Goals
1) Emphasize the differences between single-cell recordings and BOLD fMRI
2) Analyze the utility, both practically and analytically, of criteria used to identify integration
3) Propose an alternative that is both theoretically sound and empirically feasible
4) BOLD fMRI ≠ Single-cell recordings

Background
1) The study of multisensory integration has grown exponentially in the past decades.
2) Much of this expansion is the result of new techniques such as BOLD fMRI.
   — allows non-invasive study of neural mechanisms of multisensory integration in humans
3) Most of our understanding of the neural mechanisms of integration still originate from
   single-unit studies in non-human animals.
4) BOLD fMRI = Single-cell recordings
   — fMRI measures from HETEROGNEOUS POPULATIONS of neurons

Single-cell recordings: measure the action potentials of individual neurons.
— Multiple types of unisensory and multisensory neurons are found in multisensory regions.
— Criterion for multisensory enhancement = maximum criterion (AV > A or V)
— Superadditivity describes a type of enhancement, but is not used to identify integration

Requirements for a viable criterion to identify multisensory integration in the BOLD signal:
— These may include
  1) Measure changes in BOLD activation across an added factor [7,8]
  2) Superadditivity uses a population-based null hypothesis, which is more analytically
     sound than the maximum criterion, but it is not frequently seen in practice and is
     also susceptible to changes in baseline.
  3) An additive-factors design uses a population-based null hypothesis, is unaffected by
     changes in baseline, and is practical. It can distinguish between areal and neuronal
     convergence from areal convergence

Conclusions and Suggestions
1) The maximum criterion cannot distinguish between populations of neurons consisting
   of multiple pools of unisensory neurons (areal convergence) and populations with
   multisensory neurons (neuronal convergence) due to its lack of a population-based
   null hypothesis.
2) Superadditivity uses a population-based null hypothesis, which is more analytically
   sound than the maximum criterion, but it is not frequently seen in practice and is
   also susceptible to changes in baseline.
3) An additive-factors design uses a population-based null hypothesis, is unaffected by
   changes in baseline, and is practical. It can distinguish between areal and neuronal
   convergence. - drawback: It requires (at least) twice as many conditions.
4) An additive-factors design goes beyond identifying where integration occurs, also
   showing what stimulus information is being integrated. The stimulus information
   manipulated as the added factor is integrated in regions showing an interaction.

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