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Systematic Review: Permanent Object in Infant Vision

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A B S T R A C T

Infants are children who are in the age range of 0-12 months. Infancy is the first phase of human life, which requires adaptation. Babies have abilities that have been under them since birth in the world, one of which is seeing. Infants' vision of seeing an object can be said to be gradual, this ability is often an interesting part for researchers who encourage researchers to conduct experiments. This study aims to review journal articles on factors that encourage object permanence in infants. This study is a systematic review research conducted by searching journal article data through Google Scholar, Pub Med, and Science Direct which is then screened to get journals that are in accordance with the objectives of this study. The findings of this study are that there are several factors that encourage infant object permanence, namely: Memory in the baby's brain; linguistic for communication; the shape of the object seen by the baby; and finally the conditions experienced by the baby that can encourage the permanence of the baby's object.

Keywords: Object Permanency, Object Individuatuin, Infant

1. Introduction

Infants are children who are in the age range of 0-12 months. Infancy is the first phase of human life, which requires adaptation. This infancy period is a time when babies experience development in physical, cognitive and social-emotional development. Babies who have just been born into the world are blessed by God with sensory abilities, namely abilities that we know as the ability of the five senses. These abilities include the ability to feel, the ability to see, the ability to hear, the ability to smell, and finally the ability to taste. For this reason, babies also experience sensations which will provide information to babies through the senses they feel. Based on the sensations they get, it will create perceptions that are owned by babies.

Sensation itself is information to make contact with the recipients of the sensors of the eyes, ears, nose, skin, and tongue. The sensation that occurs depends on the sensor it will receive. For example, the ear sensor will receive an auditory sensation when a vibrating air wave will then be collected by the outer ear, and transmitted through the inner ear bone to the auditory nerve. Then the next example is the sensation of vision can occur when the light of the lamp makes contact with both eyes which are then focused on the retina. The information obtained by the baby will be formed as a perception, which is an interpretation of what is sensed or felt. Information about certain events that make contact with the five senses will be interpreted as a specific color, pattern, or shape. (Santrock, 2013).

Vision perception, also known as visual perception, begins in infancy. The visual world provides a wealth of information about objects. However, as the object and observer move in view, visual contact is often lost and then regained, presenting a challenge for the observer to determine whether an object currently seen is the same object or a different object from that seen previously. Infants can also absorb information in their visual world about objects which they then make into perceptions. The ability to see in this baby will tend to develop little by little to be able to see an object clearly and realistically like humans who are in the stage of children to adults. Starting to only be able to see as colors that tend to be bright (Santrock, 2013)then seeing many items and only focusing on one of them (Krøjgaard, 2000). (Krøjgaard, 2000) and so on.

The ability to see items or an object owned by infants is one phenomenon that is quite interesting to study. It can be seen that research on the ability of infant vision can show the extent to which babies can see, of course in accordance with the age that occurs in infants. Although cognitive abilities in infants, especially visual sensory, are also described by Piaget in (Berk, 2018; Irwanto, 2021) that vision in infants has begun to develop at the age of 0 to 2 years, but special research on the ability of infant vision based on objects near the baby is important. The method used in the studies that will be reviewed at this time is to use experiments.

The ability to see objects performed by infants has a variety of factors underlying this ability. These experimental studies answer the reasons for the factors that can encourage the ability in infants, and also the methods used by the experimental researchers. For this reason, based on the explanation above, a problem formulation can be drawn that will be answered in this study, namely how factors that encourage or influence the ability of babies to see. Based on the formulation of the problem, the purpose of this study is to determine the factors that encourage and influence the ability of infants to see by reviewing through systematic review of journals that have conducted research on the ability of infants to see.

2. Research methods

The preparation of this systematic review consists of several stages that are passed, including the following:

