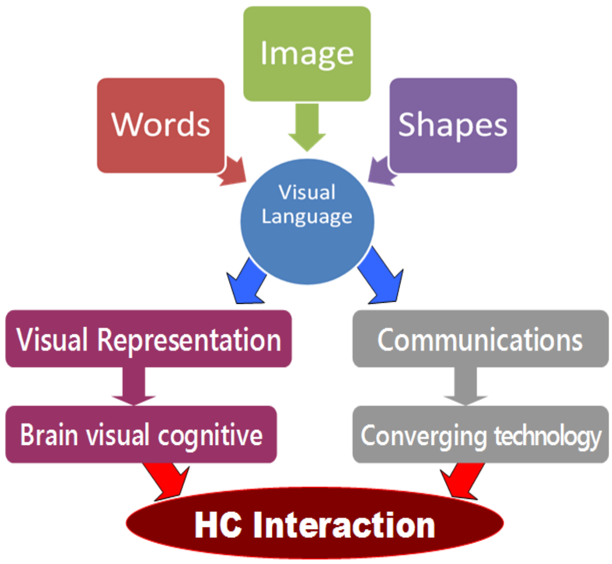


Fig. 2 The sketch map of integration for Visual Language and Converging Technology

The issues about "Can Computers Think?" is a set of visual maps to a critical debate in the field of artificial intelligence[11]. Some scholar research approach to visual argumentation is to flatten this complex, n-dimensional debate into 7 large, paper fold-out maps, each of which focuses assertions, refutations, and references on a key theme in the debate. A preliminary syntax, semantics, and pragmatics of visual language have been described. Description of, understanding of, and research on visual language would overlap with investigations of scientific visualization and multimedia. The tight integration of words and visual elements has a long history. Only in the last 50 years, with the approaching together of component visual vocabularies from such widely separate domains as engineering diagramming technologies developed in medical illustration, and hundreds of expressive visual conventions from the world of cartooning has something resembling a full, robust visual verbal language appeared [12, 13]. Even more complex program designer that have to use kindness tools and technologies to help them complete jobs. For example, the implementation of visual programming languages and their supporting environments is time consuming and tedious. Researchers have developed some high level tools to reduce the development effort. None of these tools, however, can be easily used to create a complete visual language in a seamless way like the lex/yacc tools for textual language constructions [14].

Its evolution has been rapid in the past years, especially with the confluence of scientific visualization software; widespread use of other quantitative software that permits the creation of over one hundred quantitative graphs and charts with the push of a single function key; and the profusion of multi-media presentation software, especially PowerPoint which, it is said, has several million users a day.

2.1 More Effective and Multiple Comm.

There is widespread understanding that visual-verbal language enables forms and efficiencies of communication that heretofore have not been possible. For example, improvements in human performance from 23 to 89% have been obtained by using integrated visual-verbal "stand-alone" diagrams. In the Fig.3 the importance of visual contents identified by research is shown. In this case, "stand-alone" diagrams refer to diagrams that have all of the verbal elements necessary for complete understanding without reading text elsewhere in a document. [15,16,17]

This new language facilitates complex, multi-dimensional visual-verbal thought, and -- with multimedia tools -- it incorporates animation as well. Researchers and scholars are no longer constrained by the scroll-like thinking of endless paragraphs of text.

Some article presents synergies between the research areas information visualization and knowledge visualization from a knowledge communication perspective [18]. That presents a theoretical framework and a model for the new field of knowledge visualization to the visual language. That describes guidelines and principles derived from professional practice and many researches on how architects successfully use complementary visualizations to transfer and create communication knowledge among individuals from different social, cultural, and educational backgrounds. The findings and insights are important for researchers and practitioners in the fields of visual language, information visualization, knowledge visualization, information design, media didactics, instructional psychology, and communication.

