

An empirical argument that perception is **non-conceptual**

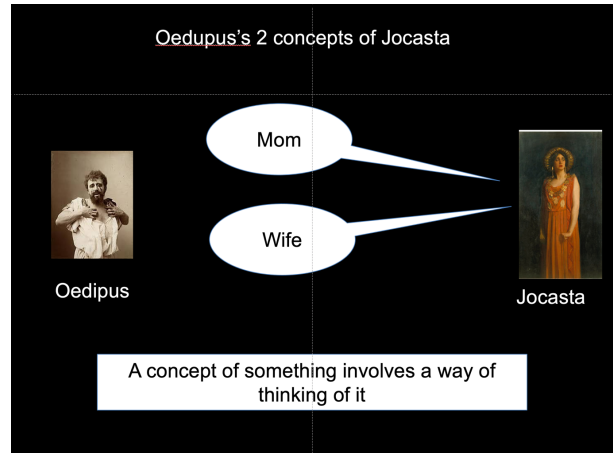
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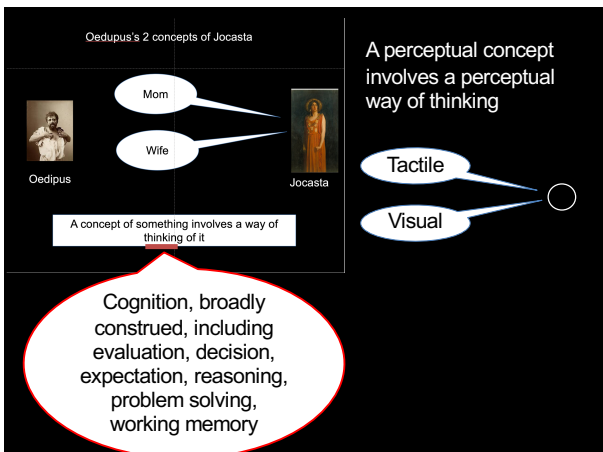
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- WHY IS THAT IMPORTANT?**
- 1. Architecture of the mind:** If perception is conceptual, the difference between cognition and perception may not be as fundamental as once thought.
 - 2. Epistemology:** If perception is conceptual, the epistemology of perceptual belief is just believing what we see; if perception is non-conceptual, we need another model
 - 3. Robot vision:** If perception is non-conceptual, then a robot whose camera fed directly into cognition would not be seeing

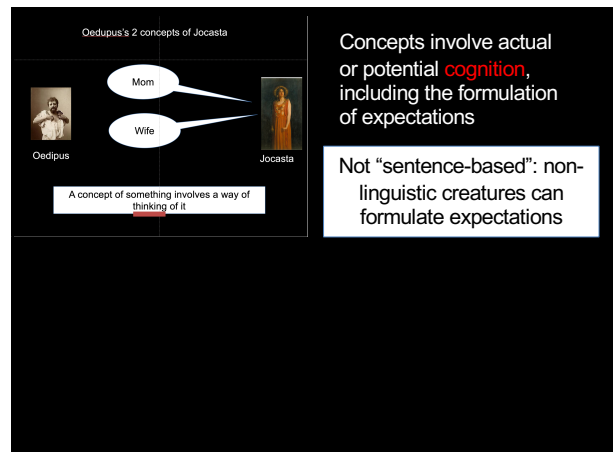
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Oedipus's 2 concepts of Jocasta

Concepts involve actual or potential **cognition**, including the formulation of expectations

A concept of something involves a way of thinking of it

Concretely, a mental representation that can play a substantive role in working memory is a concept

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3 types of representation of color

- Color **category** representations ← 4-6 months
- Color **concepts**—as diagnosed by a role in working memory ← 11-12 months
- Linguistic** color concepts ← 3 years

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4-6 months

6-11 months

Color perception without deployment of color concepts

12 months

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- Infants 6-11 months can discriminate colors and have categorical perception of colors
- Infants 6-11 months do not normally notice colors
- Color and working memory
- Color language comes in at age 3
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Categorical perception

Categorical perception: faster more accurate discrimination between than within categories

