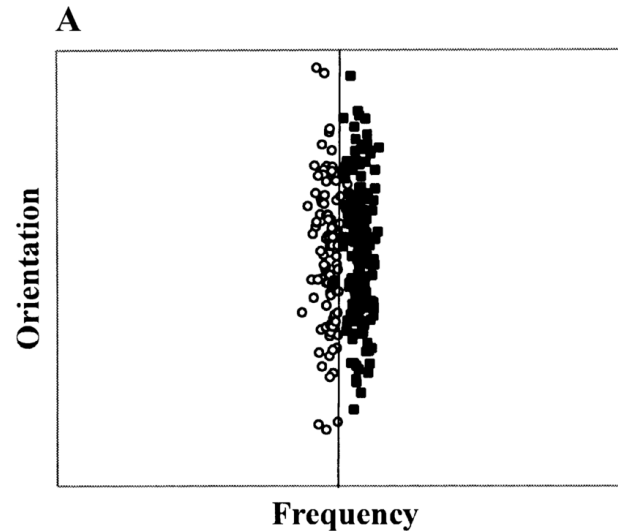# Separable vs. integral dimensions

- Garner (1970s) notice that there are two kinds of perceptual dimensions:

    - Separable dimensions are psychologically separate

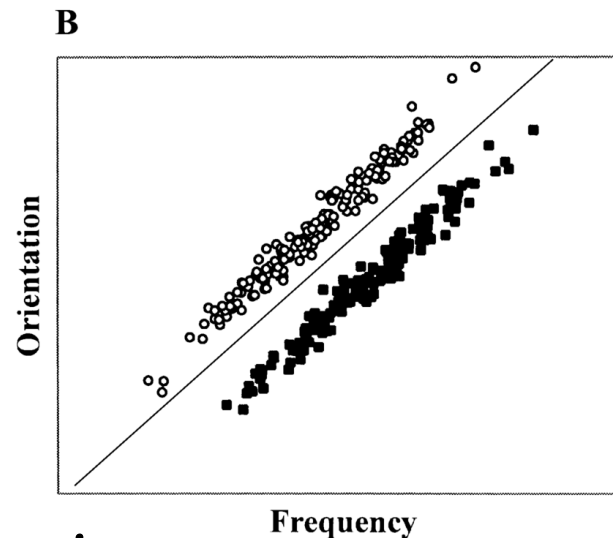   - Integral dimensions act like a single coherent space

Rule-based vs. information-integration concepts

RB

Easier
Explicit
prototype-like

II

Harder
Implicit
exemplar-like

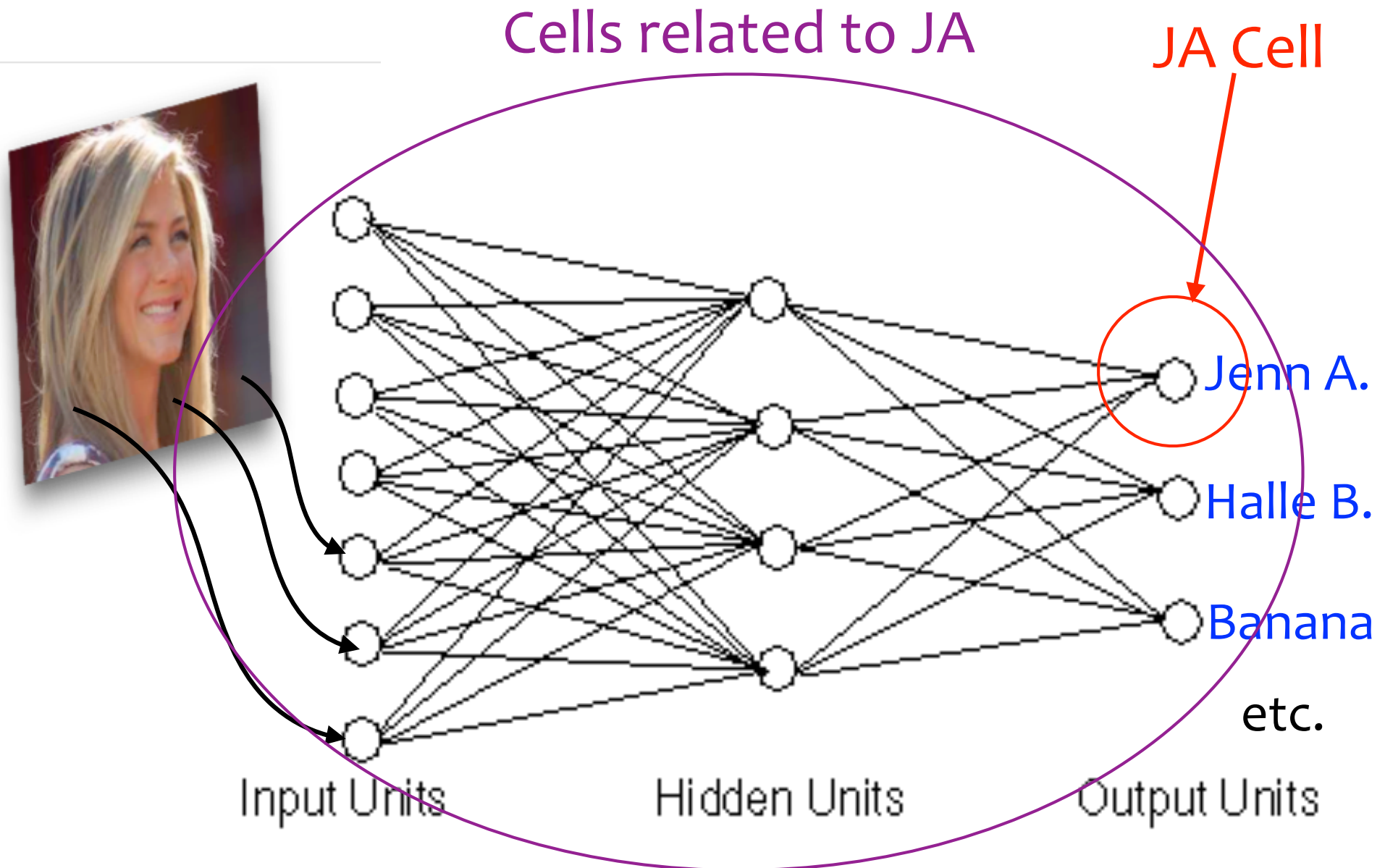Separable dimensions

Grandmother cells

- Specific cognitive functions seem to be carried out in specific brain areas.

