Research on the memory of infants and toddlers

This essay mainly discussed about the memory of the infants and toddlers especially on the Visual Recognition Memory. Memory is an important feature in cognitive regarding one is able to store information over time. Researches on infants' visual attention have supplied insights to the visual recognition memory and other cognitive processes in the early development since several decades ago. As proposed by Santrock (2009), infancy can be described as a duration in which an individual aged from birth to around 24 months. The visual memory experiments mainly recruited the infants and toddlers because their cognitive development is start to progress. The visual recognition memory is being assessed using a common procedure that is the paired comparison procedure in which familiarity and novelty preference is measured.

There were several studies found out that there are some connections between measures of information processing in infancy and measures of intellectual ability in childhood (Bornstein & Sigman, 1986). Researchers in various areas of cognitive psychology have come into a main theme about organization facilitates retention in memory (Mandler, 1967). Actually what is interesting to explore is " What do infants recall of their lives?" In this paper, the main things to discuss about are the memory among infants and toddler. At first, we have to make ourselves clear on what is memory. Santrock (2009) commented that memory can be defined as the principal feature in cognitive development that one is able to hold onto some information over time and this can be apply to all situations. Courage & Cowan (2009) described memory as food that is essential for mental growth and also as the repository of our past experiences that help to shape who we are. Individuals

who are aged from birth to 18 or 24 months period can be considered as infants. (Santrock, 2009). Toddlers are individuals that proceed from infants, in other words, the older infants. This paper main focuses in visual memory of infants and toddlers.

Piaget and the Soviet psychologists stressed on the critical role in manipulation of cognitive and also emotional functioning (Piaget, 1952). According to Piaget and the associates, infant's cognition originates from the manipulation of the visible objects which is in the mental form that resulting from internalization of this kind of apparent act (Piaget & Inhelder, 1956). Correspondingly, Zaporozhets (1965) suggested that motor activity is able to form the basis of perceptual organization. The motor image that produced from an infant's visual exploration towards an object is believed to facilitate and symbolize memory that related with that object. Infants' visual attention has provided insights into the early development of visual recognition memory and other cognitive processes since several decades of research. The current experimental studies on memory involving infants and toddlers carried out by some researchers are shown in the following.

Infants' Visual Recognition Memory of Objects

The research that conducted by Gottfried, Rose & Bridger (1978) is to determine the sight and manipulative exposure on visual recognition on the shapes of an objects. In this study, there were one hundred and eight infants that comprised of 63 males and 45 females served as subjects. Within these numbers, there were fifty-four 12-month olds, twenty-seven 9-month-olds, and twenty-seven 6-month-olds infants were recruited in this experiment. The infants of such ages were chosen due to the fact that infants in the

second half of the first year are able to attain information about the shape of an object precisely and able to distinguish an object visually. The infants were randomly allocated to one of three stimulus familiarization conditions in which they either only looked at an object (visual), looked at and manipulated an object (visual-haptic), or looked at an object enclosed in a transparent box that the infant manipulated (visual-manipulatory). The paired-comparison technique in which memory is arranged by infants' differential preferences for novel and familiar stimuli were used to assess the visual recognition memory. The study found out that (a) under all conditions, the 12-month-olds infants were able to display evidence of memory, (b) only in the visual setting, the younger infants can indicate sign of memory, and (c) there showed a greater significance in the visual condition than in the visual-haptic and visual-manipulatory conditions at all ages of the infants. In this experiment, there was an argument about the manipulatory activity by itself depressed the infants' differential preferences in the visual-haptic and also visual-manipulatory conditions. Overall, this study delivers a fact that manipulation of objects does not facilitate visual recognition memory of objects.

Behavior, Event-Related Potentials, and Cortical Source Localization on infant Attention and Visual Preferences

There were three major goals in Courage, Reynolds & Richards (2010) experimental study. The first goal was to set up a connection between behavioral and event-related potential (ERP) measures of infant attention and recognition memory. In this study, the researchers had designed a new experimental procedure that implants a behavioral measure (paired

comparison trials) in the modified-oddball ERP procedure in order to evaluate the allocation of infant visual preferences throughout procedure searchers ERP testing. To analyze the ERP components during paired comparison trials, independent component analysis (ICA) was used to identify and to eliminate eye-movement components from the electroencephalographic data. The last goal was to confine the cortical sources of infant visual preferences. ICA components that related to experimental events were assessed using the equivalent current dipole analysis. In this study, there were forty-seven infants were tested in a cross-sectional design at 4. 5, 6, or 7. 5 months of age. The findings in this experiment showed that infants who more towards novelty preferences in paired comparison trials demonstrated greater amplitude negative central ERP components across tasks than infants who not so preferred novelty. Attention and stimulus type also proved to be interrelated with visual preference. Besides this, it was proven that the inferior and superior prefrontal cortex to the anterior cingulate cortex was the parts that the cortical sources of infant visual preferences were localized. In summary, the current findings as a whole demonstrate that by measuring behavior and ERPs simultaneously in combination with the application of cortical source localization techniques, there would be increased in information gained.