1. Create a research question

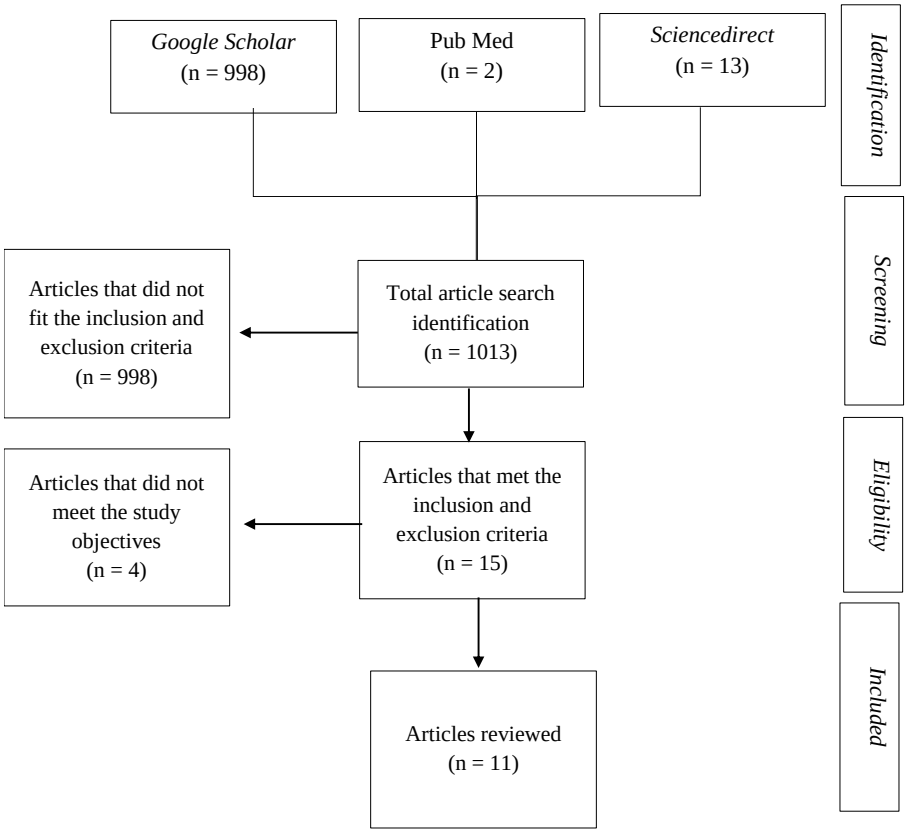
Before starting the systematic review, the researcher formulated a question to form the purpose of the systematic review which will make it easier for the researcher to guide the search for the literature to be reviewed. The questions were: What are the factors that influence the ability to see in infants.

2. Data sourcing and extraction

After developing the research question, the next step was to consult with the developmental lecturer, who would provide input on the selection of the most relevant search terms or keywords and databases to answer the research question. At the beginning of the search the reviewer deliberately searched broadly to retrieve many relevant research articles. Subsequently the reviewer specialized in searching several research journal articles that were published through electronic databases. Such as Google Scholar, Pub Med, and Science Direct with keywords used in English journals. The keywords used are: "infant individuation object", "object permanency", "object recognition". The search results found a total of 998 articles on Google Scholar, then 2 articles on Pubmed, and 13 articles on Science Direct.

3. Article Selection

The next step is for the reviewers to select articles based on the specifics of infant seeing ability, which is based on: the development of infant object permanence, and the age of the subject infant. Furthermore, the selection was carried out again. Further selection was carried out based on the inclusion criteria, namely: 1) Articles published in full text, 2) Articles with a quantitative approach 3) Articles that have the main content regarding infant vision ability.



3. Research result

Search Findings

Based on the search results using the Google Scholar, Pub Med, and Sciencedirect databases using the keywords "infant object individuation", "object permanency", "object recognition" with a total of 1013 articles. Then screening was carried out which then obtained 11 suitable articles, then mapping was carried out and classified into several article points as follows:

Country Characteristics

Table 1. Country Characteristics

No	Country	Total	Percentage
1.	Germany	1	9%
2.	United States of America	6	55%
3.	Denmark	1	9%
4.	Italy	1	9%
5.	Inggris	2	18%
	Total	11	100%

The country characteristics described in this article are mostly from the United States, followed by the United Kingdom and then Italy, Germany, and Denmark.

Research Design

Table 2. Journal Article Research Design

No	Research Design	Total	Percentage
1.	Experiment	11	100%
	Total	11	100%

The research design used in the journal that will be reviewed in the study entirely uses an experimental approach to respondents, namely infants with various ages of infants.