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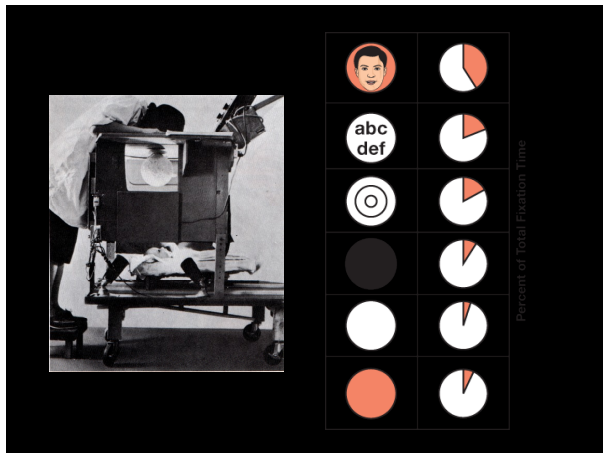
Infant discrimination

4-6 month olds fixate so as to reveal color discrimination near the adult level

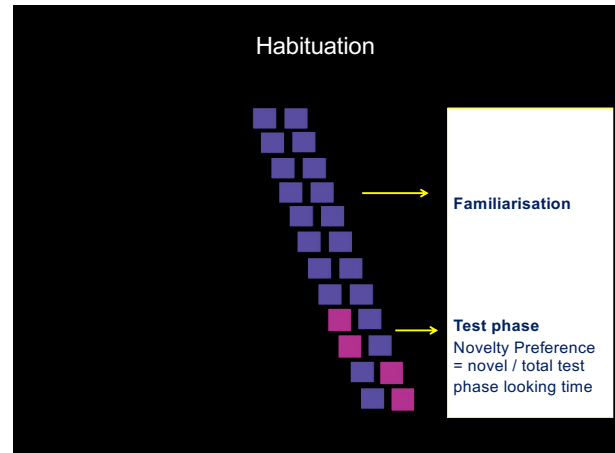
But quicker if from different color categories—allowing detecting their categories

Anna Franklin

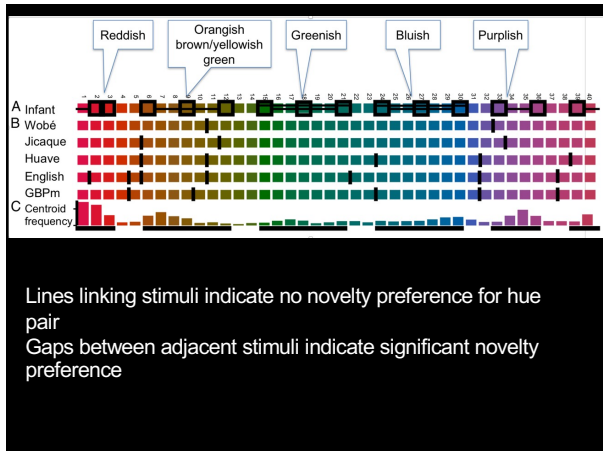
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6-11 month olds have nearly adult level of color discrimination

- They move their eyes to what they see as a different color
- Bored by same color, look to the side with new color
- (Oddball effect)

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Argument: 6-11 month old infants have color perception without showing the abilities diagnostic of deployment of color concepts or protoconcepts


6-11 month old infants do exhibit the abilities that are at least somewhat indicative of deployment of concepts of **shape**, **size** and **kind**.

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4-6 months



6-11 months

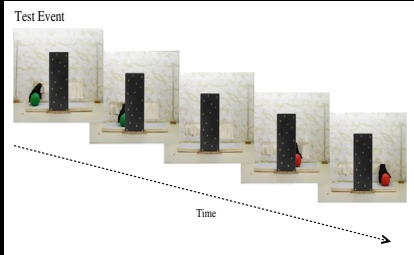
Color perception without any color concepts

12 months



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Tunnel effect: adults and adult monkeys see this sequence as a green ball turning into a red ball for narrow but not wide screen

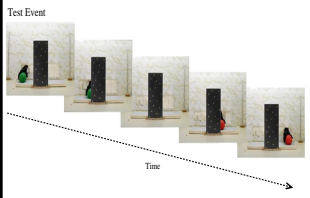


Test Event

Time

"an absolutely compelling impression of continuous and uniform movement can be produced... all the observers agree that the movement behind the tunnel is as "real" as" motion without the occluder (Burke, 1952, p. 124).

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6-11 month olds do not normally notice color

Normally, they see colors without noticing colors

- (Wilcox, 1999) 4.5 month olds show increased looking time compared to wide screen if a ball turns into a box but not if a red ball turns into a green ball
- 7.5 months: use shape and kind but not color
- 11.5 months: use all three

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Maybe the infants have a concept of color as a temporary property of things?

