



Sveriges lantbruksuniversitet  
Swedish University of Agricultural Sciences

**Faculty of Natural Resources and  
Agricultural Sciences**

# Through Interpretation, Understanding

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Department of Urban and Rural Development  
Master's Thesis • 30 HEC  
Environmental Communication and Management - Master's Programme  
Uppsala 2016



## Through Interpretation, Understanding

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**Credits:** 30 HEC

**Level:** Second cycle (A2E)

**Course title:** Independent Project in Environmental Science - Master's thesis

**Course code:** EX0431

**Programme/Education:** Environmental Communication and Management – Master's Programme

**Place of publication:** Uppsala

**Year of publication:** 2016

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**Online publication:** <http://stud.epsilon.slu.se>

**Keywords:** interpretation, knowledge, learning, model

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## Abstract

A heuristic model concerning the system of knowledge-experience-learning was constructed to understand interpretation. The model suggests that the individual constructs his/her understanding in a mediating Working Sphere in mind, only some section of his/her knowledge would be activated and drawn there and interact with the captured information from the environment. Such interaction produces a subjective experience, and, in turn, develops the knowledge. Interpretation could be understood as a special kind of experience during which the individual explores original contexts with some help from the interpreter.

**Keywords:** interpretation, knowledge, learning, model



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# 1. Introduction

## 1.1 What is “Interpretation”?

“Interpretation” is a word with many connotations – the most basic one is “to explain/reveal the meaning of something”; deriving from that, it also has more specific meanings such as “oral translation” (explain the meaning expressed in foreign language), “performance of a piece of art” (explain the meaning of the piece of art), even “explanation of dreams and omens”.

In this report, the term is employed for yet another connotation, which refers roughly to: services provided for visitors to help “reveal the meaning of” the place they visit, or things, events, concepts relevant to the place. Such services may take place at national parks, heritage sites, museums, zoos, aquariums or other similar places; including services such as orientation, additional information, and so on. It could take forms of manned activities or products, for instance, a park ranger guiding a group of visitors around, leading the way as well as talking about the site to his/her audience could be counted as interpretation; so does the trail-side label providing information about the plants next to it. Usually the first type is termed as “personal” or “face-to-face” interpretation, while the second type is termed as “non-personal” interpretation.

When the term “interpretation” is used in this specific sense, it is sometimes preceded with headings such as “nature”, “historical”, and/or “heritage” according to the topics - nature interpretation is interpretation about nature, and historical interpretation is interpretation about history, and so on.

Similar activities are also named with other terms. “Education” and “guide” are two common seen alternatives. For instance, “museum education” is a term widely used in a museum context (Black, 2005), and in Swedish, the term naturvägledning is used, which would be translated into English as “nature guide” (CNV). These activities, no matter how they are named, are all recognized as “interpretation” in this report.

## 1.2 Development of Interpretation

Interpretation as such, is considered originate in early conservation movements that began in the late 19<sup>th</sup> century in the United States. As the US national park system was developed during this period, an array of services were provided for the visitors to those parks, through displaying guide and information, helping them to better acknowledge and understand the places and related knowledge, with implicit purpose to serve conservation work, and these activities were named “interpretation” (Ablett and Dyer, 2010; Tilden, 2007).

The National Park Service (NPS) of United States, in charge of the national park system, has been investigating into such interpretation practices (Tilden, 2007), so to achieve better performance. Invited by the NPS to investigate the national park services, Freeman Tilden became a key contributor to the development of interpretation, his book *Interpreting Our Heritage* (1957), is

sometimes hailed as “the bible of interpretation” and offers tremendous perspective of current intellectual understanding and practice. (Tilden, 2007; Ablett and Dyer, 2010; Ham, 2009; Ham, 2013)

It should be noted that Tilden did not “invent” interpretation, his contribution has “forged the underlying philosophy of interpretation,” or to say, “codified the operating principles of interpretation” (Tilden, 2007).

### **1.3 The Underlying Philosophy of Interpretation**

Tilden defined interpretation as “an educational activity which aims to reveal meanings and relationships through the use of original objects, by firsthand experience, and by illustrative media, rather than simply to communicate factual information.” (Tilden, 2007)

Tilden further cultivated his philosophy of interpretation into Six Principles (See Box 01), which, according to him, “may support the structure of interpretation.”

#### **Box 01 Tilden’s Six Principles of Interpretation (Tilden, 2007)**

1. Any interpretation that does not somehow relate what is being displayed or described to something within the personality or experience of the visitor will be sterile.
2. Information, as such, is not Interpretation. Interpretation is revelation based upon information. But they are entirely different things. However all interpretation includes information.
3. Interpretation is an art, which combines many arts, whether the materials presented are scientific, historical or architectural. Any art is in some degree teachable.
4. The chief aim of Interpretation is not instruction, but provocation.
5. Interpretation should aim to present a whole rather than a part, and must address itself to the whole man rather than any phase.
6. Interpretation addressed to children (say up to the age of twelve) should not be a dilution of the presentation to adults, but should follow a fundamentally different approach. To be at its best it will require a separate program.

Although Tilden counted “interpretation” as “an education activity”, he kept emphasizing that it does not mean interpreters (practitioners of interpretation) should aim at “teaching” or “transferring factual information to visitors”.

Rather, interpretation should aim at helping the participants themselves to reveal the meaning of the interpreted subjects, to understand the subject. As Tilden put it himself “The chief aim of interpretation is not instruction, but provocation.”(Principle 4, see Box 01)



This idea has become the key point in the philosophy of interpretation, and reflected clearly in the definitions of interpretation coined by others. For instance, National Association of Interpretation (NAI) defined interpretation as “a mission-based communication process that forges emotional and intellectual connections between the interests of the audience and meaning inherent in the resource.” While Ham’s (2013) definition stated “interpretation is a mission-based approach to communication aimed at provoking in audiences the discovery of personal meaning and the forging of personal connections with things, places, people and concepts.”

Even though these definitions employed different terms, the point stands out: interpretation should help its participants to make personal meanings, not merely presenting “objective” information to them, as Tilden put it himself: “Information, as such, is not Interpretation. Interpretation is revelation based upon information. But they are entirely different things.” (Principle 2, see Box 01)

The philosophy of interpretation was summarized explicitly by an anonymous NPS personnel, which was quoted by Tilden in his book, then further cited so many times that these few words are perhaps the most cited phrases in all interpretation literature, and philosophical orientation practitioners worldwide draw upon. (Ham, 2009)

“Through interpretation, understanding;  
through understanding, appreciation;  
through appreciation, protection.”

“Understanding” - the personal, subjective, meanings and connections the participants construct themselves, not acquisition of “objective knowledge” from authority, is seen as the major aim/consequences of successful interpretation, as how Tilden would put it, “Any interpretation that does not somehow relate ... to something within the personality or experience of the visitor will be sterile.” (Principle 1, See Box 01)

This idea resonates with Constructive Learning Theory, also known as Constructivism, a set of learning theories which view learning as an active process in which “learners construct new ideas or concepts based upon their current and past understanding” (Bruner 1960, cited in Black, 2005, p.140).

## 2. Problem Formulation

Even though the philosophy of interpretation forged by Tilden was widely accepted, I would like to argue that Tilden and some of his successors had summarized their philosophy of interpretation directly from observation of field practices – from “an inductive approach” if employing the terminology from Alvesson and Sköldbberg (2009), which has the risk of excluding

some of the underlying structures/patterns. Furthermore, Tilden had not provided any theoretical framework in scientific terms – based on what kind of mechanism interpretation works.

A deductive complementation would help resolve the problem, and there are studies upon interpretation which employ general theories, especially from the discipline of cognitive psychology, to analyze the interpretation practice. However, there were critiques that these later research on interpretation had focused more on how to influence, even “manipulate” visitors’ behavior into more protective ways, and/or imposing certain “thoughts” about the interpreted subjects upon visitors, rather than following Tilden’s trend to help construct personal understanding (Ablett & Dyer, 2010) .

From my point of view, this situation is largely due to that most of such studies had still taken the perspective of interpreter, to see how their practice might influence the outcome, thus the theories employed apparently were limited to those about interpersonal influence. If the proposal from Constructive Learning Theory was to be fully accepted that “learners (in our case, participants of interpretation services) are seen as the center of the learning experience, while teachers (in our case, interpreters) serve as facilitators” (Black, 2005); then the research perspective should be shifted to the learners/participants, so that a greater body of knowledge concerning learning, understanding/knowledge and experience of human beings in general, could be employed in analysis of interpretation.