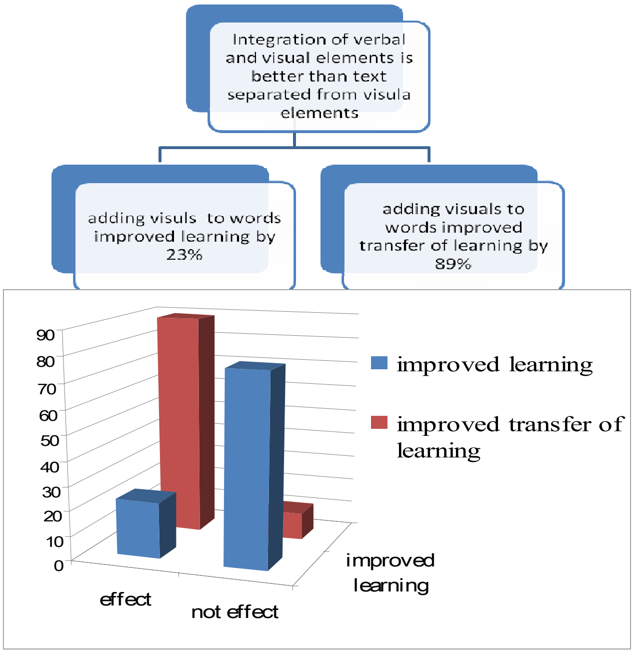


Fig. 3 Importance of Visual Contents identified by research

2.2 Complex Thoughts

Human cognitive effectiveness and efficiency is constrained by the well-known limitations of working memory that George Miller identified [19]. Large amount visual displays have for some time been known to help us overcome this bandwidth constraint. But only since the recent advances in visual language have we been able to imagine a major prosthesis for this human limitation. The prosthesis consists of a suite of visual language maps. This visual-verbal language (together with computer-based tools) may eliminate the major roadblocks to thinking and communicating big, complex thoughts - i.e. the problem of representing and communicating mental models of these thoughts efficiently and effectively. This especially includes the so-called messy (or wicked or ill-structured) problems. Problems have solutions. Messy problems do not have straightforward solutions.

They are more than complicated and complex. They are ambiguous and filled with considerable uncertainty - even as to what the conditions are, let alone what the appropriate actions might be bounded by great constraints; tightly interconnected economically, socially, politically, technologically. They are seen differently from different points of view, and quite different worldviews. They are comprised of many value conflicts, and often a-logical or illogical.

These problems are among the most pressing for our information society, for the advance of civilization, and for humanity.

2.3 Premises

The deep understanding of the patterns of visual language will permit:

- More complex and higher-order thinking, leading to a new era of thought.
- More rapid, more effectiveness, more creation interdisciplinary communication.
- Facilitation of business, government, scientific, and technical productivity.
- Potential breakthroughs in education, self learning and training productivity.
- Greater efficiency and effectiveness in all distribution.
- Better cross-cultural communication and interaction.

3. Theoretical and Fundamental

In psychology field the human who process and active interpreting and filtering external information through our perception is a instinct. This part will discuss with theoretical and fundamental of visual language with brain operation, further more probe visual–verbal activation distinguish location with converging technology.

3.1 Bottom Up of Visual Perception

In perception part which we discussed stimulus features of the object and how they are registered in the brain as lines, edges, colors etc. Perception process of sensation was first manipulates information by breaking it down into features, at next stage, processing of information becomes more complex. Simple features combine together to form precepts that make objects, contexts, and events. In this next level of processing one integrates, organizes, and interprets information, and is called perception. Perception is a mental process that involves using previous knowledge to gather and interpret the stimuli gathered by the senses. Thus perception involves input and recognition of sensory experience [20]. Visual cognitive style is one of the individual characteristics that affect any kind of information processing necessary for problem-solving. It is a psychological dimension that represents consistencies in how an individual acquires and processes information [21][22]. Visual cognitive style is related to an individual’s preferred approach of processing visual information.

Among various cognitive style dimensions proposed and studied by researchers, one of the dimensions continuously draw attention for research is how individuals process visual information using different strategies. Anne M Treisman[23] was clearly indicate attention mechanism that object perception may involve seeing, recognition, preparation of actions, and emotional that human brain imaging and neuropsychology suggest are localized separately. Perhaps because of this specialization, object perception is remarkably rapid and efficient.

Jasna Martinovic[24] designs a series ERPs experiments that verifying visual object features and feature conjunctions in the human brain, shown in the Fig.4. This article indicates object recognition is achieved through neural mechanisms reliant on the activity of distributed coordinated neural assemblies. In the initial steps of this process, an object's features are thought to be coded very rapidly in distinct neural assemblies. These features play different functional roles in the recognition process - while color facilitates recognition, additional contours and edges delay it, in the fig 5. At the lower level of this hierarchy singular features like lines are detected, at the next level features organize lines into angles, and then at still higher level into shapes (square). Such hierarchical models are called feature nets.