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6-8 month olds prefer to look at these



But not these


Kimura, A., Y. Wada, J. Yang, Y. Otsuka, I. Dan, T. Masuda, S. Kanazawa and M. K. Yamaguchi (2010). "Infants' recognition of objects using canonical color." *Journal of Experimental Child Psychology*, 105(3): 256-263.

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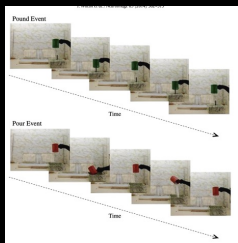
Maybe the infants **can** have a concept or protoconcept of color with training

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Supporting the objection

- Two rounds of training: 9.5 month olds looked longer at the red ball changing into a green ball
- 3 rounds: 7.5 month olds looked longer




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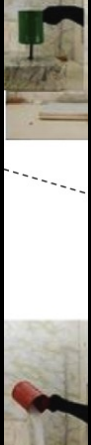
Training



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Training



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Training

Training >9.5 months transferred from red/green to yellow/blue and orange/Purple
 Training < 9.5 months did not transfer

Training can lead <11 month olds to notice color. But it does **NOT** follow that **before training** they have concepts or protoconcepts of color as a temporary property of things

Or after training

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Infants normally have no concept or protoconcept of color

Infants normally do not have conceptual color perception

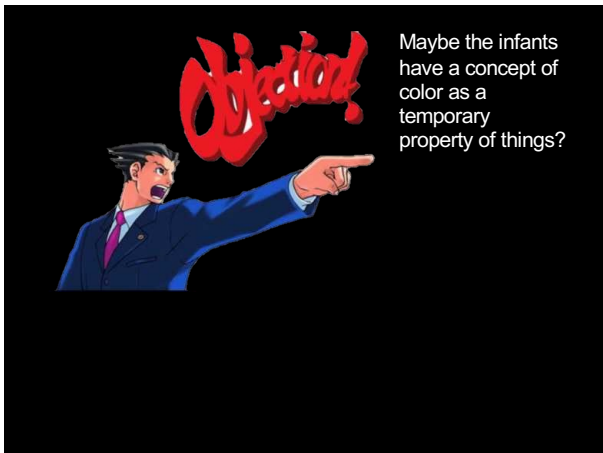
Infants **can** have a protoconcept of color

possibly

Infants ~~can~~ have protoconceptual color perception

Infants can have protoconceptual color cognition with non-**proto**-conceptual perception

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Even if color were a temporary property of things, **same color at a time** can predict something interesting

Alternative rules:

- Same shape predicts something interesting
- Same color predicts something interesting

12 month olds learned this one

Jean-Remy Hochmann

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Unlike the tunnel effect, this task requires **Working Memory**

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Working Memory

Operates over a few seconds Or longer with active maintenance

Putting these together to deduce Q requires maintaining them in working memory

"Working memory, which is the ability to briefly retain and manipulate information, is the fundamental basis of cognition" (Nieder, 2016, p. 374).

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Although working memory is a cognitive capacity, it often involves perceptual materials, especially spatial aspects

Location: Parietal
Shape: Inferior temporal
Color: Temporal-occipital

Working memory buffer

We walked across the beautiful Golden Gate Bridge!

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Familiarization Phase
Test

Control

Identification-by-Shape

<12 month olds: surprised at a change in in shape but not color.

(Tremoulet, Leslie, & Hall, 2000)

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1. Screen introduced
2. Object 1 brought out
3. Object 1 returned
4. Object 2 brought out
5. Object 2 returned
Steps 2-5 repeated
6. Screen removed revealing
Expected outcome
or
Unexpected outcome

Babies use shape and kind information in forming expectations about number months earlier than they use color

Xu & Carey, 1996

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Babies use shape and kind information in forming expectations about number months earlier than they use color

<12 month old does not expect 2 things

Xu, Carey & Welch, 1999

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6-11 months:

- normally, do not notice color
- no color representations in working memory hence no color concepts

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Why don't these paradigms show they do notice color?