Cognitive Psychology as a scientific a discipline, not only contributes a lot in our understanding of learning and experience of human beings in general; but also dominates interpretation literatures (Ablett and Dyer, 2010). However, Cognitive Psychology research usually assumes a reductionism approach, which studies different mental processes separately (Braisby and Gellatly, 2012), for instance, visual recognition process, language (auditory) perception, memory, and attention, would all be singled out and studied separately. I would argue that learning experience involves all these processes, and an integrated model instead of segmented understanding of separated processes is required.

### 3. Research Objectives and Research Questions

The major objective of this study was to investigate interpretation from the participants’/learners’ perspective, employing theories concerning learning, experience and understanding of human beings in general which derived from scientific research, formulating a consistent theoretical framework (a model), with which to analyze “learning through interpretation experience” as a specific case; and to discuss the possible application of such understanding into field practices.

In order to investigate interpretation from a relatively deductive approach - not limited to experience gained from successful interpretation practice, but to consult established theories concerning understanding, learning and experience of human beings in general, the perspective

was shifted from the interpreters to the participants/learners. Thus, the normative question “how could interpretation be well performed” could then be reformulated as “how could interpretation practice facilitate learning?” In turn, the descriptive question was formulated “what are the underlying mechanisms and patterns of learning?” And established theories derived from scientific research would be consulted to address the question.

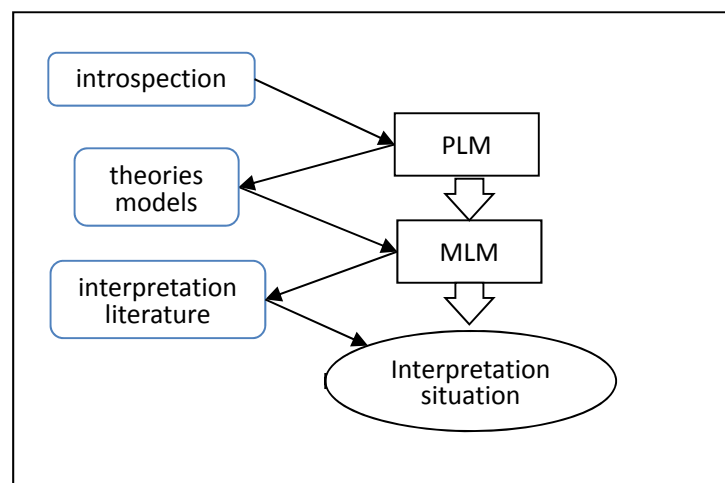
Instead of employing segmented theories to account each process which is part of the understanding- experience-learning system, my objective was to address this system as a whole, with the focus upon how understanding would be developed through the learning experience; and achieve that by integrating those theories together to formulate a uniform, consistent theoretical framework.

Finally, it was also aimed to discuss how the insights collected through this investigation could be applied in field practice.

## 4. Methods

**Model Constructing** (Braisby and Gellatly, 2012) was the overarching method for this study: A tentative model was constructed to represent understanding and learning in general, then further developed through investigating into established theories in relevant fields. In other words, theories in this study are somehow similar with empirical data in ordinary studies, which is why the theory section in this thesis comes unconventionally after the methods section. Figure 01 roughly illustrates the research progress.

Figure 01 The Research Progress



### Introspection and Primitive Model Construction

At first, a primitive model concerning the learning process in general – the Primitive Learning Model (PLM), - was constructed. This was done through introspection (Braisby and Gellatly, 2012) – the self-reflection of my personal understandings of the matter, which might come from

previous learning or personal experience. Some fundamental yet general ideas were summarized and formulated as basic assumptions, and then a major structure of the model was sketched based on these assumptions. It was also during this step that the major mental processes concerning the learning experience and understanding/knowledge, such as memory, sensation and perception, were identified for further investigation.

### **Model Modification through Literature Investigation**

The PLM was developed in three aspects during this step. First, as the assumptions derived from my introspection could not be considered as valid in scientific terms, investigation into existing research in relevant fields was carried out in seek for verification (or falsification). Literature concerning learning and other processes identified in PLM were sorted, and those assumptions made during primitive model construction were either confirmed or removed, depending on whether or not they were supported by rigorous research. More frequently, the original assumptions were neither confirmed nor removed, but modified in accordance to such investigation. In turn, the structure of the model might also be modified.

Secondly, an investigation was carried out into those processes relevant to learning, experience and understanding which were identified in PLM. Such literature investigation collected detailed and systematic illustrations and analysis of these processes from existing studies – theories, models, hypotheses and other theoretical understandings to enrich the model. Some additional processes relevant to learning were introduced, and the previously identified processes, attention and sensation for instance, were not discussed in detail in this thesis, according to the results of investigation.

Last but not least, along the lines of the previous two aspects rather than after those tasks were completed, was the task to integrate those theories into a single model, rather than remain as segmented statements. Thus, a more elaborate model concerning learning and understanding in general was developed into the Modified Learning Model (MLM).

### **Model Application and Specification**

The MLM was then applied to analyze learning and understanding under interpretation situations specifically. Tilden's book (Tilden, 2007. *Interpreting Our Heritage*. 4<sup>th</sup>. ed., first published 1957, Chapel Hill: The University of North Carolina Press) was employed as the major resource for interpretation situations. Tilden's key terms concerning interpretation and learning were explained with the Model, those examples Tilden had provided were analyzed with MLM as well. On one hand, this step served as a test of MLM; on the other, it identified the special characteristics of the learning process through interpretation experience, generating feedback so that further modification of the model might come in need - additional theories and models to be employed, or existing theories to be investigated in more detail. During this step it was also discussed how the model could serve as a tool for field practitioners to generate operational recommendations.

## 5. Theories

The theories I had employed in this thesis could be categorized into four major categories: Constructive Learning Theory, theories and models concerning the mechanism of mental activities in general, theories and models concerning Memory, and cognitive theories concerning the patterns of learning, understanding and experience.

### 5.1 Constructive Learning Theory

**Constructive Learning Theory** (Black, 2005; Fosnot and Perry, 1996), also known as Constructivism, developed by Piaget, Vygotsky, Bruner and others, is a set of learning theories proposing that learning is an active process in which learners construct new ideas or concepts based upon their current and past knowledge. The teacher (interpreter in our case) becomes a facilitator of learning rather than being central to it. Developed around this idea, this set of theories investigated into the underlying mechanism and patterns of learning.

From the perspective of Constructive Learning Theory, the term “knowledge” stands for the individual’s collection of understanding, the sum of information of what is known to him/her, instead of a body of true, justified, certain and objective information organized according to the structure of the subject (Hein 1998, cited in Black 2005). And in this thesis, the term “knowledge” is used following such Constructivism perspective.

Jean Piaget, a major contributor of the Constructive Learning Theory, had theorized learning as dissipative structure and equilibration - in analogy with the process that life emerged from a non-living environment, as well as the process of evolution. He argued that learning is a self-regulated, self-organizing dynamic process as the learner organizes information input from the environment. The learner would strive to reach equilibrium – consistent in his/her cognitions and actions, and this would be done through the balancing between assimilation and accommodation.

Assimilation refers to the process that to incorporate information input with the learner’s existing understanding, at times this would be done at the cost of modifying the information input according to one’s understanding (however, this is not necessarily always so). Accommodation, on the other hand, refers to the process which the learner reconstitutes his/her understanding so to incorporate new information input.

Another key contributor, Lev Vygotsky, had argued that scientific models cannot be transmitted from teacher to learner simply through language. In contrast to “scientific concepts”, the learner would develop “pseudo concepts” or “spontaneous concepts”, as Vygotsky named, the ideas that the learner has developed from his/her previous experience. Vygotsky proposed that the learner

would only be able to learn the scientific model when he/she has developed his/her spontaneous concept to a certain extent, and where the self-developed spontaneous concept meets scientific concept was named "Zone of Proximal Development" by Vygotsky.

## **5.2 Cognitive Theories and General Mechanism of Mental Activities**

**Cognitive theories** (Braisby and Gellatly, 2012) are a set of learning theories of psychology that attempts to explain human behavior by understanding the thought processes. It is assumed that human individuals are thinking beings, experience and act upon the world they live in actively and dynamically, make the choices that make the most sense to them; instead of simply responding to external stimuli in a mechanical way. It should also be noted that although individuals are seen active, they are not entirely independent, which infer that their experience and subsequent behaviors are largely influenced by the natural and cultural environment they dwell in. Cognitive Theories explained major processes which constitute understanding, learning and experience.

### **The Astonishing Hypothesis** (Crick, 1994)

It is stated that the mental activities of humans are the product of the physical activities of the body, primarily the neuron system, the brain, rather than the other way around, so that any mental process could be represented as neuron actions.