Characteristics of research subjects

Table 3. Characteristics of Research Subjects

No	Research Subject	Researcher
1.	- A total of 92 6-month-old infants were divided into 3 groups for the experiment. - In good health, especially eyesight	Langus, Alan, Hohle Barbara (2020)
2.	- 10- and 11-month-old infants, 79 in the first experiment and 51 in the second experiment. - In good health, especially eyesight	Rivera, Susan dan Zawaydeh, Aseen Nancie (2006)
3.	- 65 infants aged 9 months 27 days to 10 months 18 days - Good health, especially in eyesight	Krojgaard, Peter (2000)
4.	- 16 infants aged 18 months to 19 months. - Healthy condition, especially the eyesight	Zosh, Jennifer M; Feigenson, Lisa (2012)
5.	- 40 10-month-old babies - 83 students who are in early adulthood - In good health, especially the eyes	Decarli, Gisella; Franchin, Laura; Piazza, Manuela; Surian, Luca (2020)
6.	- 108 babies 8 to 9 months old - In good health	Wilcox, Teresa; Woods, Rebecca; Chapa, Catherine (2008)
7.	- 30 5-month-old babies	McCurry, Sarah; Wilcox, Teresa; Woods, Rebecca (2009)
8.	- 132 12-month-old babies	Xu, Fei; Carey, Susan; Quint, Nina (2004)
9.	- 60 5-month-old babies	Kibbe, Melissa M.; Leslie, Alan M. (2015)
10.	- 41 17-month-old baby	Csink, Viktoria; Mareschal, Denis; Gliga, Teodora (2020)
11.	- 65 6-month-old baby	Lany, Hill; Aguero, Ariel; Thompson, Abbie (2022)

The research subjects in the 11 selected journal articles were the youngest infant ages, from 5 months old to 18 to 19 months old. These ages can provide an overview of the differences in vision that the baby begins to experience which will be discussed in the discussion. The following are the results of a thorough search of articles conducted by the author, as follows:

Table 4. Journal summary

No	Tittle / Author / Year	Informant / Observer	Object shape / Factors that influence	Methods	Results
1.	Object individuation and	The parent helps to hold the baby on the	4 pieces of 3D tetris-shaped blocks	Using the eyetacker. The infant is shown two boxes	First, they showed that infants as young as 6 months of age can

	labeling in 6-month-old infants / Langus, Alan, Hohle Barbara (2020)	lap that will be observed with the eye tracker. Parents wear glasses with non-transparent lenses to avoid eye tracking through the app. The researcher made observations with the TOBII 1750 eye tracker at a frequency of 50 Hz (i.e., at 20 ms intervals).	/ Sounds will be non-linguistic. help babies to imagine the shape of objects	side by side on the eyetacker screen. This experiment had 3 conditions. - First, the Visual Only condition is the silent familiarization phase and the baby can only rely on the shape of the object. - Second, linguistic labels, the presentation of objects accompanied by nonsense words. The linguistic labels are 4 nonsense words, All words are polysyllabic and all syllables are consonant-vowel (CV) structure (NUPI, TEVO, LIME, KUMA). - Visual vs. Language condition, object shapes were pitted against linguistic labels: two identical objects emerging from the same box were labeled with different nonsense words and two different objects emerging from another box were labeled with the same nonsense word.	succeed in a complex object individuation task by relying on object property information alone - our results show that language provides young infants with cues strong enough to guess how many objects are involved in an occlusion event. - Third, 6-month-old infants have a tendency to follow linguistic labels rather than object shapes in determining how many objects are hidden in the box.
2.	Word comprehension facilitates object individuation in 10- and 11-month-old infants / Rivera, Susan dan Zawaydeh, Aseen Nancie (2006)	Researchers monitored the experiment from another room. Parents help the researcher by showing themselves in front of the baby	The objects used are balls, books, bottles, cars, cats, cups, dogs and shoes. / Vocabulary helps performance in object saliency in infants.	The infant experimenter was placed into one of the groups, then the infant was shown the object through an occlude.	Infants who are 10 and 11 months old are not at object permanence stage 4 (according to Piaget's 1954 theory). - Vocabulary helps performance in object saliency in infants. - The baby can see the object clearly, but when it is picked up the baby will think the object is missing.
3.	Object individuation in 10-month-old infants Do significant objects make a difference / Krojgaard, Peter (2000)	The baby's parents help by holding the baby on their laps as they are confronted with a large puppet theater.	A white kitten made of cloth about 14 cm long, 7 cm wide and 7.5 cm high; and a red car made of metal and plastic about 11 cm long, 4.5 cm wide and 3 cm high. / Spatio temporal condition	An experiment where the baby is shown some objects such as cats, and toy cars in a puppet theater shown to the baby.	- The baby's reaction to seeing the object disappear behind the screen is no different from the object existing. - Infants who had been spatio-temporally informed were more emphatic about the number of objects present in the trial than infants who had only seen the objects.
4.	Memory load affects object individuation in 18-month-old infants / Zosh,	The researcher as the experimenter in charge of observing and replacing objects on	- Fluffy stuffed cat, red cloth shoes, and yellow metal bus. - Non-solid substances.	- Methods - Infants retrieve objects from a 32 - 25 - 12.5 cm black box with a spandex-lined opening at the front. The spandex has	- The results of Experiment 1 show that 18-month-olds' individuation ability depends on memory load. Infants appeared to have stored enough feature