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I am using a sense of 'notice' that involves cognitive categorization of the sort required for formulating expectations in paradigms such as these:

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Maybe the infants' color constancy is too poor to support expectations of color

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Training

Pound Event

Pour Event

Yields good enough constancy to be surprised by this, even for 7.5 month olds

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On average, children know 4 basic color words by 3 years, 3 months


Mabel Rice

Teaching experiment: Group of 2-3 year olds who knew no color words were taught the difference between 'red' and 'green'. For most children, learning this difference took over 1000 trials over several weeks.

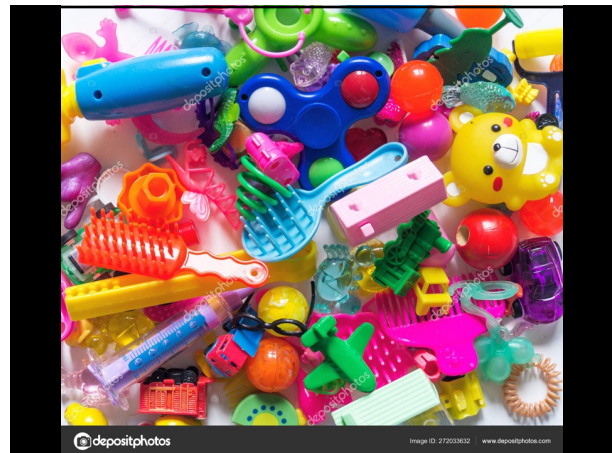
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"I attended carefully to the mental development of my young children, and with two or as I believe three of them, soon after they had come to the age when they knew the names of all common objects, I was startled by observing that they seemed quite incapable of affixing the right names to the colors in colored engravings, although I tried repeatedly to teach them. I distinctly remember declaring that they were color blind..."

Farbendummheit
(Nagel, 1906)



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- Color **category** representations
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4-6 months

11-12 months

3 years

Why aren't color categories a kind of concept?

No role in thought or reasoning

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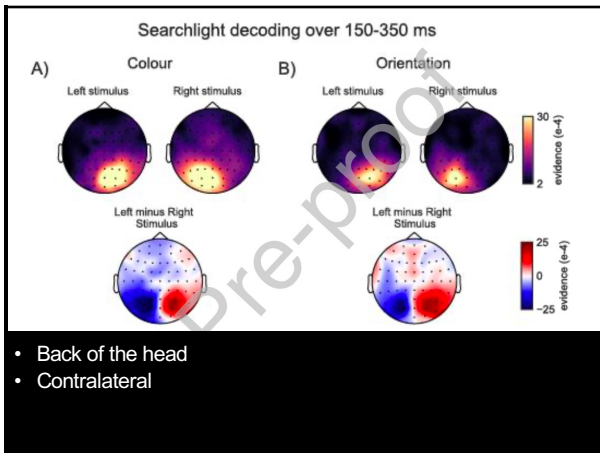
4-6 months

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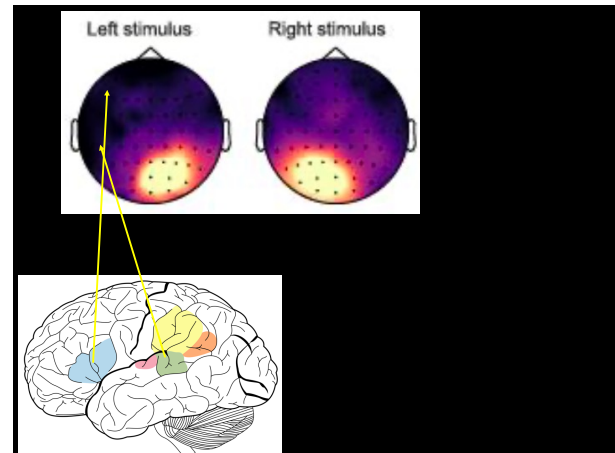
3 years