### **Parallel Distributed Process Model** (Passer et al., 2009)

Parallel Distributed Process Model, also known as neural network model or connectionist model, is a general model describing how mental activities are accomplished through understanding how the neuron system works. The model is constructed based on the observation that neurons (nerve cells) interconnect with each other, formulating a network system which accomplishes the task of information processing through neuron impulses. As the impulses are spread throughout the network, firing in parallel at each instant and simultaneously, the model is named as such. Parallel Distributed Process Model provides a uniform model to illustrate various mental activities, and in this thesis, it was simplified as the act of meaning making and subsequent activation (see section 6.2).

## **5.3 Theories and Models Concerning Memory**

Memory is the faculty in the individual by which things (including knowledge) are stored in the mind. Thus I considered the study of memory as a major component of the study of knowledge/understanding and learning. Thus, I had investigated theories and models concerning memory in this thesis.

### **Multistore Model of Memory** (Atkinson and Shiffrin, 1968 cited in Braisby and Gellatly, 2012, p.235)

It is proposed that there are three separate memory stores (Sensory Memory, Short-Term Memory and Long-Term Memory) with which humans store information in the mind. Information

must flow from one store to the next when the individual memorize and/or remember information.

**Episodic and Semantic Memory** (Tulving, 1972 cited in Braisby and Gellatly, 2012, p.236) | Episodic and semantic memory were distinguished from each other. Episodic memory involves the storage and retrieval of specific events (including place and time). Semantic memory stores information/meaning about the world including general and abstract facts. The model was developed based on the observation that some patients who suffered from brain damage would lose certain types of memory.

**Procedural/Implicit Memory** (Squire, 2004 cited in Braisby and Gellatly, 2012 p.236)

It proposed an alternative way to divide memory, rather than by “episodic” and “semantic”: memory is divided instead as explicit/declarative memory and procedural/implicit memory. The former refers to the information one may consciously retrieve, while the procedural memory won’t be retrieved consciously; it influence one’s behavior, such as, the memory of certain motor skills when used to playing a musical instrument.

**Semantic Associative Network Model** (Collins and Loftstus, 1975 cited in Passer et al., 2009, p. 346)

This is a model for semantic memory, which pertains to Long-Term Memory, it is suggested that the individual makes understanding through associating ideas and concepts with others so to form a massive network in the mind. Each concept or unit of information is represented by a node; the network in which nodes connected with each other, in turn, represents how the individual organizes information about the world.

#### **5.4 Other Theories Concerning Knowledge, Learning and Experience**

**Cognitive Dissonance Theory** (Festinger, 1987 cited in Passer, et al., 2009, p. 610-12)

It is proposed that people feel distressed when they “find themselves doing things that don't fit with what they know, or having opinions that do not fit with other opinions they hold.” To reduce or reconcile such mental states of “cognitive dissonance”, people have a motivational drive of altering those existing cognitions, adding new ones to create a consistent belief system, or alternatively by reducing the importance of any one of the dissonant elements. The ideas proposed in Cognitive Dissonance Theory are similar with those formulated by Piaget, so I employed it here as additional reference.

**Triadic Process of Signs** (Peice, 1998; Craig and Muller, 2007)

It is proposed that the individual’s understanding of the world involves the object in the reality world, the sign or “representamen” with which he/she used to stand for the object, and the idea or “interpretant” with which the object and sign are connected. The thinking process could be illustrated as ideas chained together. In this thesis, such concepts were reformulated as sensory/motoric, symbolic and semantic representations.

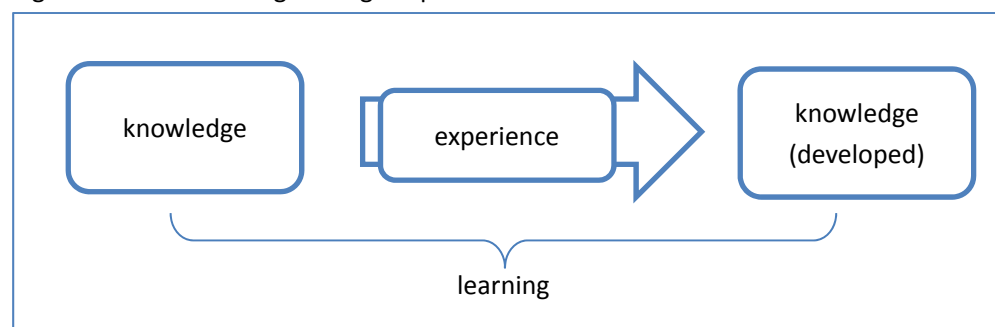
## 6. Findings – Model Construction and Application

In this section, I demonstrate how the model concerning learning in general was constructed, developed and applied into understanding interpretation. To be clear, the term “individual” was employed to stand for an average of normal human being, so to discuss the general patterns. The term “knowledge” was used in its Idealism aspect, standing for the sum of information which was known to the individual, NOT as Realism’s notion of “objective, justified truth”. The term “understanding” refers to the specific case when the individual’s knowledge was applied. As it came to “learning”, I had focused on the development of knowledge in this thesis, despite that the development of skill (procedure memory instead of semantic memory) could also be counted as learning.

### 6.1 Structural Framework of the Model

One of the core ideas of Constructive Learning Theory suggests that people construct their own understanding (of something) through the learning experience. Based on this idea, I designed the basic structure of the Primitive Learning Model (see Figure 02).

Figure 02 PLM: Learning Through Experience



A stereotype of “learning” is that a student sitting in a classroom listening to the teacher’s lecture. However, “learning” could be defined in a broader sense; for instance, Passer et al. (2009) defined learning as “a process by which experience produces a relatively enduring and adaptive change in an organism’s capacity for behavior.” In this thesis, learning was evaluated as an overall consequence of experience, instead of as an outcome against an intended objective. For instance, I learned that my former classmate, Hu, preferred the red color, as he wore red a lot, yet I had no intention to learn that. **Any development of the individual’s knowledge could be counted as learning.** (Please note here that “knowledge” is used in its Idealism aspect, which means the knowledge the individual has acquired was not necessarily objectively correct.)

With the basic structure illustrated in Figure 02, existing theoretical understandings concerning both “knowledge” and “experience” were then investigated. Theories on **memory**, especially Long-Term Memory - how the individual holds and organizes his/her knowledge enduringly and

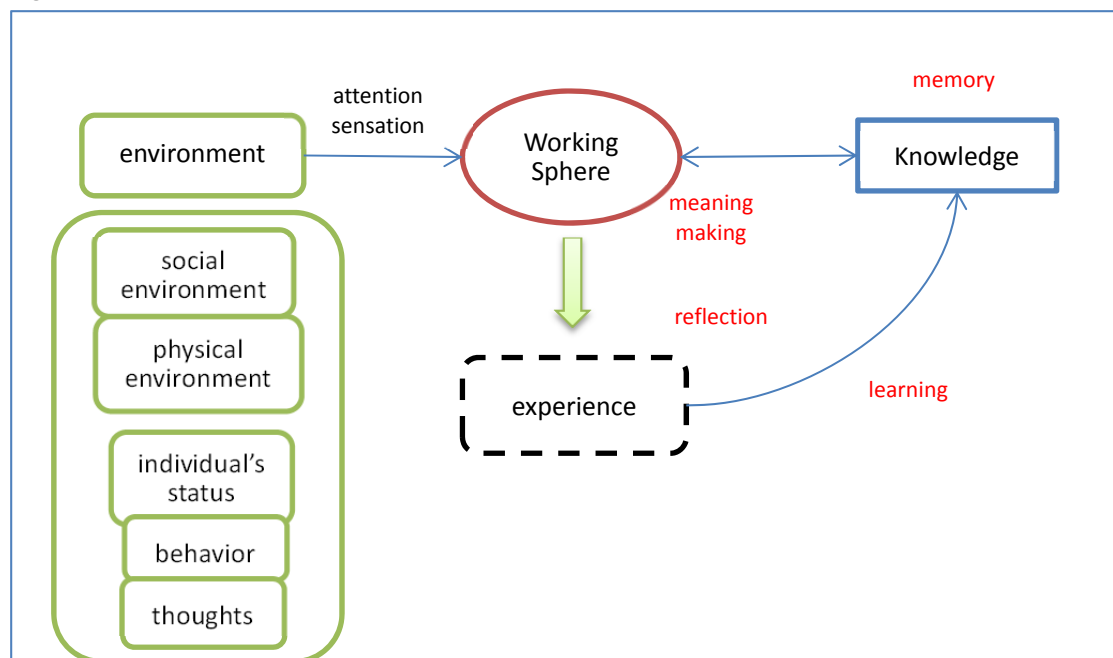


employs such knowledge when in need – were mainly consulted when it came to “knowledge”.