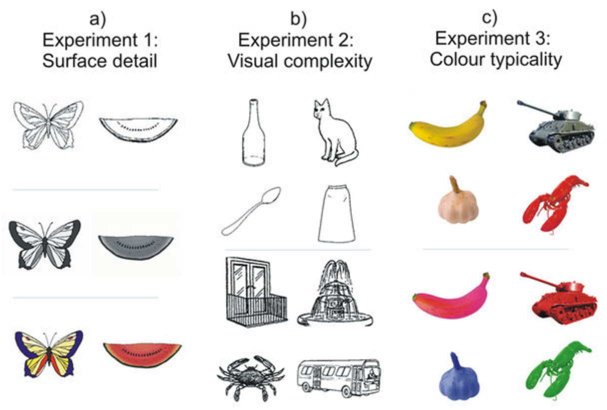


Fig. 4 Visual Object features and feature conjunctions experiments

Hubel & Wiesel[25,26] whom provided neurobiological evidence from their study of feature detectors(neurons) in the primary visual cortex.

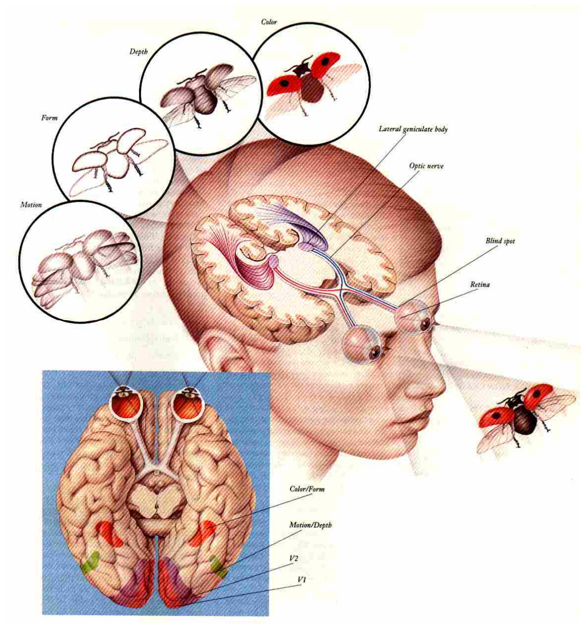


Fig. 5 The illustration of Eye and Brain function, Source: http://eyemakeart.wordpress.com/2009/07/25/eye-brain-funktion/

Any single object can project an infinity of image configurations to the retina. The orientation of the object to the viewer can vary continuously, each giving rise to a different two-dimensional projection. The perceptual recognition of objects is conceptualized to be a process in which the image of the input is segmented at regions of deep concavity into an arrangement of simple geometric components, such as blocks, cylinders, wedges, and cones. The geon theory explains how people recognize objects by detecting three-dimensional components, called geons[27]. The geons are found in encoded visual stimuli and then the person accesses memory to establish that the object they are looking at is made up of these geons.

3.1 Meaning Forming on Visual Language

However perception is not knowledge. Perception frequently contradicts what we know is “possible” or not. Knowledge and perception are mutually influenced, but are not the same thing. The perceiver and the knower are distinct in many instances. Therefore visual perception was becomes visual cognitive that have a series processing progress was called “complex thoughts”, included individual’s background knowledge and physiology difference. Finally through the knowledge into our visual cognitive that summarize our knowledge of visual learning. In the Fig.6 the visual learning sketch map is shown.