	Jennifer M; Feigenson, Lisa (2012)	the black box in question.	- A set of red metal car, yellow plastic duck, blue plastic brush / memory in infants	horizontal slits that the infant can reach but cannot see. The box has a hidden door on the back so that the experimenter can secretly insert or remove the object.	information to individuate when recalling one and two hidden objects. But when recalling three objects, infants failed. This result is surprising given that across all Switch trials, infants saw the same change (e.g., a cat turning into a car) regardless of how much the object that had been hidden changed when recalling one or two objects) is unlikely to be due to a failure to encode or remember three numerically distinct objects. (in the face of their successful individuation using the same change when remembering one or two objects) is unlikely to be caused by a failure to encode or remember three numerically distinct objects. - Experiment 2 is changing the initial object to an object that has a soft texture. This experiment shows that the shape of the object that has been held which is solid then changed to a non-solid substance makes the baby look for the solid object, thus showing that the shape of the object forms the baby's memory to give the identity of the item which supports the individuation of the object. - In the third experiment, infants' individuation ability depended on the number of objects recalled. When recalling one and possibly two hidden objects, infants appeared to have stored enough feature information to detect object switches and use them for individuation (although this was not statistically significant on two-object trials). But when recalling three objects, infants failed to individuate.
5.	Infants' use of motion cues in object individuation processes / Decarli, Gisella; Franchin, Laura; Piazza, Manuela; Surian, Luca (2020)	Two researchers served as observers in this experimental study where the observer would press a button while the infant was viewing the event. Parents help to hold the baby on their lap at a distance of approximately 60 cm	- Experiments 1 and 2: yellow duck and red car - Experiment 3: numerical objects / Hand movements that put objects to look at and hand trajectories when putting things away	- Experimental method 1 A 27-inch iMac monitor was placed in the center. The curtain was lowered on the monitor between trials, and on both sides. There was a web-came under the monitor focusing on the baby's face to observe the baby's behavior and record the fixation of viewing time. Experiments	- Experimental result 1: the results of this experiment clearly show that 10-month-old infants rely on movement cues to distinguish objects and that the contrast between self-propelled movement and passive movement results in two different objects - Results of Experiment 2: Infants looked longer at the one-object outcome than the two-

		from the center monitor.		were conducted in a quiet testing room.	object outcome in the agency condition, whereas they equally looked at the two types of outcomes in the baseline condition. Thus, we provide further evidence that infants' individuation process is primarily based on motion information - Experiment 3 results: When adults are presented with an object event, they first make categorical representations and temporary features on the appearance and disappearance of the object. When the object reappeared at the scene, it was compared with the contents of the temporary representation. This comparison allows adults to decide whether the two objects are the same or different.
6.	Color-function categories that prime infants to use color information in an object individuation task / Wilcox, Teresa; Woods, Rebecca; Chapa, Catherine (2008)	Parents help to hold the baby on their lap and close their eyes to avoid interacting with the baby. Observations were made by two researchers, who would then click a button when the baby was looking at the baby. Then another observer will record during the experiment	- Objects for experiment 1: Green and red and yellow and blue perforated serving spoons and spaghetti spoons. - Bowl measures 6cm deep and 14 cm in diameter - Object for experiment 2: purple and orange spaghetti spoon - Objects for experiment 3: Yellow and blue spoons - Objects for experiment 4: Brown spoon and cream spoon / - Identical object shapes - Baby's age - Object color	- The images are shown on two screens, a wide screen (41 cm wide and 30 cm deep) and a narrow screen (41 cm wide and 17 cm deep). - Procedure of experiments 1 and 2: On a narrow screen each infant will see the experimenter wearing white gloves stirring and lifting salt with a green serving spoon in a bowl with salt. Then alternate with other color spoons - Experiment 3 procedure: In Experiment 3, 9-month-olds were presented with both spoons together during the pretest event, giving them the opportunity to directly compare the spoons of each stirring pair - Experimental procedure 4: i.e. with the chocolate spoon stirred and the cream spoon lifted.	- The results of experiment 1 showed that Infants who saw a stir-fry event with green and red spoons looked longer at the narrow-screen test event than the widescreen test event, indicating that they distinguished the green and red colors. - Experiment 2 results: The 9.5-month-old successfully distinguished the green ball from the red ball in the trial, while the 9-month-old failed to do so. . If infants cannot identify the relationship between color and function, they will not have the information necessary to form event categories (let alone form generalized event categories on color). This analysis predicts that if infants are tested under conditions that facilitate the identification of this relationship, they will tend to form abstract categorical event representations. Another possibility is that younger infants can identify the relationship between color and function in the context of this task, but are slower to do so. Perhaps if younger infants were shown additional pairs of exemplars, they would be able to identify this relationship and then construct relevant (and more abstract) categories.