Visual Recognition Memory in Early Infancy Resulted from the Feeding-Based Arousal

Geva, Gardner, & Karmel (1999) conducted a study about the arousal effects on a 1-trial visual recognition paired-comparison task. The experiment recruited 227 healthy infants who participated as part of a low-risk cohort in

a larger longitudinal follow-up study of various prenatal and neonatal risk conditions. The infants were administered longitudinally at newborn, 1-month, and 4-month. With arousal assumed to be lower after feeding, the infants were tested before and after feeding. In this study, it was shown that for the newborns and 1-month-olds infants that with the familiarity preference before feeding were shifted to a novelty preference after feeding. The shift was confirmed to be not related with the increased stimulus exposure using the control group after feeding. By 4 months, infants displayed novelty preferences and the preferences were not depends on the feeding. With inclusion of endogenous arousal with age, stimulus, and length of exposure as contributors to familiarity-novelty preferences, the previous knowledge on arousal interaction for recognition memory at this age. Converging evidence for arousal effects on visual attention in early infancy that found previously with preferential looking were extended and provided in the study. It can be shown that the statement on a shift from subcortical to cortical dominance is supported. To conclude, developmental age, type of stimulus, and length of exposure that can add arousal level, all contribute to produce either familiarity or novelty preferences were shown in this study.

Infancy's Memory for Multiple Visual

In Zosh, Halberda, & Feigenson (2011) experiment, infants were addressed on whether they represent ensembles, if the response was favorable, then at one time will be how many, in order to explore the developmental origins of ensemble representations. The 9-month-old infants were familiarized to arrangements that contained 2, 3, or 4 spatially mixed colored subsets of dots. Question regarding whether there is a change in one of the subsets or

to the superset of all dots. There were three series of experiments were carried in this experiment. The finding in the Experiment Series 1 showed that infants were able to detect a numerical change to 1 of the subsets when the array contained 2 subsets but not 3 or 4 subsets. Regardless the present of how many subsets in Experiment Series 2, infants were found capable to detect a change to the superset of all dots. Both the approximate number and the cumulative surface area of these ensembles were represented by the infants in Experiment 3. As suggested by Halberda, Sires, & Feigenson (2006), this study indicated that as similar with the adults, infants are capable in storing a total of 3 ensembles, which means about 2 subsets plus the superset. The identified limit on the number of specific objects infants and adults can store was converged in this indication. It also suggested that an ensemble functions almost similar with separate object for working memory throughout development of an infant. In summary, for visual attention and working memory, ensemble representations function individually and this continues throughout the lifespan.

Capacity and Recency Effects towards the Visual Short-Term Memory in the First Year of Life

Rose, Feldman, and Jankowski (2001) were conducted an experiment within a duration of time to evaluate the quantity of information could store in infants' short-term memory. There were four items that demonstrated to the infants in sequence. They were then tested using the sequential pairing of each the item with a novel one. In this experiment, each infant was given 10 problems, in spans of one, two, three, and four items. Infants that were full-terms and preterm of low-birth-weight (< 1, 750 g) were assessed

longitudinally, at 5, 7, and 12 months of age respectively. The results showed similarity in both groups. It was found that for longer duration, the amount of information that infants could hold in their short-term memory was difficult, especially for the 5- and 7- month olds infants. Throughout the first year of life, the memory capacity was increased. Besides this, it was shown that less than 25% of the subjects that at younger ages were able to hold 3 to 4 items in mind in a time during younger ages. Approximately half of the12-month olds infants could do so. For spans of 3 or 4 at all ages, there was noticeable recency effect (greater memory for the final item). Individual differences in memory capacity displayed some steadiness from age to age, showed moderate cross-age correlations in this study.

Similarities in methods of testing the infants for each of the studies

Among all the experimental studies that discussed above, there are some common and differences. Most of the studies were using the paired-comparison procedure regarding visual memory in infants (Colombo, Mitchell, & Horowitz, 1988). Infants are exposed to one stimulus that so called “ familiar” stimulus during a familiarization phase in this procedure. The “ familiar” stimulus will pair with a “ novel” stimulus that is not presented in the previous familiarization phase. The advantage of this paired-comparison procedure is there is some tendency for the infant to pay more attention at the novel stimulus as compared to the familiar stimulus. In this procedure, the novelty preference can be a measure of recognition of the familiar stimulus. In most visual-recognition memory experiments, the brief stimulus exposure periods will be assessed during the familiarization

phase which can result in a familiarity preference during the test phase, and the attention that present in the familiarization phase has on the novelty-familiarity preference for the visual stimulus that exposed briefly. The duration of the exposure to the stimulus in the familiarization phase is the variable that will affects recognition memory in the paired comparison procedure. However, the studies that discussed above had control this variables explicitly.