It was a bit more complicated when it came to “experience”: according to the general assumption of cognitive theories, experience is not to be simply understood as the environment surrounding the individual - objects out there, events happening; rather, experience is the individual’s subjective perception of such objects and events, as well as his/her own interaction with the environment. As perceptions are made based on knowledge, thus, there could be no experience the individual may have independently of his/her knowledge.

Based on Multistore Model of Memory and other theories presented in Section 5.3, I propose that the individual does not apply the entire collection of his/her knowledge directly into understanding from time to time, in other words, environmental information input and the individual’s knowledge do NOT interact directly. Rather, there is a mediating entity, where the information to be understood is held, and relevant pieces of information from the knowledge collection would be drawn there, for the individual to construct understanding – mental representation of the world (or the situation), and produce experience. I termed this mediating entity as “Working Sphere” in this thesis. And the act which the individual carries out to draw his/her knowledge into Working Sphere, was termed as “meaning making”. See Figure 03.

Figure 03 The Basic Structure of Modified Model



The individual’s status (“hungry” and “upset” for instance), behaviors and thoughts, are special components of experience, as they could be seen on one hand the consequences of meaning making; on the other, as “environment” in a broad sense which provides materials for further meaning making.

The process illustrated in Figure 03 is not to be understood as a simple linear one, that first the individual captured stimuli from environment first, then put the stimuli into the Working Sphere,

and after that draw knowledge from his/her memory to make meaning of the stimuli. Rather, the process is dynamic and interactive, for instance, it could be the case that the individual holding an idea from his/her knowledge in the Working Sphere, then seeking environmental stimuli which fits the idea.

I would like to highlight the importance of the very existence of the “Working Sphere”. First, with such mediating entity, the individual could maintain a relatively stable and resilient knowledge system, despite experiencing a rapidly changing environment. Secondly, it made it possible for the individual to make meaning of the meaning making process itself, to reflect upon his/her own status, behavior, thoughts and knowledge, instead of simply reacting to the environment with preset knowledge patterns.

Thus, the PLM was modified and further developed to become the MLM as it was illustrated in Figure 03. In the following sections, I would demonstrate the MLM model in more detail about:

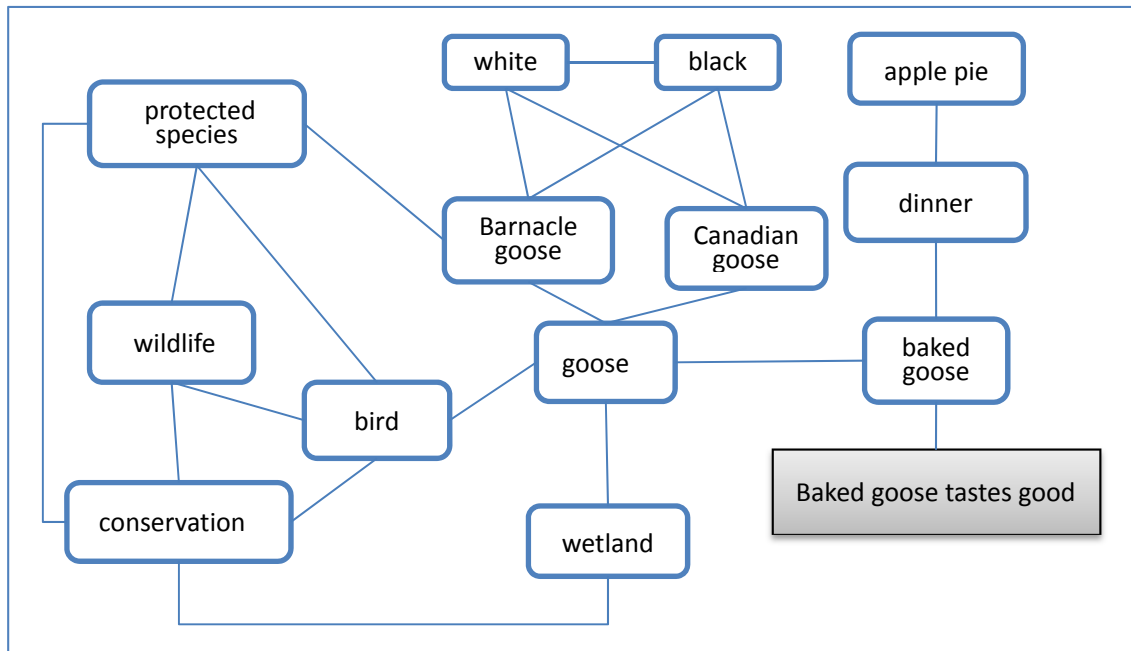
- How the individual organizes and represents his/her knowledge in memory;
- How the knowledge is applied into understanding/constituting experience through meaning making acts;
- How meaning making and reflection facilitate the task of learning.

## **6.2 Semantic Associative Network: A Model of Knowledge**

### **6.2.1 Knowledge as Semantic Associative Network**

One’s knowledge, termed as Semantic Memory in memory research, could be modeled as a Semantic Associative Network (SAN), a massive network of associated mental units - concepts, ideas, and principles (Collins and Loftus, 1975 cited in Passer et al., 2009, p. 346). See Figure 04 for example.

Figure 04 An exemplar portion of Semantic Associative Network



**Concepts** are mental categories into which we place objects, activities, abstractions and events that have essential features in common (Passer et al., 2009); they are the basic and major units that constitute the Associative Network.

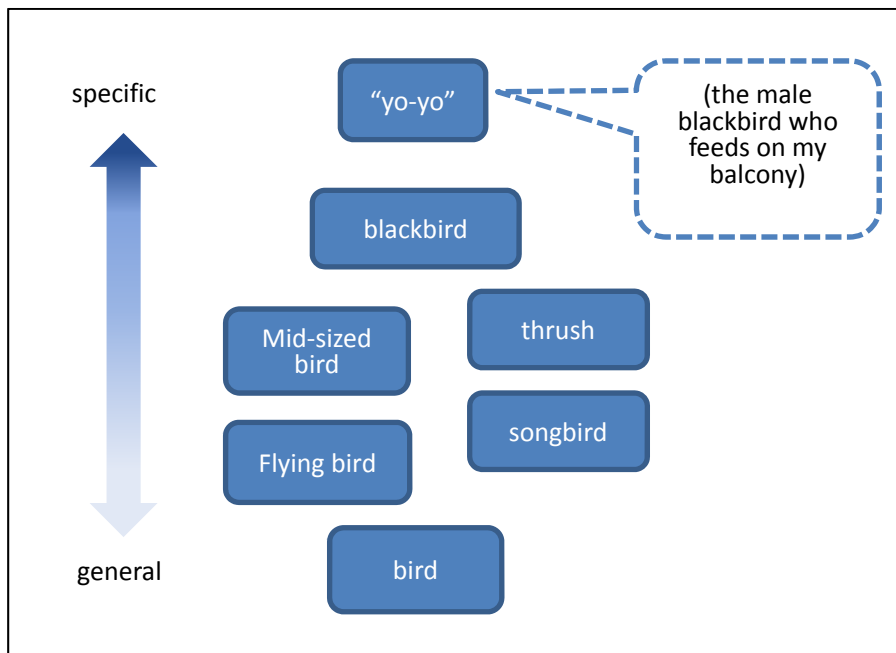
According to Rosch (1977 cited in Passer, et al., 2009, p. 405), most concepts are defined by prototypes, the most typical and familiar members of a category, instead of explicit definitions. For instance, when someone thinks about the concept “bird”, it would more likely come as “something like sparrow”, rather than “feathered, winged, bipedal, endothermic, vertebrate animal”.

People would decide whether something fits a given concept by its degree of resemblance to the prototype.

It should be noted that different people may employ different prototypes for the same concept, for instance, I may employ “sparrow” as the prototype for the concept “bird”, while another person might use “raven”. On the other hand, the same object (or abstractions, events, activities) might be used as a prototype for different concepts, even contradictory concepts by different people, for instance, “football” might be the prototype for “interesting sport” for me while “violent and boring game” for another.

The individual may construct a concept for very specific objects/events on one hand, and very general genre on the other. See Figure 05 for example of concept from specific to general.

Figure 05 A Series of Concepts, from Specific to General, Example



**Ideas**, another kind of important building block of the network, could be seen as certain combinations of several concepts expressing specific meaning, for instance, the idea “baked goose tastes good” combined the concepts “baked goose”, “taste” and “good” together. An idea does not necessarily need to be expressed explicitly, taken the previous idea for instance, it could manifest as when the individual thinks about a baked goose, he/she would then think about its good taste.

**Principles**, are special ideas which the individual usually would follow when thinking about relevant matters. For instance, a principle, such as “it’s better to gain more while it’s better to lose less” may guide the individual’s reason and subsequent behavior in trade. It should be noted that a mental principle does not mean it is objectively correct.