Whatever you call this difference it is of fundamental importance

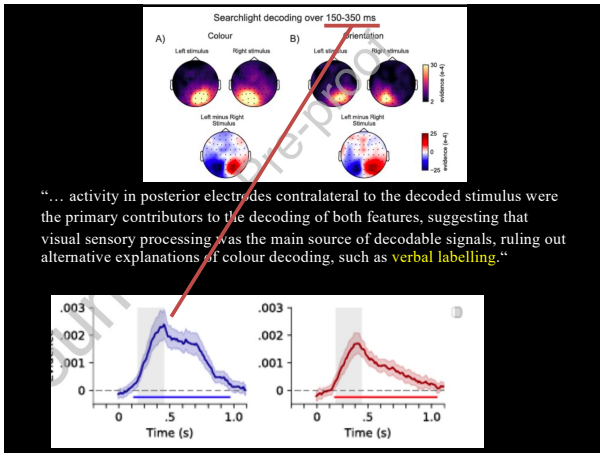
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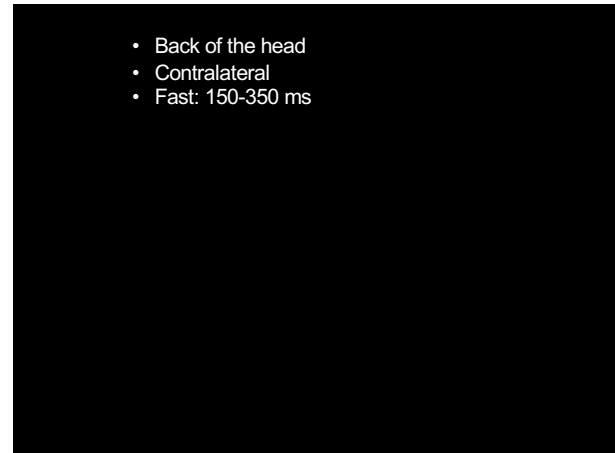
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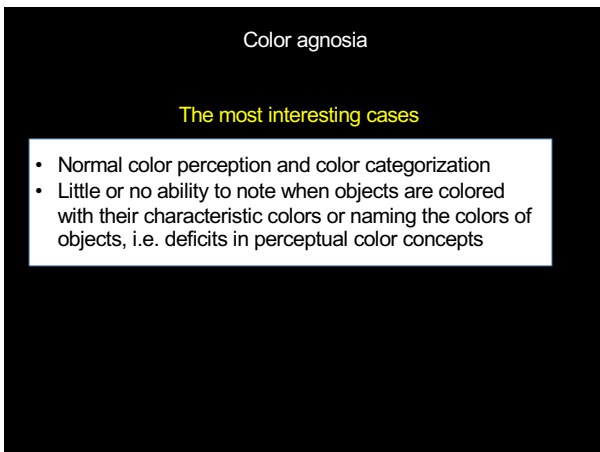
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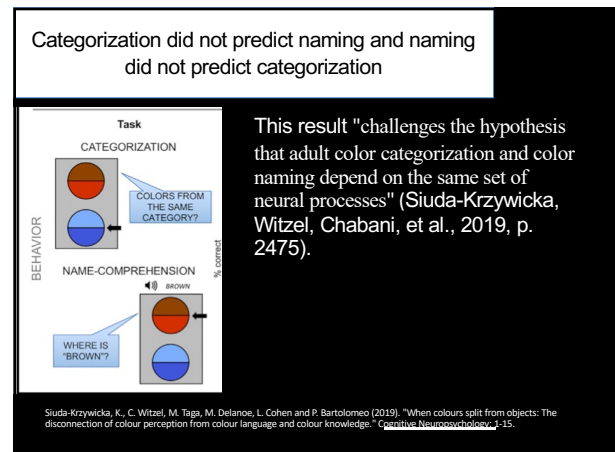
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The time it takes to move one's eyes to a target of a different color category is the same for both hemispheres, 350 ms

No advantage for left hemisphere, as would be expected for verbal concepts

Presumably, conceptual processing in addition to perceptual processing would take additional time

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- (1) **Replacement** of non-conceptual categories with concepts
- (2) **Preservation** of non-conceptual categories but modified by top-down-influence ←
- (3) **Dualism**, the view that adults have both non-conceptual and conceptual color perception.

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Are the perceptual representations of color different at different stages?

Evidence equivocal

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- 6-11 month infants normally have color perception without color concepts
- There is some evidence that adult color perception does not involve an extra conceptual representation

But none of this shows that **high level** perception or **object** perception are nonconceptual

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Summary

- Infants can see colors at near adult levels at 4-6 months and they perceptually categorize colors
- Infants can use shape, size and kind information in forming expectations and as inputs to rules at least **6 months earlier** than they normally use color information
- **Two years later**, most children do not know the basic color words and many children don't seem to know what color-talk is about
- Substantial reasoning with color seems to happen at the same time as learning color words

6-11 month old infants have color perception without color concepts

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WHY IS THAT IMPORTANT?



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2. **Robot vision:** If perception is non-conceptual, then a robot whose camera fed directly into cognition would not be seeing
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