					- Experimental result 3: This experience led to better performance: 9-month-olds successfully played with the green ball and the red ball in a trial event. - Experiment 4 results: this experiment allowed the child to directly distinguish the objects used. However, after seeing three pairs of different colored spoons involved in the stir and lift event, 9-month-olds failed to notice the color difference in the test event. This result is consistent with the results of pattern formation experiments conducted with younger infants. Recall that infants first spontaneously use pattern differences as a basis for object individuation at 7.5 months of age.
7.	Beyond the search barrier: A new task for assessing object individuation in young infants / McCurry, Sarah; Wilcox, Teresa; Woods, Rebecca (2009)	The parent helps to hold the child on their lap who then faces the table with the box in front of them. Parents are forbidden to interact with the baby Observations were made by the researcher	The ball is 10.25 cm in diameter, the rectangular block is cut from one side. / The form of goods that are the object	In the first phase, the infant will be shown the experimenter putting objects (box-ball or ball-ball objects) into the box. In the second phase, the infant is allowed to search within 20 seconds.	- The experimental results showed that after seeing the box-ball sequence, infants directed their reaching behavior towards the fringed screen rather than the visible ball, suggesting that they interpreted the event as involving two different objects, - When the baby gets the object of two balls, the baby will focus only on one ball, while the other ball is ignored by the baby. - One of the biggest puzzles of cognitive development is why younger infants, when tested with expectancy-violating tasks, show object permanence (i.e., the understanding that objects continue to exist when hidden). However, when search tasks are used, infants less than 8 months old fail to show this capacity. One interpretation that has been offered for this dissociation is that young infants' hidden object representations are relatively weak and may drive behavior to look but not reach.
8.	The emergence of kind-based object individuation in infancy / Xu, Fei; Carey, Susan; Quint, Nina (2004)	Observations were made by the researcher with the help of a camera under the stage Parents help look after the baby who sits	- Experimental object 1: Two blue bottles with small pink bears and one green bottle with a small brown bear. Then two tennis balls with green and pink stripes; the other	The experiment was conducted on a stage measuring 80 cm long, 31 cm wide, 30 cm high. A black curtain was hung behind the stage to accentuate the objects and background and to hide the movements of the	- Experimental result 1: 12-month-old infants in the Different Colors Condition failed to use the color difference between two objects (ball/bottle/cup) to create representations of two different objects behind the screen