### 6.2.2 Mental Representations and Mental Connections

Note that those semantic units (concepts, ideas) in Figure 04 and 05 were represented with words and sentences, which are the building blocks of the major symbolic system human beings used for communication – language. The term **proposition** in this thesis referred to those ideas which are represented explicitly through language in one’s mind, in other words, as inner conversation with oneself.

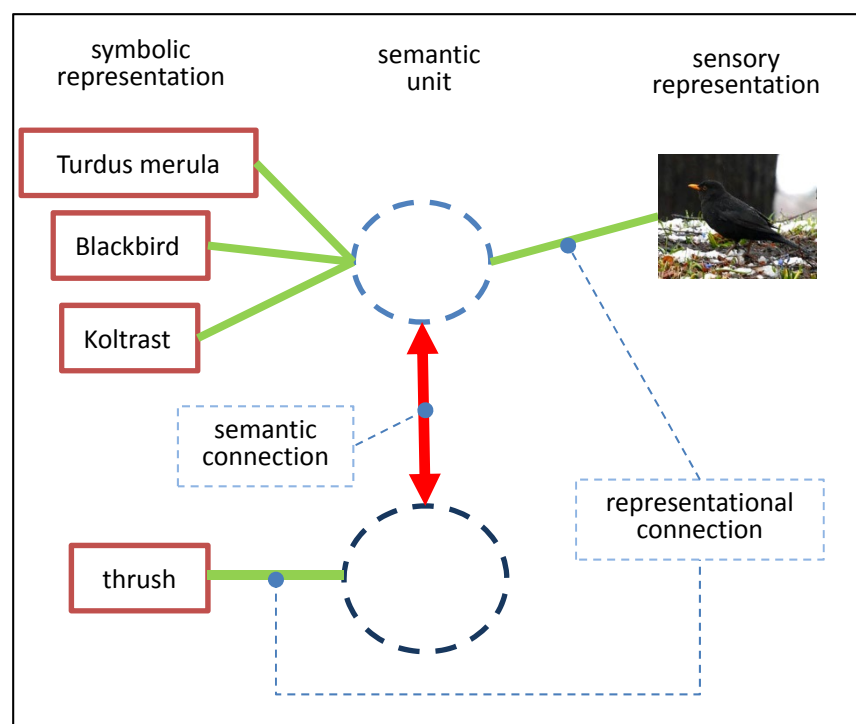
However, semantic units could also be represented in another way - by sensory features. For instance, try to think about the concept “blackbird”. Besides thinking the concept as a proposition, one would also be able to (if he/she knows the concept “blackbird”) imagine the vivid image of the bird’s appearance and action, the vivid melody of its songs, the tender touch of its feather and the warmth of its body... employing **imaginal thinking** (or **sensory thinking**) rather than **propositional thinking**.

Parallel to sensory representations, which concerns the imagination of sensory features, there is also **action representation** or **motoric representation** – mental representation of one’s own movement, imagine waving your hand without physically doing so for instance. (Passer et al., 2009)

Based on Triadic Process of Signs (Peice, 1998; Craig and Muller, 2007), I would propose that a **semantic unit** as the central building blocks of knowledge, has to be expressed by representations: **sensory representation** (the image, the sound, the smell, the taste, the touch, the temperature and so on) or motoric representation (if the concept is a movement) on one hand; **symbolic representation** (here we mainly consider linguistic symbol) on the other. In other words, semantic unit could not exist on its own.

On the other hand, it is not necessary for a semantic unit to have both sensory representation (or motoric) and symbolic representation. Actually, it is quite usual for a concept to have only one of them. For example, I cannot think of any specific sensory feature for the abstract concept “democracy”; while there is no specific symbol in my understanding for the sensory-laden concept of the special smell of over-night blue cheese.

Figure 06 Mental Representation and Mental Connection blackbird as example



### Mental Connection

The illustration above helps to introduce the concept of **mental connection** – the linkages which connecting those units and representations constituting the Semantic Associative Network. Mental connections could be categorized into two groups – **semantic connections** are those connecting different semantic units, while **representational connections** connect different representations of the same semantic units. See Figure 06 for an example of mental

representations and mental connections.

### **6.3 Working Sphere and Meaning Making: From Knowledge to Experience**

As it was discussed in Section 6.1, the individual would not employ his/her entire collection of knowledge directly into understanding, rather, the individual would draw information from his/her knowledge into the mediating Working Sphere, where he/she constructs understanding and produces experience, and this is done through the very act of meaning making. I would illustrate this process in more detail in the following section.

#### **6.3.1 Activation and Meaning Making**

As “meaning making” was defined as the act of attempting to understand, the concept of “activation” would be seen as the result of meaning making – that certain semantic units in one’s knowledge collection (SAN) would be **activated** and brought into the Working Sphere for understanding. When the individual carries out a meaning making act upon a piece of information held in the Working Sphere, he/she may activate relevant mental representations, if the individual possesses such knowledge. For instance, when I spot a blackbird outside my window (visual stimuli), I may activate the semantic and symbolic representation of it (name of the bird); and further activate the concept “thrush” (name of the genus which Blackbird belongs to).

However, possessing the knowledge does not guarantee the activation. Has there been a case when you observed an object, a bird for instance; you thought you knew its name, but had problem in spelling it out? I would like to propose that such situations could be explained with the concept of **activation probability**. As the name suggests, activation probability refers to the probability, or likelihood for one mental representation/semantic unit to be activated through individual’s meaning making of relevant input information. The higher the activation probability is, the more likely the mental representation is to be activated.

The activation probability could be indicated by the **strength of connection** in Semantic Associative Network: when two representations/units in the Semantic Associative Network are connected, the more likely one representation to be activated by another representation, the stronger the connection is considered to be. Thus the recall failure could be explained as an existing weaker connection in the Semantic Associative Network, alas, low activation probability.

#### **Spreading Activation**

In Semantic Associative Network, semantic units are usually inter-connected – one unit (concept, idea, or principle) is connected with multiple other units through semantic connections. Thus, when the individual is making meaning of a semantic representation, he/she would likely activate those units connected to it. The term **spreading activation** (Passer et al., 2009) refers to such a process that when one semantic unit in the Semantic Associative Network is activated, those units connected to it would all become more likely to be activated subsequently.

On the other hand, as those mental connections would not be all the same in strength, which

means the probabilities for the semantic units to be actually activated are different. Those connected with stronger connections might be activated while weaker ones are ignored. Still, a stronger connection means that it is more probable to be activated; it does not guarantee the activation over weaker connections. In other words, understanding is not deterministic, but arrangement of activation probability.

### **Integration Level**

As it was stated above, the case for a given semantic unit (concept, ideas and/or principle) to be activated by the individual into Working Sphere is probabilistic. The activation probability of a given semantic unit, does not only depend on how strong it is connected with other units, but also how many units it is connected with. The concept integration level could be seen as the weighted combination of the connection strength of a given semantic unit, which indicates how well the unit is integrated in the Semantic Associative Network, in turn, how it is likely to be activated. For instance, the concept mass-energy equivalence formula ( $e=mc^2$ ) could be strongly connected to the concept of Einstein, but it is still rarely activated as it is connected to few other concepts. On the other hand, concept such as “gain” and “loss” are frequently activated during daily life, as their integration levels are high.

### **Automatic and Effortful Meaning Making**

The strength of the connection does not only indicate whether or not the activation would happen, but also implies how effortful (or rather, effortless) the meaning making process would be for the result of activation to happen. If the connection is strong, then the meaning making would happen automatically, (effortless, taken for granted), while it would take some effort for the individual to activate relatively weak connections.

I would like to propose that automatic activation, rather than effortful activation, is the major mode how one’s knowledge is applied in experience. In other words, people usually employ their knowledge without being fully aware of it. I would like to emphasize that activation, no matter if it is automatic or effortful, is the result of the individual’s active meaning making, instead of passively triggered by input information.

### **6.3.2 Understanding: Context and Knowledge**

#### **Co-Activation and Context-Based Understanding**

There is hardly, if any, a case that the individual is given a single piece of input information for meaning making out of nothing – meaning making and subsequent activation always take place under context. Context means not only multiple resources of stimuli competing for the individual’s attention at a given moment, but also a continuous series of information drawn into the Working Sphere. Thus, I would like to propose that activation of a semantic unit is not solely resulted from the meaning making of a single attended piece of input information, but influenced by multiple information the context presents. In other words, activation probability should not be evaluated according to the strength of the single connection, but a weighted combination of connections.

