Neural markers of categorization

Experience, Human Nature

\n[toc title="Table of Contents"]\n

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In 2006, University of Delaware’s Paul C. Quinn andHarvardMedical School’s Alissa Westerlund, and Charles A. Nelson study titled “ Neural Markers of Categorization in 6-Month-Old Infants” was published in PsychologicalScience. The study was motivated by the lack of existing literature on neural markers in infants. These neural markers have been seen as critical in developing an underpinning concept-formation in infants which in turn influences perception and cognitive development.

Despite the importance of the neural markers of categorization to various fields of study, there is limited existing literature about it. Furthermore, existing literatures have not yet determined the neural markers and conditional determinants that can be associated with category formation. Most studies on infants have focused on the use of novel stimuli or the use of behavioral indicators to indicate categorization or concept formation.

Study Objectives

The main objective of the study was to identify neural activity involved in concept-formation in infants. By analyzing learning a category during familiarization, behavioral performance preference for a novel category global-level category learning, neural determinants will be identified. This will then enhance existing methodologies and research regarding concept formation, in particular, category-learning processes in infants.

In doing so, the study will be able to not only further knowledge in neural markers and development but also serve as a means to verify conclusions regarding the topic determined outside of neural indicators (Quinn et al 58). Furthermore, the study is to serve as a foundation for further studies focusing on infant development and learning.

Methodology

Ten infants were included in the study that was selected from an original group of twenty one. Criteria for inclusion included were the child’s ability to stay focused on the stimuli and behavior. The mean age of participants was 198. 8 days and 70% of the selected participant were female (60).

The stimuli used for testing were colored photos featuring various breeds of cats and dogs assuming different postures. Luminosity of the photographs was based from analysis of the pictures using Adobe Photoshop: luminosity of the pictures ranged from 225. 54 to 248. 42 for pictures depicting dogs, for cats 226. 05 to 249. 57. Shape values ranged from 20. 03 to 56. 88 for cats and 24. 28 to 61. 65 for dogs. While the area and perimeter of the pictures was based on LASICO 1281 Area/Line Meter.

Testing procedures included event-related potential (ERP) Testing, ERP Waveform Analysis and Behavioral Testing. ERP Testing was conducted in an acoustically shielded and light-controlled room. The infants sat with a respective parent in front of a monitor measuring 48 centimeters across and 31 centimeters tall. The infants viewed the pictures randomly from a distance of 60 centimeters with each picture being flashed for 500 ms. Adjustments were made based on observations on the child through video monitors.

The results were then recorded and amplified onto a vertex reference at 0. 1- to 100-Hz band-pass filtering and digitized at 250-Hz. Electroencephalographic data was handled through NetStation 4. 0. 1. Adjustments were made as baseline correction to 100-ms prestimulus recording interval. Final phase of testing was done to determine behavioral evidences for category learning. Two 5-s test trials during which a novel cat was paired with a novel dog in a left-right arrangement with two independent observers, both blind to the lateral position of the animals shown to the infant.

Results

The study concluded that infants, in the processes of learning a category, exhibited higher negative amplitude on left occipital-parietal scalp in response indicating initial experience with category exemplars with the first cat pictures 1 to 18 and novel dogs. Furthermore, comparisons

of average amplitude of ERP signals between 1, 000 and 1, 500 ms after each picture was shown did not vary in cats 1 to 18. this indicates that

neural instantiation of are key behavioral indicants of categorization implying that the infants respond to the novel as something familiar.

With regards to novel categories, the results indicated the infants' preference for such (61). This was indicated by the infants' response to the novel dogs: negative amplitude over left-central became more pronounced. The implications is that Nc component or negative central component of the ERP waveform can be e a neural marker of infants' novel-category preference.

Behavioral Performance tests from the looking-time data recorded when paired-preference was conducted indicated the infants' preference for the novel dog versus the novel cat. The infants also showed novel-category preference by 62. 52%. Since this value exceeds probability thresholds which in the study are divided equally between cats and dogs, the researchers are confident in concluding that the infants learned category representation for cats that included novel cats without the exclusion of the dogs.

The results also yielded conclusions regarding global-level category learning. The researches believe that global-coding nodes are quickly learned as a means to represent or map large differences when there are a limited number of attributes that distinguished the global level

Significance and Implications

Thediscriminationof entities categorically is believed to have its roots during development. Therefore, determining the mechanism of category representations develop together with knowledge structures, vocabulary

development and expressions that influence cognition, thus, the importance of measuring infants' visual timing and recognition when presented with both realistic and abstract figures. This will allow for insights to not only in visual and cognitive development but also provide critical information in the overall development mapping of an individual (59).

However, since there are no previous studies existing to evaluate the conclusions of the study to, the determination made by the paper will need further research, a constraint that the researchers themselves recognized (61). Despite this constraint, the study was able to provided significant evidence using neural markers using ERP and brain wave mapping that infants learning a category through the process of familiarization have a preference for novel category and respond to category exemplars at multiple levels of inclusiveness. Therefore, neural architecture required for object categorization processes is present in infants aged six months and below which in turn is giving greater insight to the neurological developments critical to learning and development.

Work Cited

Quinn, Paul C., Westerlund, Alissa and Nelson, Charles A. Neural Markers of Categorization in 6-Month-Old Infants. Psychological Science 17 (1) (2006), 59–66.