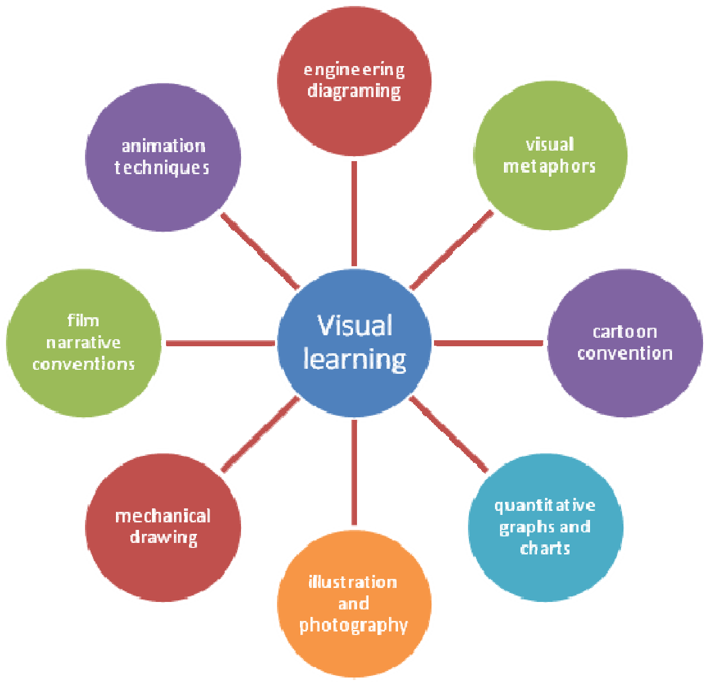


Fig. 6 Structure of Visual Learning

Visual cognitive style is related to an individual’s processing visual information, the classic categorization with to visualizer-verbalizer both, based on visual information processing, has been widely studied since its introduction [28][29]. According to this distinction, individuals can be classified as either verbalizers or visualizers, depending on their preferred modes of information processing, i.e., cognitive styles. Until recently, before neuroimaging technologies were developed, research on individual difference in visualization processing styles and preferences has been based mostly on the theory that imagery is a single dimension and therefore individuals may be classified as good or bad visualizers [30, 31].

While the visualizer and verbalizer concepts were considered to be opposite ends of a single continuum [32], recent empirical studies in neuro-imaging and neuro-psychology suggest that there are two areas in the brain that are functionally distinct for perceptual processing of object properties and spatial relations. And finally end up in two streams processing ”what”(inferotemporal cortex) the object is “where”(posterior parietal cortex) it is located. How do these parallel streams process bits of information and recombine them? Neuroscientists call this the binding problem, that are various inputs processed by separate systems bind together into the correct representation of a single object.

Kozhevnikov et al. [33] found that visualizers fell into two contrasting groups for either low or high spatial ability. A newer approach to characterizing individual differences in cognitive styles is based on the evidence in neuro-psychological studies proving that higher level visual areas of the brain are divided into two functionally distinct subsystems: the object and the spatial relations subsystems [34]. Similarly, in neuroimaging studies, spatial and object imagery tasks led to very different patterns of brain activity [35]. Particularly relevant to the current study is the well-established distinction between the ventral visual system functions (mainly for processing shapes and other properties of objects such as color and texture) and the dorsal visual system for processing spatial relations.

3.2 Object Visualizers versus Spatial Visualizers – Object Centered and Viewer Centered

Human observers can recognize three dimensional objects seen in novel orientations, even when they have previously seen only a relatively small number of different views of the object. How our visual system does this is a key problem in vision research. Recent theories and experiments suggest that the human visual system might store a relatively small number of sample two-dimensional views of a three-dimensional object, and recognize novel views by a process of interpolation between the stored sample views (Vetter, Poggio, & Bülthoff, 1994).

Recognizing objects is one of the central functions of human vision. One of the key issues in object recognition is the nature of object representation. Blajenkova et al. have defined object visualization as “representations of the literal appearances of individual objects in terms of their precise form, size, shape, color and brightness” [37], and spatial visualization as “relatively abstract representations of the spatial relations among objects, parts of objects, locations of objects in space, movements of objects and object to parts and other complex spatial transformation”.

Objects viewed from different angles will cast different 2D retinal images, yet we are able to recognize objects from many viewing angles. Two competing theories of object recognition propose different ways for the human visual system to recognize objects from different views.

During the last years, there has been a strong discussion in two different paradigms for object representation:1.object-centered or primitive-based representations, 2.viewer - centered or appearance-based representations[38]. A typical feature of primitive- based approaches is the decomposition of objects in a set of primitive shapes like Biederman geons. The problem to be solved therefore was to reconstruct a 3D object description from the given 2D image and to find the correspondences between the reconstructed object description and the object model. These object-centered representations have been used in the well-known work of David Marr [39], he suggested a number computational steps take place in the brain, before the object becomes a 3D representation.