As different contexts may present different input information, then the resulting activation of meaning making might be different. Thus, the individual's understanding, to a certain extent, is context-based. For instance, if we relate back to the example in Figure 04, the individual may recognize a Canadian Goose as wildlife when spotting the bird while hiking in a nature reserve, however, perceive the same kind of bird as potential food when visiting a restaurant. Of course, the understanding the individual may have also depends on his/her knowledge. For a hard-core conservationist, the individual would not see the bird as food, even if it is caged, because the connections between the bird and conservation concepts are very strong for him/her.

On the other hand, based on the concept of spreading activation, the individual would not activate only one semantic unit when meaning making, but several which are relevant to the given context. And his/her understanding and subsequent behavior would be a weighted consideration of these activated semantic units. In other words, the assumption that the individual would understand and behave according to a single piece of beliefs about the given concept or behavior, does not describe the patterns accurately. For instance, when my boss offered me a glass of wine, despite that I had activated the idea that "alcohol is bad for my health", I had also activated the idea "by denying the offer I may lose my job", thus, I might decide to accept it.

To summarize briefly here, the individual's understanding and behaviors, are influenced by both the knowledge he/she possesses and the context he/she is in.

### **Schema**

In this thesis, the term "schema" referred to the individual's knowledge about certain aspects of the world (Passer et al., 2009). It could be seen as the sum of semantic units which are likely to be activated in a certain context; or with the Semantic Associative Network, it could be modeled as a collection of semantic units and mental connections organized around a certain concept, such as football schema, bird schema and so on. When the individual perceives the context fitting with such schema, usually through activation of key semantic units of the given schema, he/she would be more likely to activate the semantic units under such schema, as a result of the combination effects of spreading activation and co-activation.

For instance, the individual would be more likely to recall the name of a football player when watching a match, if compared to question under an unrelated circumstance. Similarly, the individual would be more likely to activate environmental friendly ideas and principles during a guided tour in nature, compared to when he/she is making decisions in daily urban life.

Schema plays very important role in learning experience, which I would explore in the following sections.

## **6.4 Learning: Development of Knowledge through Experience**

As learning is defined as development of one's knowledge, and one's knowledge was modeled as



Semantic Associate Network, thus learning could be modeled as development of the associative network.

Development of Semantic Associative Network does not only include constructing new semantic units and modifying existing ones, but also construction and modification of mental connections (both representational connections and semantic connections). I would like to highlight here that the modification of the connection strength should be considered an important component of learning – as it influences the activation probability – the likelihood for certain pieces of knowledge to be employed by the individual.

In this section, I would like to explore how learning is accomplished through experience.

#### **6.4.1 Output and Input of Knowledge – Reproduction and Construction**

Before exploring how learning is accomplished through experience, I would like to discuss a little about the materials of experience, the output and input of one's knowledge.

When we think, or hold knowledge in our memory, concepts and ideas could be represented by symbolic and/or sensory/motoric units, however, when it comes to the output (expression) of our understanding, our methods are mainly limited to symbolic system (language).

Firstly, few (if any) human beings demonstrate the ability of telepath, at least there is little evidence anyone does – in reality, hardly any human being is capable to put a semantic unit or sensory/motoric mental representation of the unit from his/her mind directly into another's. The individual would have to either employ symbolic representation, or reproduce the sensory representation in other physical ways so that it could be received by his/her audience.

When the individual would express a motoric representation without employing language, he/she may consider carrying out the movement for others to see. However, one's imagination may go far beyond his/her physical capability. For instance, I may imagine a spiral kick while not being physically able to perform one. As for sensory representations, our abilities to reproduce them are quite sterile compared with the richness of imagination. One may hum a melody (auditory sensory feature) or paint a picture (visual sensory feature), and it requires quite some talent and practice to make the reproduction well enough; however, with little ease, the individual may imagine an orchestra performance or a fast developing scenario which easily going beyond his/her ability of reproduction.

As an alternative to reproducing the representation, the individual could direct the audience to the original sources of the sensory imagination, so rather than mimic what a barnacle goose would look like, one could try to direct his/her audience to spot one. Yet, this way of communicating one's idea is greatly limited by the resources at hand.

Much more frequently, we humans express our understandings and thoughts through the symbolic system – language. Even if the thought was originally represented with sensory

representations, it is more efficient to employ the corresponding symbolic representations. As a matter of fact, the symbolic expression of understanding constitutes to a greater extent of our experience, in other words, the symbolic output of one's knowledge could become the input of another's understanding.

However efficient it is to express one's knowledge with the symbolic system, there is one shortage. As in most cases, the association of the symbolic representation and the semantic unit is rather arbitrary, for instance, the symbolic representation "sky" has little (if any) resemblance to its corresponding semantic unit. As it is mentioned earlier in section...., different people employ different prototypes when applying concepts, thus, it is not guaranteed that people use the same term to refer to exactly the same meaning, which may obscure our communication of understanding.

Besides capturing the expressions of other people as input for understanding, the individual would also construct his/her own knowledge with the sensory features he/she captured as input, no matter whether the sensory feature is reproduced by other people. For instance, I may learn the appearance of barnacle goose not only by listening to someone's description, but also through watching the birds in reality (original sensory features) or seeing a painted picture in bird book (reproduced sensory features). Such sensory features are considered as important input for understanding in interpretation, as it is reflected in Tilden's definition "interpretation is ...through the use of original objects, by firsthand experience, and by illustrative media, rather than simply to communicate factual information".

#### **6.4.2 Learning as Strengthen of Connection**

I would like to start with relatively simple type of learning – strengthening of existing connections. In this type of learning, no new semantic units, representation nor mental connection would be constructed, only the probability for activation is modified. This type of learning usually happens as individuals make meaning of inputting information that he/she has experienced before. For example, a bird watcher recalls the name of a bird which he/she encountered before.

I would propose a hypothesis that through activation, and only through activation, a mental connection might be strengthened. If the individual makes meaning of a piece of input information, and successfully activates the corresponding representation/semantic unit then that mental connection would be strengthened. This makes the activation more probable in the future, or makes the activation more effortless.

Take traveling from central station to campus for instance. At the beginning, the individual would need some effort to recall which bus could take him/her to campus when waiting at central station. When the bus came, the individual would need to think (effortful meaning making) for a little while to be sure whether it was the correct bus, or even need to confirm with the bus driver. After several trips, it became much easier to recall the bus number, and he/she would automatically jump onto the bus if it was the right one.

Activation could be facilitated by providing retrieval cues – additional information input that, together with the input information the individual had attended, would help implement the activation. Repetition as a method to reinforce certain “knowledge” could be seen as a typical example of this kind of learning: through imposing the symbolic representations of the semantic units, to strengthen the semantic connections. However, it should be noted that this method could only strengthen the repeated mental connection, but contribute less in increasing integration level.

The point here is that, the seemingly mundane daily activities are not meaningless in the sense of learning; they help strengthen some of the mental connections.

#### **6.4.3 Assimilation: Enrich of Schema**

As human beings, the individual keeps encountering context and/or information which he/she had not exactly experienced before. However, this does not mean the individual would necessarily fail to make meaning of such information/context, rather, he/she would attempt the meaning making with the knowledge he/she possesses.

For instance, even though I had not encountered any Barnacle Goose before I came to Sweden, I had no problem in recognizing the bird as some kind of wild geese when I came across a flock, as I had activated the general concept and then schema of goose into understanding the situation. Such experience in turn developed my schema of goose, concept and sub-schema of the Barnacle Goose was added.

Similarly, the individual might also construct new action by combining existing semantic units of actions to deal with novel situations. For instance, combining the representation of action - “clean with the toothbrush” and representation of action - “to clean the keyboard” (plus the availability of toothbrush) to formulate the representation of action - clean keyboard with toothbrush. In turn, develop the SAN that toothbrush could be used as a tool for cleaning a keyboard.

Employing the term from Piaget, this type of development of SAN could be called “assimilation”. New components are added (assimilated) onto the existing SAN without modifying the existing structure.

However, the individual assimilates existing sections of SAN to make meanings of novel information or contexts, this sometimes involves distorting the input information so that it fits better with the existing knowledge. For instance, when people saw two Kissing gourami (*Helostoma temminckii*, a kind of fish from the Helostomatidae family) meet their mouth, it is common to activate the concept “kiss”, which many human lovers do to express their love for each other (alas the name of the fish), however, that behavior of fish is hardly about love.

#### **6.4.4 Disequilibrium and Accommodation: Modification of Knowledge**

As the individual experiences the world, he/she might come across disequilibrium – meaning making which fails in sufficient and consistent activation. Disequilibrium could appear as a novel situation which the individual could not understand with his/her existing knowledge (at least not automatically), or a specific case that contradicts his/her existing knowledge which would suggest as general; it could also be a contradiction that be two lines of reasoning each plausible in its own sense but contradicting each other. Disequilibrium could be resolved through the individual's modification of the existing knowledge, termed as “accommodation” by Piaget.