Differences in methods of testing the infants for each of the studies

In the other hand, there were studies that used stimulus durations by varying intervals across different groups or different stimuli in order to achieve equivalent novelty preference proportions (Freeseman, Colombo, & Coldren, 1993; Rose, 1983). The ages of infants recruited in the experiments were different from one study to the other. The difference in ages of the infants had some effects of the findings in each of the studies. Fagan (1974) commented that in certain age, improved fixation duration on the novel stimulus during the paired-comparison test phase happened if there was increased exposure duration during the familiarization phase.

Rose (1983) also proposed in order to reach a comparable novelty preference level, older infants that across the 3- to 12-month old age range will need less exposure time. For instance in Gottfried, Rose & Bridger (1978) experiment, 12-month olds, 9-month-olds, and 6-month-olds infants were recruited in this study. The reason given was that infants in the second half of the first year are able to attain information about the shape of an object

precisely and able to distinguish an object visually as compared of younger infants.

In each of the studies, the aims were different from one another; as a result the stimuli used were not same in order to achieve the goals. The differences in methods of testing the infants in each of the studies were discussed below.

In Gottfried, Rose & Bridger (1978) study, there were three familiarization conditions; they were visual, visual-haptic, and visual-manipulatory. The manipulation of objects was used in this study. The infants in the visual condition were shown an object, and only visual inquisition was allowed. In the visual-haptic, infants were allowed to see and touch the given object. Whereas in the visual-manipulatory condition that served as a control for the visual-haptic condition, the object was encased in a clear transparent plastic box, so the infants was able to see and manipulate the box containing the object but was prohibited to touch the object. This study used these stimuli to test the infants on whether the manipulation of objects in different conditions will give effects on visual recognition memory of objects.

In order to investigate whether the effects of familiarization and attention on event-related potential (ERP) correlates of recognition memory in infants, Courage, Reynolds & Richards (2010) used two stimuli that were used for later or not used later in the experiment. Infants were also explored to a recording of Sesame Street to stimulate attention or inattention. Besides this, they were offered with both familiar and novel stimuli. This study used

the electroencephelogram (EEG) to measure ERPs related to infant recognition memory.

For nonverbal populations, especially when studying human infants in information processing and cognitive abilities using visual recognition memory testing procedure. This was shown in Geva, Gardner, & Karmel (1999) experiment. The goal of this study is to examine the developmental changes on visual recognition memory responses in early infancy under the effects of arousal modulation. The study used a feeding-based self-manipulation of arousal as this design was found to be not confounded with the familiarity-novelty characteristics of the test situation because of it can manipulate easily. Besides this, the study was able to maintain some consistency for different conditions excluding for experimenter manipulation. With the assumption of lower arousal after feeding, infants were tested both before and after feeding by displaying two identical visual stimuli at a fixed time. Such pattern of design made an assumption that the information is process in short-term memory but not cause by the immediate sensory stimulation in infants.

In Zosh, Halberda, & Feigenson (2011) experiment, infants were administered on whether they represent ensembles, if they did, then the study further investigate on the number of ensembles they represent at a time. The goal of the study was to find out the origins of ensemble representations during developmental. 9-month-old infants were familiarized to arrangements that containing 2, 3, or 4 spatially inter mixed colored subsets of dots. The infants then asked whether they detected a numerical change in this experiment.

Rose, Feldman, and Jankowski (2001) study was to assess the amount of information that could hold by infants in short-term memory. 4 items were presented in sequence to the infants in this study. They were then examined using the sequencing pairing of each of the item with a novel item. This study was different not only in term of ages of the infant as compared to other studies but the infants that administered were of full-terms and low-birth-weight preterms that tested longitudinally, at 5, 7, and 12 months of age. Recency effects also being explored in this study.

Conclusion

This paper mainly discussed about the visual recognition memory. At the beginning, the infant will present with an item, as the infant turns familiar with that stimulus to the extent that he or she is able to recognize it even when it is presented along with a new item. To signify continued encoding, it is being argued that the familiar stimulus was preferred. The infant is able to not only identify but to encode the novel information that leads to display novelty preference once the familiar stimulus turns into adequately encoded. There are some substantial aspects to determine whether the infant will display familiarity towards the familiar or novel stimulus. The aspects that included are the age of the infant, the nature of the stimulus and the time spend on familiarization. It will be more difficult for a younger infant to process information as the information may seem difficult to the infant. If the given processing time is too short, the infant will continue in processing and encoding the familiar stimulus and display preference towards the familiar stimulus as compared to the novel stimulus. Visual cognition memory is proved to have some relation to the functioning of the brain and behavior.

More effort should be placed in this area. Besides this, further development on techniques that able to measure the behavior and brain activity in infant should be explored.