		backstage next to the baby	ball with purple and orange stripes - Experimental object 2: Two balls painted bright red with a layer of glitter. Two brains painted orange with blue stars and blue glitter on the front. Two bottles painted green and decorated with purple dots and thin silver lines. - Fourth experimental object: A 5 cm diameter soccer ball decorated with orange, green and white hexagons. A small glass measuring 6.5cm wide and 6.5cm high in bright yellow with green and red lines. A large glass measuring 7cm wide and semi-transparent in color with bright orange edges and decorated with red, green and yellow brains and circles. A small light brown duck with a yellow beak. The large duck is bright yellow with a red beak. / - Spatiotemporal conditions - Different shape conditions - The cross-kind condition, which gives objects that have different shapes.	experimenter. The experimenter will show a ksong stage, then object 1 will be shown from the right and pulled back, then the next object will be shown on the left and then pulled back.	- Experimental result 2: failed to use size differences as a basis for individuating objects. Analysis of the coding data revealed that infants did code size differences between objects, as evidenced by a slower rate of habituation in the Different Size Condition than the Same Size Condition among the first three - The main result of Experiment 3 was that infants failed to use a combination of differences in color, size, and surface pattern to create a representation of the two objects behind the screen. - The results of the fourth experiment, the Cross-kind condition, infants were successful in individuating objects, so they had to pay attention to shape differences. Moreover, the overall habituation rate between the first pair and the last pair of encoding trials (about 45% in each condition), was comparable to other experiments in this series. This suggests that infants encode the properties of these objects.
9.	The ring that does not bind: Topological class in infants' working memory for objects / Kibbe, Melissa M.; Leslie, Alan M. (2015)	Parents help to hold the baby on their lap and sit in front of the stage 70cm away from the stage. The researcher observes through the monitor	- Redwood ring 10.15 cm in diameter / - Stimulation of the child - Number of objects shown in the experiment	- The experimenter will lift the stage curtain and show that the stage is empty. The experimenter then places the ring object on the stage. - Experiment 2: was conducted with Infants seeing one of three possible outcomes: one-third of the infants saw the object that was originally hidden there (e.g., the ring was hidden and the ring was revealed; control condition), one-third of the infants saw another unexpected object (e.g., the	- Experiment 1 results: about topological classes in working memory. In addition, it shows that differences between stimuli can indeed be detected and remembered by 6-month-olds - Experiment result 2: the infant failed to show that it knew the texture of the object or the topology class of the hidden object.

				ring was hidden and the disk was revealed; swap condition), and one-third of the infants saw that the object had disappeared completely (missing condition) (between-subjects design). The object was hidden for about 7 seconds before it was revealed.	
10.	Does surprise enhance infant memory? Assessing the impact of the encoding context on subsequent object recognition / Csink, Viktoria; Mareschal, Denis; Gliga, Teodora (2020)	The parent helps to hold the infant on the lap who is looking at the object. Parents are given sunglasses to avoid being detected by the eye tracking device Observations were made by the researcher through a Tobii TX300 eye tracker at 120 Hz.	- Picture of a bird - Car / - Infant memory that records objects and their labels	- The implementation is where the infant will be presented with familiar objects and labeled. Some objects will be given matching and familiar labels such as (bird labeled bird) while others receive labels that are familiar but do not match the image such as (bird labeled car) or random labels that do not match such as (bird labeled cost). Parents were not allowed to interact with the infants during the experiment. The experiment was conducted for 10 minutes.	- Experimental results: infants respond to object mislabeling by dilating their pupils. This response measured in pupil diameter may signal increased levels of arousal, greater cognitive effort, or increased focused attention while processing the mislabeled item. - a participant responded with increased pupil dilation for previously seen compared to unseen items. In this experiment, a single brief presentation of 20 items elicited reliable differences in infants' recognition memory between previously seen and unseen items, - then found no difference in pupil size during the recognition memory test suggesting that infants have better memory for items that previously violated their expectations.
11.	The temporal dynamics of labelling shape infant object recognition / Lany, Hill; Aguero, Ariel; Thompson, Abbie (2022)	The parents helped to hold the baby on their laps facing a 55-inch wall-mounted LCD with two digital cameras mounted directly below it to observe the baby. Caregivers wore sunglasses with an opaque cardboard base to prevent them from seeing and responding to visual stimuli, and inadvertently refracted the baby's appearance pattern. Observations were made by the researcher through the monitor.	- Green spinner toy - Ballpoint pen with orange tassel tip - Flashlight with perforated side texture / - synchronous condition in infants	- All infants were familiarized with 3 objects paired with a spoken word, and tested for recognition of those objects when later viewed in silence. The way infants were familiarized with objects was manipulated across participants: Infants were randomly assigned to one of three Recognition conditions (Synchronous, Asynchronous, and Static), which differed only in the way objects were paired with words during Recognition trials, as described in detail below. All infants were given 3 Trial-Type (i.e., Trial-Type was manipulated within participants). These trials tested object recognition by displaying a familiar object side-by-side with an unfamiliar foil object in	- Experimental results showed that Infants across all three Conditions showed evidence of being able to recognize habituated objects when paired with foil that differed in shape and color (i.e., Different-Shape-and-Color trials). Specifically, infants spent more time attending to the familiar object, showing no signs of a shift towards a new preference across the two trials. This suggests that infants were strongly attracted to the familiar object, even when distinguishing it from the foil was relatively easy. At no point (Trial 1 or 2) did infants in either condition show a new preference on the Different Shapes-and-Colors trial.

				silence (i.e., using the VPC paradigm). On a given Test-Trial Type we assessed infants' ability to distinguish the familiar object from objects that differed in shape and color, shape only, and color only. Furthermore, the test for each object involved two trials (Trials 1 and 2, also a within-participant factor), and the side on which the familiar object was first presented was counterbalanced, as is typical in the VPC paradigm.	

