Visual working memory for multiple moving objects in occlusion

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Background
Change detection task: Stationary, vanishing items
Sequentially-hidden objects in motion (Kibbe & Leslie, 2013)

Adults: ~3-4 items
Infants succeed
Infants fail

Set size: 2
Last item is removed, 1000 ms interval.

Sequential removal

Occluded

Vanished

N=24

N=24

Items descend (250 ms each) and either become occluded or vanish.

Overall Change Detection Performance

Mean proportion correct

Set size

0.5 0.6 0.7 0.8 0.9 1

0 2 3 4 5 6

Occluded

Vanished

Exp. 1: Orientation

Current aims
In the physical world, VWM may have to maintain representations of multiple items as they move in and out of occlusion. This may put different demands on VWM, requiring more attentional resources than maintaining representations of stationary items or of items that vanish completely. Here, we explored VWM for sequentially-hidden items that were either occluded or vanished. We asked:

• Are occluded items remembered differently than vanished items?
• Does encoding new items while attempting to maintain representations of already-removed items impact how items are remembered? YES. When items were occluded, increasing set size had a negative impact on VWM, but only for a subset of items; more recently-removed objects were privileged in VWM, regardless of set size. However, when items vanished, increasing set size had a negative impact on VWM for all items.

Varied:
• Occlusion: items occluded versus vanished (between subjects)
• Set size: 2-6 items per trial (within subjects)
• Probed Item: Which item in the sequence is probed (last, 2nd-to-last, 3rd-to-last, etc.) (within subjects)

Constant:
• Timing: Time between removal and reappearance of objects is the same for each set size regardless of occlusion.

General methods
Item motion

2nd to last

Last

Sequential removal

Set size (2-6 items)

120 trials, 6 per probed item per set size (e.g., 12 trials at set size 2, 18 trials at set size 3, etc.) On half of trials, an item changed.

Exp. 2: Color

Occluded

Vanished

N=13

N=11

Items descend (250 ms each) and either become occluded or vanish.

Overall Change Detection Performance

Mean proportion correct

Set size

0.5 0.6 0.7 0.8 0.9 1

0 2 3 4 5 6

Occluded

Vanished

Exp. 1: Orientation

Occluded

Vanished

N=24

N=24

Items move sequentially (500 ms each) and either become occluded or vanish.

Two items become disoccluded or reappear. On change trials, one item changes orientation (>30° difference).

Conclusions
• Are occluded items remembered differently than vanished items? YES. While overall performance was similar, occluded items were remembered better than vanished items when last-removed items were probed.
• Does encoding new items while attempting to maintain representations of already-removed items impact how items are remembered? YES. When items were occluded, increasing set size had a negative impact on VWM, but only for a subset of items; more recently-removed objects were privileged in VWM, regardless of set size. However, when items vanished, increasing set size had a negative impact on VWM for all items.