Appearance-based approaches gained notices attention within the last years. These view-based object representation schemes that may include photometric as well as purely geometric information renounces the use of explicit object models. Instead, they base on a set of characteristic 2D views of the object. Thereby, a viewer-centered object representation is built. The main advantage of this class of approaches is that the learned 2D views can directly be compared with the presented 2D object view. View-point aftereffects were found in viewer-centered object representation in the human visual system[40], but not across, categories of objects tested (faces, cars, wire-like objects).

Recently, Chabris et al. [41] have established the validity of the dissociation between object and spatial visual cognitive styles with 3,800 participants. Using the Object-Spatial Imagery Questionnaire (OSIQ) self-report inventory, they found that object and spatial processing preferences were uncorrelated. In addition, women, humanities majors and people with visual arts experience preferred object visualizations, where as men, science majors and people with videogame experience preferred spatial visualization. It was also found that object visualizers performed better on a difficult test of picture recognition, whereas spatial visualizers performed better on tests of mental rotation and virtual maze navigation. The distinction between spatial-object cognitive styles is recent and gaining more convincing evidence from experiment studies [42].

Zimmer[43] was macroscopic discuss on sensory information of visual operation. It is shown in Fig.7, that visuo-spatial working memory is better characterized as processes operating on sensory information (visual appearance) and on spatial location (environmental coordinates) in a distributed network than as unitary slave system. Results from passive (short-term) and active memory tasks (imagery) disclose the properties (capacity, content) and the components of this network.

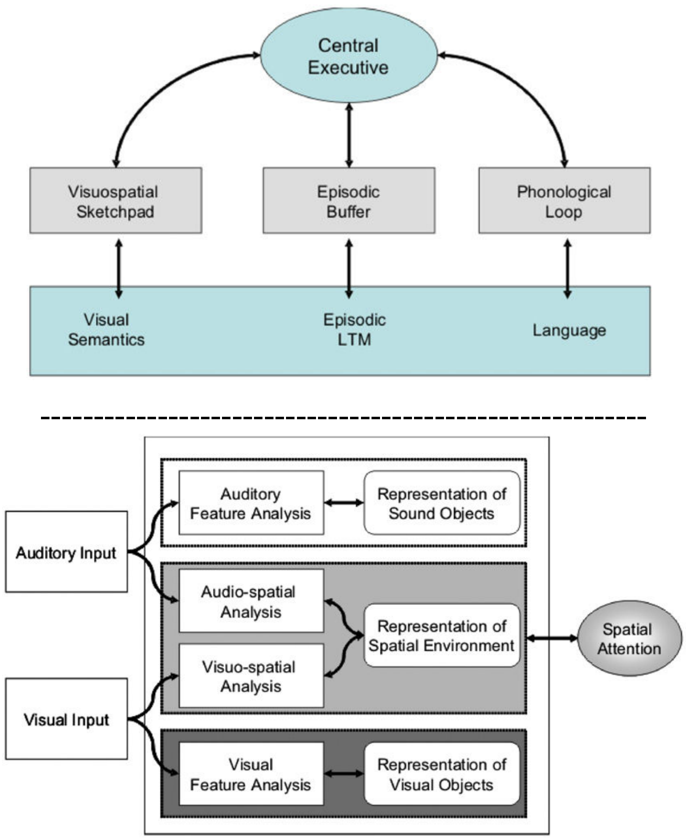


Fig. 7 An illustration of the tripartite memory model

Many major jumping-off research platforms have been created for rapid future development of visual language e.g. the Web, especially XML is becoming one of the most influential standards concerning data exchange and Web presentations [44], the ability to tag content with XML; database software; drawing software; a fully tested, widely used content-organizing and tagging system of structured writing and a systematic understanding, growing of the patterns of visual-verbal language.

4 Conclusion

4.1 Goals of Visual-Verbal Language Studies

A virtual superhighway for rapid development in visual language can be opened and the goals listed above in the premises can be accomplished only sufficient founds over the next few years are applied to the creation of

- Tools development
- Techniques creation
- Taxonomies establishment

On the other hand, it is necessary to be systematically conducting empirical research on effectiveness and efficiency of components, syntax, semantics, and pragmatics of this language. This in turn will aid the synergy produced in the convergence of biotechnology, nanotechnology, information technology, and cognitive science.