However, encountering disequilibrium does not necessarily lead to accommodation. First, the individual may consider the disequilibrium not important, even ignore it. Secondly, the disequilibrium could also be resolved through assimilation. The individual may modify his/her mental representations of the situation, instead of the structure of existing knowledge; or activating additional courses – an excuse – to account the case as a special one. Or as the information may have come from other people, the individual may choose to doubt the credibility of the resources of information. For instance, if the individual held the knowledge that “geese eat fish”, and then someone told him/her that “geese eat grass”; the individual may choose not to believe that person (not to accommodate according to the experience). If the individual saw the geese foraging the grassland, he/she may consider that “it's some kind of ritual instead of foraging” or “grass are only snack for geese”, without modify his/her knowledge. However, it is worth noting that under such circumstances, although the very piece of knowledge “geese eat grass” had not been modified, the individual had developed his/her schema of goose.

I would like to argue that for accommodation – for the modification of existing SAN to happen, the first step is to acknowledge the disequilibrium – the contradiction between the understanding the individual had made under the specific context and the knowledge he/she held as general. As the individual may apply different schema under different contexts, he/she might not recognize that the understanding he/she had constructed concurrently was actually contradicting some knowledge which was not activated at that given moment.

Before continuing, I would like to note two points. First, accommodation does not mean that the development would necessarily be a desired one. It is possible for the individual to develop his/her knowledge from “correct” to “wrong”. Second, development of SAN hardly manifests as pure assimilation or accommodation, but as interaction of those two lines.

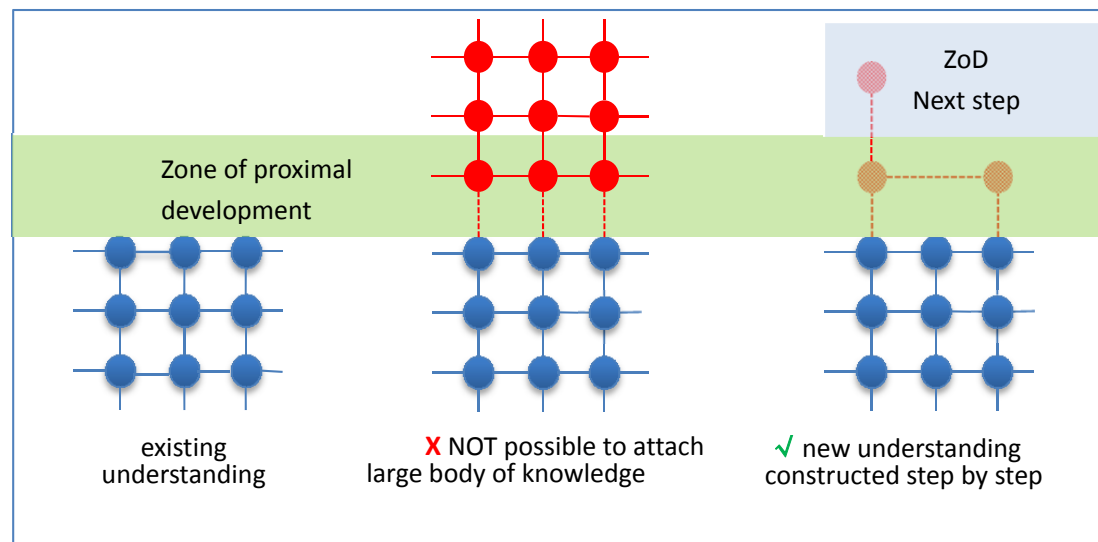
#### **6.4.5 Zone of Proximal Development**

Whether or not the development of SAN is assimilation or accommodation, it would happen within Zone of Proximal Development. Derived from Vygotsky's original definition, while abandoning his dichotomic distinction of “spontaneous concept” and “scientific concept”, zone of proximal development could be understood as limit of the individual's capacity of developing knowledge.

The capacity for the learner to construct new knowledge/reconstitute existing ones within certain “learning episodes” (time period, resources constraint) is limited, thus knowledge

(re)constructed could not extend the limits – beyond the concurrent but not too far beyond - within the Zone of Proximal Development. In other words, it is not possible to attach a large body of “knowledge” onto one’s SAN, or rewrite one’s concurrent SAN in one blow; learning has to be taken step by step (See Figure07).

Figure 07 Zone of Proximal Development – Step by Step



Moreover, it is not only suggested that information should be broken into small pieces for the learner to consume, as many educators have already performed (Black, 2005), but also the information input should be organized in a way which the learner could perceive. With the SAN Model, it could be expressed that when the learner makes meaning of the information input, he/she should be able to connect it with existing mental representations/semantic units, which means the input fit the existing structure of the network. If representations and connections expressed by others do not match the structure of the learner’s network well, however small the piece of information input might be, it would still be difficult for the learner to understand. For instance, if a guided tour in botany gardening would be arranged for visitors with little or no background in botany, then it might not be a good idea to identify plants for them in accordance to plant taxonomy. Despite each episode of information would be small, the representations such as “Phylum”, “Genus”, “androgynous”, and “bulbel” would not fit into their existing Network well. It might yield better outcome by employing some common sense concepts such as tree, bush and grass, potential usage, and sensory features such as shape of leaf, color of flower, for example, might work better.

On the other hand, it is not suggested that learning would simply manifest well with slow pace and segmented material. After all, Zone of Proximal Development locates **beyond** the learner’s concurrent knowledge. While learning tasks far beyond the learner’s grasp would be frustrating, those too close to their concurrent understanding would be deemed boring. The difficulty, speed and organization of learning should not be measured in accordance to certain objective standards, but to the specific situation of the learner. Optimal learning would be achieved when it fits the learner most.

#### **6.4.6 Facilitating Learning: Contextualization and Decontextualization**

Facilitating learning, based on the Model discussed above, on one hand is to facilitate the learner to make meaning of current situation/information with existing knowledge - to facilitate activation of relevant semantic units; on the other is to facilitate the development of SAN according to concurrent understanding. The former aspect could be termed as contextualization, while the latter as decontextualization.

Of course both contextualization and decontextualization could be facilitated through asking the learner to make the connection, asking question such as “Why do you think like that?” and/or “What have you summarized from that?”

Additionally, contextualization could be facilitated by providing cues that commonly associate with general knowledge, so that to co-activation the relevant semantic units, or presents the context with alternative representations.

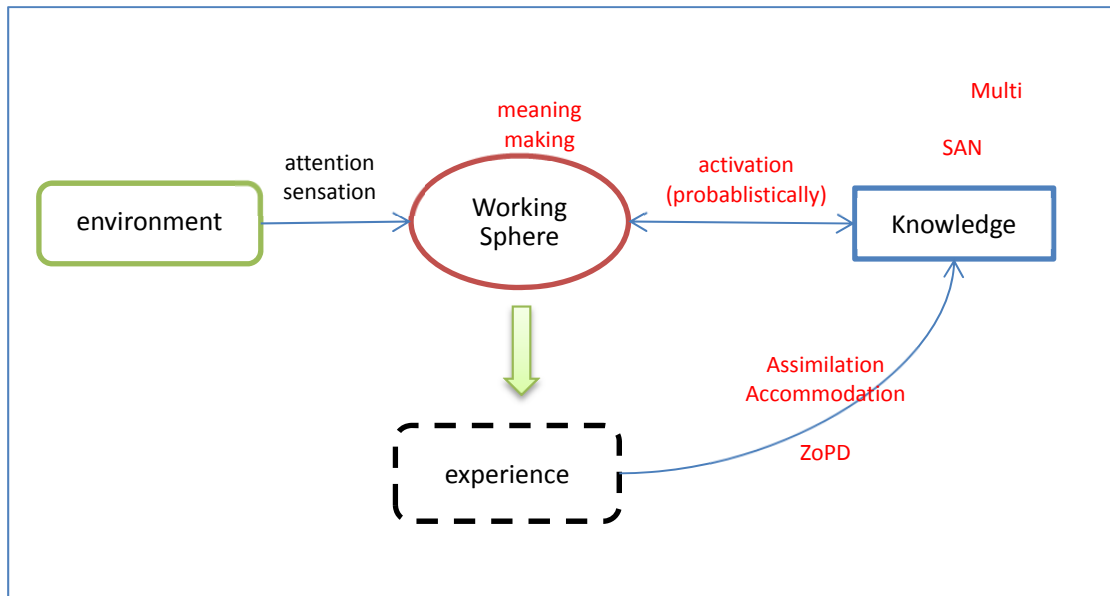
As for decontextualization, it differs according to whether it is assimilation or accommodation is to be facilitated. For assimilation, decontextualization could be facilitated by moving from the specific concept to a more general concept (the case in Figure 05 for instance). For accommodation, is to acknowledge the disequilibrium and then activate alternative units.

