The algorithm: „lifting the weakest“

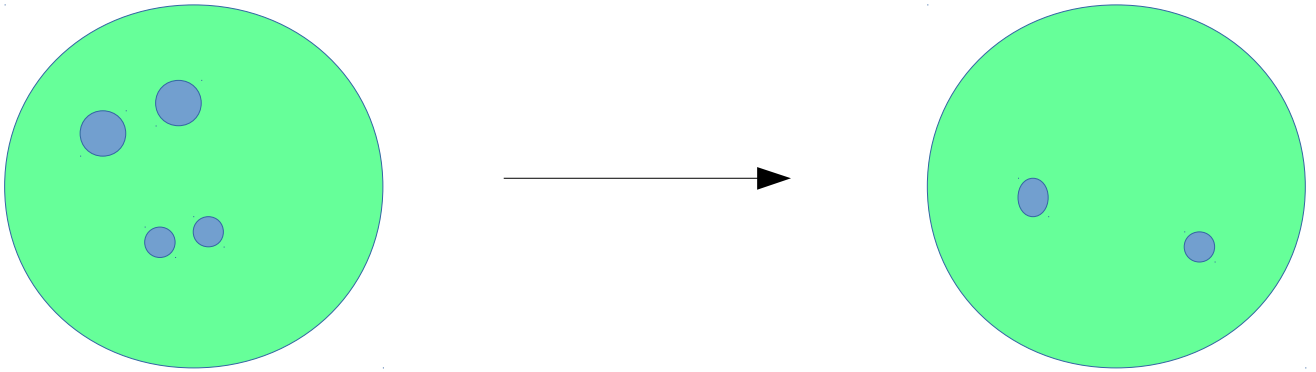
Heuristically optimizies the estimated trial efficiency for the subsequent trial

Questions from last week

- Do the algorithm need all the items in subsets after initial arrangement to estimate the subsets with the weakest evidence?

Assumptions of the algorithm

- Relative Dissimilarities
  - Each item subset is assumed to reflect the relative, not the absolute dissimilarities between the items
  - Distance of 0 represents identity
  - The same dissimilarity will become bigger in a smaller subset



Assumptions of the algorithm

- On-screen placement error
  - Each item in an arrangement is affected by a displacement error
  - The displacement error is isotropic and has a constant variance across trials
  - Placement error is small relative to the distances

Assumptions of the algorithm

- Dissimilarity signal-to-noise ratio
  - Dissimilarity signal = on-screen distance
  - Dissimilarity signal-to-noise ratio is proportional to the on-screen distance
    - The larger the on-screen distance, the larger the signal-to-noise ratio

Assumptions of the algorithm

- Dissimilarity-evidence weight = signal-to-noise ratio²
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Assumptions of the algorithm

- Dissimilarity evidence matrix
  - The current evidence for each item pair is a sum of the evidence weights across trials
  - Dissimilarity matrix which is **updated after each trial**

Example for item pair 1&2

- Item 1 & Item 2 = ew1+ew2+ew3+ew4+ew5 = ewg(i1xi2)

Assumptions of the algorithm

- After each trial the question: do we need another trial? Termination when...
  - 1) time is up (time limit a free choice of the scientist)
  - 2) dissimilarity evidence criterion is reached
    - All current evidence-weights exceed some threshold

Assumptions of the algorithm

- „Lift the weakest“
  - Seek more evidence for item pairs for which the current evidence is the weakest
  - To formalize the goal of „lift the weakest“ there is the concept of evidence-utility

Assumptions of the algorithm

- Evidence-utility
  - $u(w) = 1 - e^{-w \cdot d}$
  - u = usefulness of the current evidence
  - w = evidence weight
  - d = evidence-utility exponent

Assumptions of the algorithm

- Trial benefit = evidence-utility gain
  - Evidence-utility gain = total evidence-utility after the trial – total evidence-utility before the trial
  - Trial benefit = u(w) after – u(w) before
- Trial cost = time taken to arrange the subset
  - Time = $n^{1.5}$
- Trial efficiency = benefit / cost

Answer to the question

- The algorithm should ask for all 20 items after the initial arrangement because he doesn‘t have any evidence about them and needs to find evidence for them and when evidence is saturated he will stops to ask for evidence.