A research program requires both bold, general goals and specific landmarks along the way. A major effort to deal with the problem of increasing complexity and the limitations of our human cognitive abilities would benefit all human endeavors, and could easily be focused on biotechnology and nanotechnology as prototype test beds. We can contemplate, thus, the steady incremental achievement of the following goals as a realistic result of a major visual language program:

1. Policy-makers provided with comprehensive visual-verbal models.
2. World-class, worldwide education provided for children.
3. Large breakthroughs in scientific research.
4. Enriched art of the 21st century.
5. Emergence of smart, visual-verbal thought software.
6. Wide open doors of creativity.

Researchers in biotechnology and nanotechnology will not have to wait for the final achievement of these goals to begin to benefit from advances in visual language research and development. Policy makers, researchers, and scholars will be confronting many scientific, social impacts, ethical and organizational issues, and each leap in our understanding and competence in visual language will increase our ability to deal with the complexity. Normally, as a language advances in its ability to handle complex representation and communication, each such advance can be widely disseminated because of the modular nature of the technology.

Table1 Brain Converging Technology with introduction

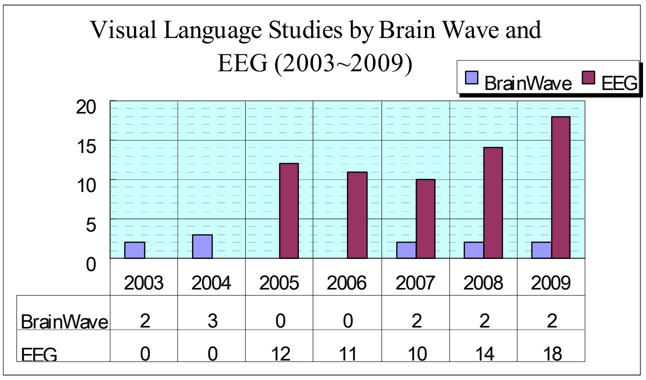
Term.	Complete name of brain technology
CT	**Computerized Tomography**
	CT scanning has been available for about 25 years. In CT scanning, the computer reconstructs images from a series of X-ray scans taken from various angles.
EEG ERPs	**Electroencephalography, Event-related potential**
	Many of the brain's cognitive and motor functions produce characteristic patterns of neuronal electrical activity. EEG is a method that amplifies these patterns and records them as distinctive signatures on an EEG. EEGs offer excellent temporal resolution and are used to construct brain maps, procedures known as **evoked related potentials** are often employed. In an evoked potential procedure, the subject is exposed to a particular stimulus (such as an **image**, a **word**, or a **tactile** stimulus) and the neuronal response associated with this stimulus in the brain is recorded on the EEG [47].
TMS	**Transcranial Magnetic Stimulation**
	As 1960s, and until 1980s that transcranial magnetic stimulation (TMS) was developed. Its original use was for studying the motor pathways that descend from the motor cortex down into the spinal cord and on to the muscles.
MEG	**Magnetoencephalography**
	MEG is a relatively non-invasive functional imaging technology that lets scientists and clinicians view the brain in action, by measuring the very weak magnetic fields generated by its electrical activity. MEG was first developed in the 1970s, but did not really come into its own until later on, when more powerful computers and more sophisticated computation algorithms became available.
MRI	**Magnetic Resonance Imaging**
	When MRI technology emerged in the late 1970s, it had the impact of a bombshell in the medical community. The conventional imaging methods of the day relied on either X-rays or ultrasound. But MRI uses magnetic fields instead, thereby exploiting the physical properties of matter at the sub-atomic level, and especially of water, which accounts for about 75% of the mass of the human body.
fMRI	**Functional Magnetic Resonance Imaging**
	Unlike ordinary MRI, which is used to visualize the brain's structures, functional magnetic resonance imaging (fMRI) is used to visualize the activity in its various regions. The scanning equipment used and the basic principle applied in fMRI are essentially the same as in MRI, but the computers that analyze the signals are different.
PET	**Positron Emission Tomography**
	Positron emission tomography (PET), was the first functional brain imaging technology to become available. It was developed in the mid-1970s. The physiological phenomenon on which both PET and fMRI are based was discovered when neurosurgeons found that the brain's cognitive functions cause local changes in its blood flow. When a group of neurons in the brain becomes more active, the capillaries around them dilate automatically to bring more blood and hence more oxygen to this more active part of the brain.

