



Size and Distance Perceptions

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Size and Distance Judgments

- We continuously make many judgments of the size and distance of objects in our environment.
 - Driving
 - Stepping
 - Placing
 - Grasping, etc



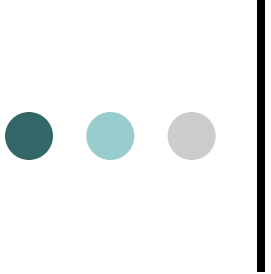
Size and Distance Judgments

- We continuously make many judgments of the size and distance of objects in our environment.
- Judgments of size and judgments of distance do not seem to be independent.



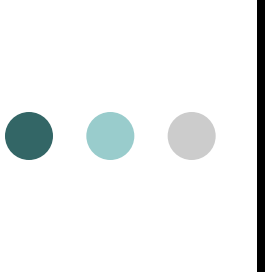
Size and Distance Judgments

- The relationship between our perception of size and our perception of distance is described as either:
 - Objects appear smaller as they move away and larger as they move closer (SOLI), or
 - Objects appear smaller as they move closer and larger as they move away (SILO).



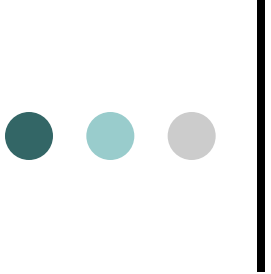
SILO and SOLI: The problem?

- Many contradictory observations of both the SILO and the SOLI relationships are reported.
- Various explanations have been offered to resolve these discrepancies.
- I find the various attempts to resolve those inconsistencies less than satisfying.



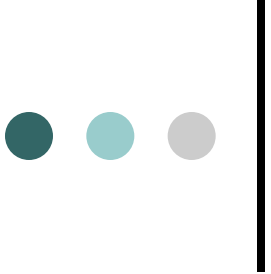
SILO and SOLI: The problem?

- Some presenters described SOLI as “real life” and SILO as “something else.”
- Others describe SILO as conflicting with “the logic of daily experience.”
- The SILO response is said to indicate reliance on current visual input while the SOLI response is said to indicate reliance on past experience and logic.



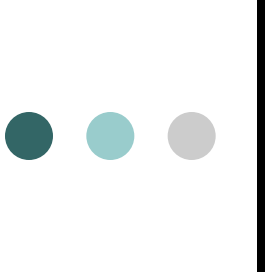
SILO and SOLI: The problem?

- Or SILO is said to not be subject to the “laws” describing size constancy because it applies only to images and not to solid objects.
- Do you find these descriptions satisfying?



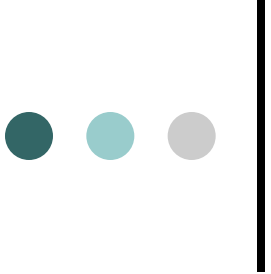
SILO and SOLI: The problem?

- I am uncomfortable with the idea that “current visual input” is somehow “illogical.”
 - It bothers me that we should have this very elaborate and pervasive visual process for the primary purpose of directing action and it produces “illogical” results for something as basic as size and distance judgments?



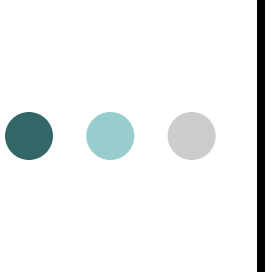
SILO and SOLI: The problem?

- It also seems strange to me that real objects and images should obey entirely different “laws.”
 - Are these laws tied to objects or to the systems viewing the objects?
 - Isn't the visual process always dealing with images?
 - If you project your acuity chart is it a “solid object” or an image?



SILO and SOLI: The problem?

- Does it make any difference?
 - I think that something so pervasive in our daily visual experience should have a better foundation.
 - Are we sure that SOLI is “real life” and that SILO “conflicts with the logic of daily experience?”



SILO and SOLI: The problem?

- Does it make any difference?
 - Many times – probably not!
 - Except sometimes, depending on the sophistication and/or complexity involved – you may get yourself screwed up and get caught in a discrepancy!



SILO and SOLI: Moving forward...maybe!