#### **6.5 MLM: Model Summary**

The Modified Learning Model (MLM) which had been developed above could be summarized as following. See Figure 08.

- The individual’s knowledge was modeled as Semantic Associative Network, and the semantic unit could be represented by multiple representations.
- The individual does not employ his/her entire collection of knowledge directly into make meaning the world, rather, he/she draws information from his/her knowledge and environment into the mediating Working Sphere, to construct understanding and produce experience.
- The specific understanding and experience the individual constructed is influenced by both the context and his/her knowledge. The individual activates his/her knowledge through meaning making act, and the activation is probabilistic.
- The specific understanding and experience the individual has constructed in turn develops his/her knowledge as a combination of assimilation and accommodation, which would be within the Zone of Proximal Development.

Figure 6-7 Modified Learning Model



## 6.6 Interpreting Interpretation

With the Modified Learning Model, interpretation could then be seen as a specific type of experience for learning. And I would like to carry out the discussion from two aspects, the context of interpretation and the role of interpreter (practice of interpretation).

### 6.6.1 Context of Interpretation

The context for interpretation experience is rich with original objects, even if the entire context is not original (museums, zoos, aquariums instead of original heritage sites, nature reserves, and national parks), which means the participants of interpretation could explore the context by themselves, construct their own understanding based on their collection of sensory stimuli and their existing knowledge, assume connections among those objects and events, to contextualize the general knowledge. Additionally, it is possible for the participants to construct an inter-connected schema of the context, instead of separated connections.

Moreover, with the original objects, the participants may also construct multiple sensory representations of the same semantic unit, which may facilitate different semantic connections to other semantic units, further enriching the potential schema.

On the other hand, participants' major aim during interpretation is not to learn, but rather to seek joy (Ham, 2013), thus, they are not likely to take an extra effort to memorize information which is not relevant (from the participants' point of view) to the context.

Also it should be noted that, usually interpretation contexts possess characteristics which distinguish it from daily contexts the individual experiences, thus, the knowledge learnt during interpretation is not guaranteed to be activated under another context. It might require the interpreter to facilitate decontextualization.

### **6.6.2 Role of Interpreter**

According to the core theme of Constructive Learning Theory, interpreters should play the role to facilitate the participants to construct their own understanding, on one hand to facilitate the participants to make meaning of the context with their knowledge, to develop their knowledge according to the specific understanding and the experience they have during interpretation on the other.

This means that the interpreter need not simply present his/her own knowledge about the context to the participants, but also to connect these presentations with the participants' knowledge. In Tilden's word "Information, as such, is not Interpretation. Interpretation is revelation based upon information. But they are entirely different things. However all interpretation includes information. (Principle 2)"

To achieve this, it is not a simple matter to break down the information into small pieces, but also take the participants' original knowledge into consideration – the general concept/schemas which are closely related to the given context, and their Zone of Proximal Development. There might not be a single interpretation recipe that would fit all the participants. Again in Tilden's words, "Any interpretation that does not somehow relate what is being displayed or described to something within the personality or experience of the visitor will be sterile." (Principle 1)

Additionally, based on the SAN model and the concept of spreading activation, the participants' learning under interpretation context could be facilitated by developing an inter-connected, consistent schema, instead of presenting separate pieces of information. This means that the interpreters are recommended to relate what are displayed (the objects and events participants could sense by themselves on one hand, additional information provided by interpreters on the other) to general concept/schema of the participants already have. This does not only facilitate the experience during interpretation, but also contributes to the activation of such knowledge in other contexts. This idea could be related to Tilden's Principle 5: "Interpretation should aim to present a whole rather than a part, and must address itself to the whole man rather than any phase".

Last but not least, it should be recognized that it is the participants who construct their understanding; the interpreter cannot finish the job for them. In Tilden's word "The chief aim of interpretation is not instruction, but provocation. (Principle 4)" However, the interpreter could definitely provide explicit cues for the participants which facilitates (co)activation.

## **7. Discussion**

### **7.1 Development for Complete Model**

I would like to point out here that the model development was far from completed, and requires



further development. Many components related to learning, knowledge and experience were not included in the current model, this was largely due to constrain of resources (time, and room of report) of the thesis study.

The other two types of Long-Term Memory (Episodic Memory, memory of personal experience of the individual; Procedural Memory, memory of learnt skills) were left out, which are definitely relevant to learning. Investigation into the interconnection amongst these memories might present interesting results.

Maybe more importantly, the “affection” aspect was excluded in the model. From my point of view, the status of the individual, especially the status of the Working Sphere, does not only constitute major parts of experience, but also influence the learning process greatly. Also this involves two aspects of affection – the affection itself and the individual’s perception of his/her own affection status. From the perspective of interpretation, positive affection status is also desired in its own sake. But how do we define positive affection status, surely “happy” is preferred to “stressed”, but how about “excited” and “relaxed”? And how does such different affection status influence the learning experience?

As both Episodic Memory and Affection were not included in the current model, the discussion about the episodic perception of experience was not fully carried out - How the individual perceive his/her past, current and future experience, what kind of general schema/semantic units he/she would employ to account for such perception, and how such perception would influence the experience and knowledge development – by answering these questions, we may have more competence in facilitating better learning experience.

The model would also benefit from more investigation into value system – when the individual has activated several semantic units which contradict each other, how he/she would value each of such units and make the decision, and how this would in turn influence his/her knowledge.

Last but not least, the social factors were but briefly mentioned in the current model, which could and should be expanded in further studies. For instance, as Vygotsky had pointed out, human learning happens most in social contexts, and presence of others may have a great influence on one’s own learning. Thus, the concept of equilibration (and disequilibration) could be extended from the individual level to group level, that to explore how a group may learn together, attempt to reach overall equilibration as well as in each individual.

## **7.2 Reflection of the Model**

It would be ideal if I could test the model in real practice, generating measurable empirical data which I may compare with predictions made based on the model, thus to confirm the validity of the model. However, with given resources that was not possible.

As a consequence, I had to rely on existing data presented by existing research. Not only had I employed the theories (models, hypothesis and other theoretical understandings) into

developing the model, but I also employed the empirical data these theories based on, and other research had presented to test the model. For instance, the visual agnosia (a syndrome that the patient lost ability to tell objects through visual recognition) could be seen as evidence supporting the Model component - Multiple Representation of Semantic Units. Also when I found Piaget's concept of Equilibration resonated with Frestinger's Cognitive Dissonance Theory, I felt more confident about the model.

On the other hand, I had strived to construct a practical model, in other words, I had constructed the model to fit better with (my perceived) interpreters' schema. For instance, even though Parallel Distributed Process Model gained its popularity in cognitive studies on memory as it matched well with the description of how neuron systems work, I had still employed the Semantic Associative Network Model as the major representation of the memory, as it could provide a more intuitive view of the structure of one's knowledge (what is known to the individual), in turn came more practical when employed to plan interpretation practice. Yet, with the concept activation probability, SAN model could be explained as a heuristic tool according to the PDP Model – that processing of information activates stored knowledge with a certain probability.

In general, I would consider the current model to fulfill the ambition to account the system of knowledge-experience-learning sufficiently well.

### **7.3 Applying MLM as a Tool for Interpretation**

I had constructed Modified Learning Model not only as a tool for understanding interpretation, but also to help interpreters to prepare, conduct and evaluate their work.

For instance, interpreters may employ Semantic Associative Network Model to comb their own knowledge into key messages – what they consider important for the participants to know, the core knowledge they would like the participants to construct. Ham (2013), has provided a thorough discussion about how such messages could be developed, which I had no intention to repeat here. With MLM, the interpreters could further plan how such message could be represented through concrete objects and events the participants would sense, and how to complement with additional information; on the other hand, take the general knowledge which the participants would likely to have into consideration, and provide explicit cues so that the participants would activate such knowledge as they experience the interpretation.

With MLM, it is not necessary for the interpreter to start planning from the message, they could start with what they are most familiar with – no matter it is the knowledge organized according to certain scientific discipline or the context of interpretation, or the general knowledge structure of certain type of participants (primary school students for instance), the interpreters could reach out from there to the other components of the model and gradually develop the interpretation program.

During the interpretation activities, the model may serve both as reminder and as the blueprint

on which the interpreter could make contingency changes in accordance to the situation.

With MLM, the interpreters could also prescribe his objective and evaluate accordingly. For instance, inviting the participants to draw their own schema of the situation (SAN section) after the interpretation and compare with his/her own sketch.

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