4.2 Brain Research and Technologies Trend

In recent years, advances in brain research publishes report about interdisciplinary investigations of nervous system structure, function and chemistry at all levels of resolution, from molecular to behavioral and social that are of general interest to the broad community of neuroscientists. These major subjects whose primary focus on "Cellular and Molecular Biology of Nervous Systems", "Nervous System Development, Regeneration and Aging", "Neurophysiology, Neuropharmacology and other forms of intercellular Communication", "Structural Organization of the Brain", "Sensory and Motor Systems", "Regulatory Systems", "Cognitive and Behavioral Neuroscience", "Disease-Related Neuroscience", "Computational and Theoretical Neuroscience" [45].

These studies most primary focus from microscopy to non-invasive functional imaging technology application, included on the structural organization of the healthy nervous systems, chemical senses, vision, auditory and vestibular sensation, somatic sensation (including pain), sensorimotor integration, oculomotor control, central pattern generators, further on neural mechanisms of cognition and behavior in humans and animals basic behaviors such as feeding, mating, reproduction, and aggression, and higher mental functions such as attention, learning and memory, language, judgment, reasoning, decision-making, emotion, and higher-order perceptual and motor processes, and so on. Brain converging technology with introduction was listed table 1[46].

Fig. 8 2003~2009Visual Language and Brain Wave Studies



In the Fig.8 which combined with brain technology(Ex. EEG) and visual language that on current studies status of investigate from database of WOS(Web of Science). Results for these publishes whose can probe increase trend of visual language and brain technology both.

In the Fig. 9, the research topics distributions under visual language were founded. The drawing field is the major focus.

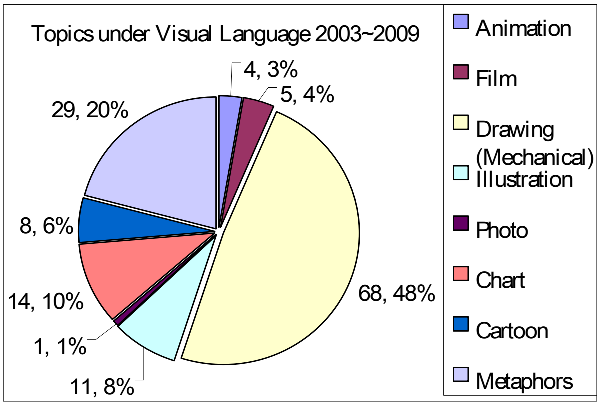


Fig. 9 Topics distribution under visual language

4.3 Top-down Grounding

These major developments of brain visualize and visual language enhancement that will change our future knowledge of ecological but also will lead us to a glimpse into the brain, mysterious performance.

The next stage we should think that how to improve our literacy of visual language and enhancing ability of technology application, called top-down problem solving competence. Similar with UK technology education primary focus is on the literacy of design. It begins in the elementary stage to implement the learning of recognition of drawing, design(CAD), and manufacturing of artificial world (CAM). McCormick[48] points out that CAD/CAM applications could fully help students, introducing new design and new working methods that express their cannot be expressed. International technology educators association(ITEA, now called ITEEA) also promotes the school's computer-aided design, and called for education in science and technology education should include manufacturing systems, robotics, and computer aided design system [49].

As for the industrial category of professional whose, for the knowledge map and drawing ability is a basic ability. Similar to the trend for drawing that have the some results of visual language studies statistics in table3. Therefore, ability to foster consensus map, the subject in the school for the learning stage becomes an important issue in education[50]. Moreover complexity thinking of visual language that will deeply discovery the mechanism with brain process. Symbolic representation of visual language which that tend to specific fundamental narrow down and more theory construction. These major trends were let's wait expectantly. There are also different interesting related research topics, such as PBL, Mobile Learning, and Databases integrating [51,52,53] all are worth for intensive concerns of their developing trends.

In conclusions, the drawing field should be put more attentions and the trend of using EEG technology in visual language had become the major tool for exploring research problems of visual language.

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