- But how specific does localization of function get? Do individual neurons have specific functions?

- Grandmother cells (Jerome Lettvin - RU)

- The case of the Jennifer Aniston cell

40 Hz

1 s
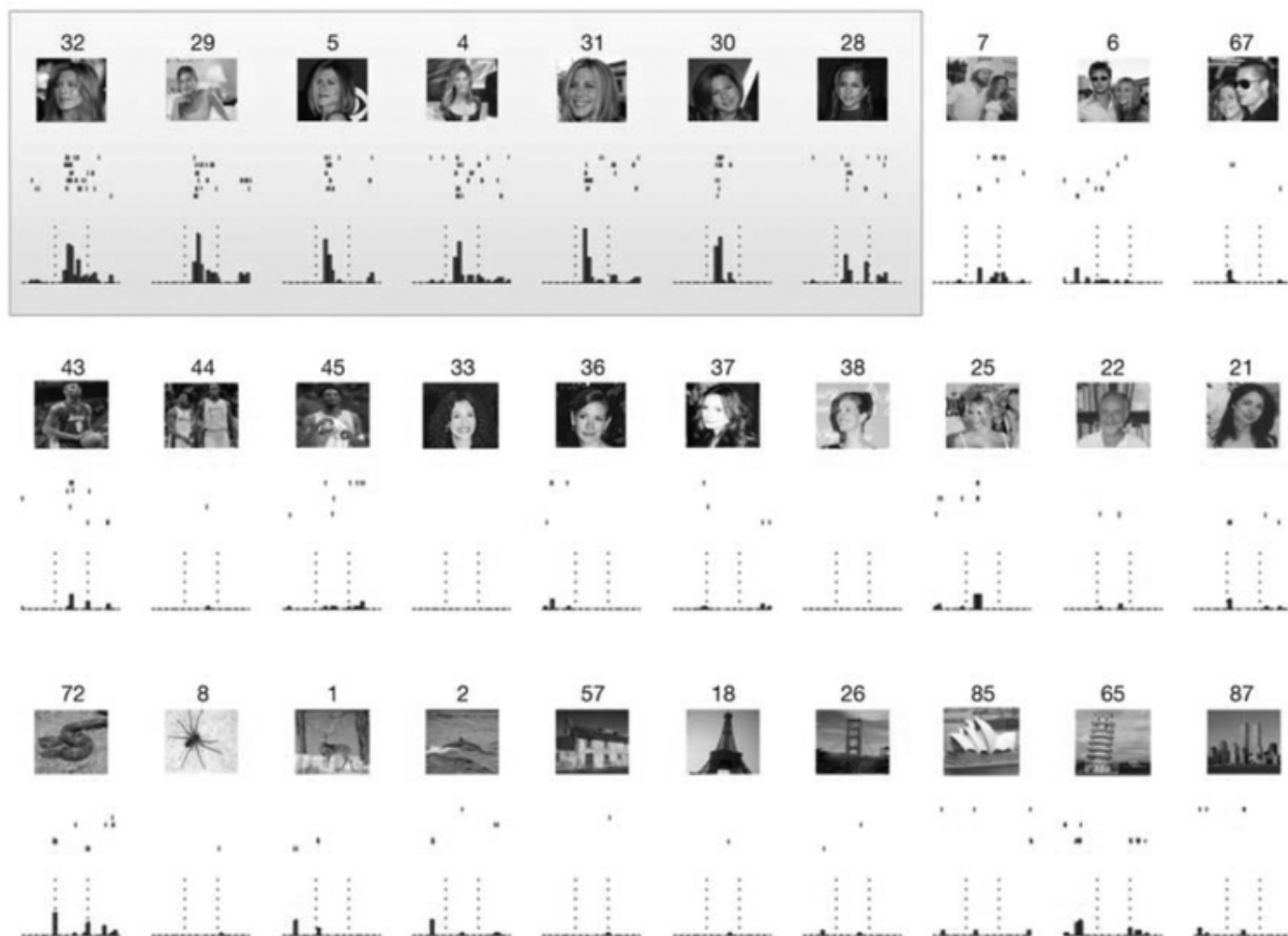
Concept cells

- Quiroga et al. consider these concept cells because they

  - respond differentially to particular categories (people, places, things...)

  - are not specific to one modality (e.g. are not specific to visual face recognition)

How many cells for JA?

Cells related to JA

JA Cell

Jenn A.

Halle B.

Banana

etc.

Input Units   Hidden Units   Output Units

Deep Learning and neuroscience

- Given their basic architecture, DNNs and neuroscience should be a perfect fit.

- Much recent work in theoretical neuroscience builds on this potential correspondence

- But there are a number of points of potential conflict:

    - Real brain areas appear to be highly specialized; DNNs by design are not

    - The human mind seems to incorporate strong priors, allowing it to learn quickly from little data; DNNs by design do not.