That infants are active learners who systematically select information for further exploration and learning has received support from research showing that infants prefer novel stimuli as a function of their complexity and that they learn better about objects that they themselves select as sources of further information (Cohen, 2007). (Aslin, 2007). Infants can see the object because there are drivers that affect this ability, as follows:

Memory in the Infant Brain

Infants have the ability to see objects and have the ability to see objects in focus only on the intended object based on the memory possessed by infants. Memory is one part of the brain that has a function to store information that has been obtained from sensations obtained based on sensory stimuli obtained from the environment. (Berk, 2018). In the first study, namely research conducted by Zosh & Feigenson (2012) *"Memory load affects object individuation in 18-month-old infants"* shows that memory in the brains of 18-month-old infants stores enough information features to individuate an object. This is shown that in the study, the baby can show that there are two objects hidden, so that the baby can know that the object shown the first time is a different object from the object shown the second time, this shows that the baby's memory will store all information about the object that is seen, from the texture of the object, the shape of the object. (McCurry et al., 2009; Xu et al., 2004). and the topology of the object and the number of objects (Kibbe & Leslie, 2016)..

The 18-month-old infant cannot remember objects with a large number of scales. 17-month-old infants also need memory to record the shape of objects to recognize an object they see as a form of information obtained (Csink et al., 2021). What is experienced by 18-month-old babies cannot be experienced by 6-month-old babies. Research conducted by (Kibbe & Leslie, 2016) entitled *"The ring that does not bind: Topological class in infants' working memory for objects"* shows that 6-month-old babies still do not have the ability to recognize the shape and topology of the object. So that the baby himself does not know the texture of the object or the topological class of the object seen. In addition, babies also cannot distinguish the shape and topology of objects that are hidden when an experiment is carried out. Memory plays a role in remembering vocabulary, or names that are shown as depictions of the shape of objects carried out by infants, this is shown by research conducted by Csink et al. (2021) entitled *"Does surprise enhance infant memory? Assessing the impact of the encoding context on subsequent object recognition"* In this study it was shown that 17-month-old infants responded that when the experimenter showed objects with inappropriate labels (for example: the object was a car with a cat label) the baby gave a shocked response and gave more focus to the wrong item with the label.

Linguistics

Linguistics is a science that focuses on language and its use as a means of communication. Infants have the ability to capture forms of communication from the environment. Research conducted by Langus & Höhle (2021) with *"Object individuation and labelling in 6-month-old infants"* shows that the voice spoken by the experimenter can help babies in imagining 6-month-old babies against an object. In addition, language cues obtained by babies through hearing can be a basis for babies to guess the number of objects to be seen in an experiment. Research conducted by (Rivera & Zawaydeh, 2007) entitled *"Word comprehension facilitates object individuation in 10- and 11-month-old infants"* explains that object permanence in infants at the age of 10 to 11 months cannot run perfectly. Vocabulary introduced to babies will help performance in object permanence in babies. Babies can see objects or objects clearly, but when the object is taken the baby will think the object is missing.

Speaking of communication, the hand gestures made by the experimenter were also used as a means of communication. This was done by Decarli et al. (2020) entitled *"Infants' use of motion cues in object individuation processes"* Based on the results of the research conducted, 10-month-old infants, namely Infants look longer at the results of one object than the results of two objects in the agency condition, while they both see two types of results in the initial condition. Thus, we provide further evidence that infants' individuation processes are primarily based on motion information. Based on this explanation, we can take the information obtained from the experimenter, namely hand movements and hand trajectories when placing items.