- Let's talk about perceived size and distance.
 - There is nothing in the retinal image that provides information about absolute size or distance.



A Question of Size and Distance

- I heard it explained in a lecture that a person moving away from me looks smaller and a person moving toward me looks larger.
- This was given as an example of the “real world” nature of SOLI, but...
- Is this what we mean by size & distance judgments?



A Question of Size and Distance

- Should I deduce that I must sit in the front of the room because the chairs in the back of the room (where all you little people are sitting) are too small?
- Or, is our judgment of size (and distance) a matter of grasping how we will accomplish our intended action?



A Question of Size and Distance

- Is there really some value to me thinking that I can pack 10 of you (little) people from the back of the room into my car, but only three or four from the front of the room?
- What are the basic metrics of our size and distance judgments?



A Possibility

- I'd like to suggest a simple proportionality between
 - Retinal Image Size – (S_{RI})
 - Perceived Size - (S_P)
 - Perceived Distance - (D_P)
- that might be useful for describing perceived size and distance relationships...



A Possibility

$$S_{RI} \propto S_P / D_P$$



What does this suggest?

- Let's try manipulating the expression.
- Assume that the perceived size is constant.

- $S_P = k$

- The statement becomes:

$$S_{RI} \propto (k) / D_P$$

- This describes the basic **size constancy** situation.



The second manipulation

- Assume that the retinal image size is held constant.

- $S_{RI} = k$

- The statement becomes:

$$k \propto S_P / D_P \text{ or...}$$

$$(k) D_P \propto S_P$$

- This describes **SILO**



The third incarnation

- The last manipulation involves holding the perceived distance constant.

- $D_P = k$

- Then the statement becomes:

$$S_{RI} \propto S_P / (k)$$

- **What situation would this describe?**



Inferences

- So, one form of this proportionality describes **size constancy** phenomenon, and...
- another form of this proportionality reasonably describes the “**Ames room**” phenomenon.
- Both of these are well established and consistently reported among observers.



Inferences

- Since these two forms of the proportionality seem to describe the processing of the normal visual system, it seems reasonable that the third form may do also.
- **SILO** then should be considered a “natural” and “logical” aspect of our daily visual experience.



So, where does SOLI fit?

- This form of the proportionality,

$$S_{RI} \propto S_P / (k)$$

most closely describes the SOLI response.

- That is, when $D_P = k$, SOLI is a more likely response.
- This occurs when a 3-dimensional space is collapsed toward a 2-dimensional space.



So, where does SOLI fit?

- To me this argument suggests that SILO is the natural and logical description of size and distance judgments.
- This argument further suggests that SOLI describes a situation when the normal 3-dimensional space is collapsed.



So, where does SOLI fit?

- This is the case in perspective drawings where 3-dimensional space is collapsed onto a 2-dimensional surface.



Limitations

- Our size and distance judgments are meant to support our natural activities -
- things like reaching, grasping, and manipulating objects in our “immediate” environment and...
- locomotion within a dynamic, local “volume” of space.



Limitations

- In situations well beyond the ordinary, judgments of size and distance become less reliable and probably less consistent.



Directions

- For most of our testing and therapy procedures SILO is the expected response.
- I don't think that this means we “train” a SILO response, but it becomes an indicator of the normal and logical processing of the spatial volume.
- A SOLI response indicates that the 3-dimensional space is collapsed.



Directions

- The spatial transformations induced by spherical lenses are “symmetrical.”
- That is they either shrink

$$\mathbf{S}(x,y) \mathbf{I}(z),$$

or expand

$$\mathbf{L}(x,y) \mathbf{O}(z)$$

the visual space.



Directions

- When parents (or others) ask what “the” lenses do, I try to dispel them of the notion that lenses clear and blur things and discuss, instead, how lenses move things (as described by these transformations).



Speculations

- There is reasonable evidence to suggest that visual space is non-Euclidean.
- A hyperbolic geometry is probably a better descriptor.



Speculations

- A hyperbolic geometry has a couple significant implications:
 - Near space and far space are different
 - Near objects should be seen as smaller and far objects should be seen as larger.



Mercifully...

The End