Form of Goods

Research conducted by McCurry et al., (2009) entitled *"Beyond the search barrier: A new task for assessing object individuation in young infants"* shows that 5-month-old infants can perform object individuation of the intended objects according to the experiment. This is shown by the baby will focus on one of the objects that are interesting to him, and seen for a long time. In this study, 5-month-old babies were very focused on the shape of blocks and balls. Research conducted by Wilcox et al. (2008) *"Color-function categories that prime infants to use color information in an object individuation task"* explains that the age of 9 months has failed to distinguish which items are due to the similarity of the shape of the object used as the object in the study. In addition, color also helps infants to distinguish the object used from other objects.

Conditions experienced by Infants

When babies get information, especially visual information, they will process the information in the form of object permanence. This object permanence will be optimal when the baby experiences several conditions, the conditions are first, spatiotemporal conditions (Krøjgaard, 2000; Xu et al., 2004) where the baby is able to recognize objects due to the process of providing information about the object used in the experimental research and given a time interval for the baby to recognize the shape of the condition of the object that is the object of research. The second condition that can support object individuation performed by infants is the *cross-kind* condition (Xu et al., 2004). (Xu et al., 2004)The second condition that can support the existence of object individuation performed by infants is the cross-kind condition (Xu et al., 2004), which is where the baby gets another object that can show a difference in the shape of the object in the study. The third condition is the synchronous condition (Lany et al., 2022) in infants, where 6-month-old infants can show evidence of being able to recognize a habituated object when paired with a foil that differs in shape and color (i.e., Different-Shape-and-Color-Different trials). This is demonstrated by the infant spending time observing the object and not turning to other objects.

4. Conclusion

Based on the explanations above, it can be concluded that object individuation or object permanence experienced by infants can be driven by several factors, including the conditions experienced by infants, the form of objects that become objects of research, language or linguistics that become tools to communicate with infants, and also infant memory. The baby's brain has an important role as a place that processes the information obtained, and as a storage of information that has been obtained by the baby from the surrounding environment.

References

Aslin, R. N. (2007). What's in a look? Developmental Science, 10(1), 48-53. https://doi.org/10.1111/j.1467-7687.2007.00563.x

Berk, L. E. (2018). Development through the lifespan (7th ed., Vol. 1). Illinois State University.

Csink, V., Mareschal, D., & Gliga, T. (2021). Does surprise enhance infant memory? Assessing the impact of the encoding context on subsequent object recognition. Infancy, 26(2), 303-318. https://doi.org/10.1111/infa.12383

Decarli, G., Franchin, L., Piazza, M., & Surian, L. (2020). Infants' use of motion cues in object individuation processes. Journal of Experimental Child Psychology, 197, 104868. https://doi.org/10.1016/j.jecp.2020.104868

Irwanto. (2021). History of Psychology: The Development of Theoretical Perspectives (2nd ed., Vol. 1). PT Gramedia Pustaka Utama.

Kibbe, M. M., & Leslie, A. M. (2016). The ring that does not bind: Topological class in infants' working memory for objects. Cognitive Development, 38, 1-9. https://doi.org/10.1016/j.cogdev.2015.12.001

Krøjgaard, P. (2000). Object individuation in 10-month-old infants. Cognitive Development, 15(2), 169-184. https://doi.org/10.1016/S0885-2014(00)00020-4

Langus, A., & Höhle, B. (2021). Object individuation and labeling in 6-month-old infants. Infant Behavior and Development, 65, 101627. https://doi.org/10.1016/j.infbeh.2021.101627

Lany, J., Aguero, A., & Thompson, A. (2022). The temporal dynamics of labelling shape infant object recognition. Infant Behavior and Development, 67, 101698. https://doi.org/10.1016/j.infbeh.2022.101698

McCurry, S., Wilcox, T., & Woods, R. (2009). Beyond the search barrier: A new task for assessing object individuation in young infants. Infant Behavior and Development, 32(4), 429-436. https://doi.org/10.1016/j.infbeh.2009.07.002

Rivera, S. M., & Zawaydeh, A. N. (2007). Word comprehension facilitates object individuation in 10- and 11-month-old infants. Brain Research, 1146, 146-157. https://doi.org/10.1016/j.brainres.2006.08.112

Santrock, J. W. (2013). Life Span Development: Life span development (H. Sinaga & Y. Sumiharti, Eds.; 5th ed., Vol. 2). University of Texas.

Wilcox, T., Woods, R., & Chapa, C. (2008). Color-function categories that prime infants to use color information in an object individuation task. Cognitive Psychology, 57(3), 220-261. https://doi.org/10.1016/j.cogpsych.2008.02.001