



Grasping beer mugs: On the dynamics of manipulable objects

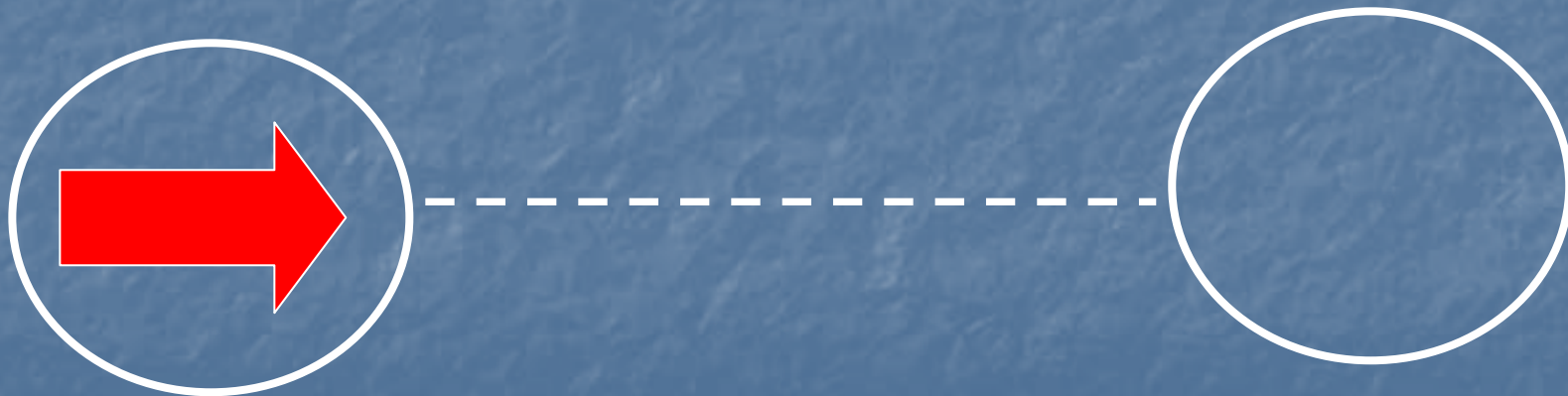


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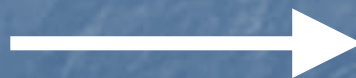
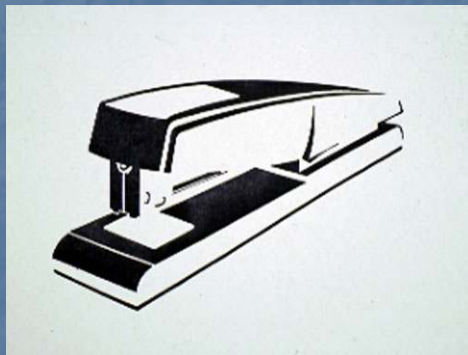
The dynamics of action frequently require that the brain resolves competition between an intended act and competing actions invoked automatically by stimulus-driven events.



Manipulable objects raise important questions about the nature of competition between intended actions and other competing actions associated with a particular object.

Most objects are associated with a variety of habitual actions.

In order to clear a space, John lifted the stapler.

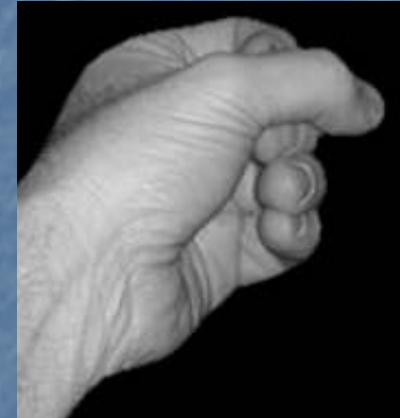


?



Objects with handles form an interesting subclass of manipulable artifacts because actions may be automatically invoked on one or the other side of the body, depending on the position of the handle.

But if we wish, we can apply a left-handed grasp to the beer mug, despite the habitual action invoked by the handle on the right.

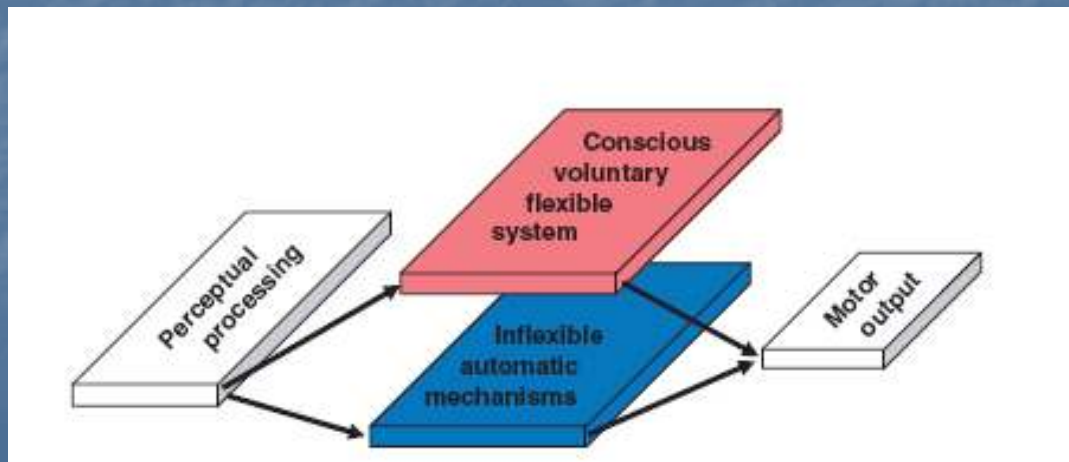


Under what task conditions are motor affordances automatically evoked?

Possibility 1 (*See* \rightarrow *Act*_{automatic}): Perception of a manipulable object automatically triggers motor-based representations which then compete with the intentions of the observer.

Possibility 2 (*Motor Intention* → *See* → *Act_{automatic}*): Objects do not inevitably afford actions during perception.

Rather, motor intentions play a crucial role in determining whether perception generates habitual actions.



See – Grab!

vs.

Motor intentions generate actions,
even automatic affordances.



Measuring the presence of automatically evoked action representations:

We assume that certain perceptual events (e.g. the photograph of an object) automatically evoke motor representations based on previous experience (call these, evoked action representations)

Assume participants are asked to carry out an intended action to some cue, occurring in close temporal proximity to the perceptual event.

Then: Intended actions should be affected to the extent that they share features with the evoked action representations that are activated by the perceptual event.

How do we investigate the dynamic resolution of competition between a habitual action evoked in response to a handled object and an intended grasp action?

Participants learn to produce a particular action on a single response element to a color cue, either with the left or right hand.



Left hand



Right hand

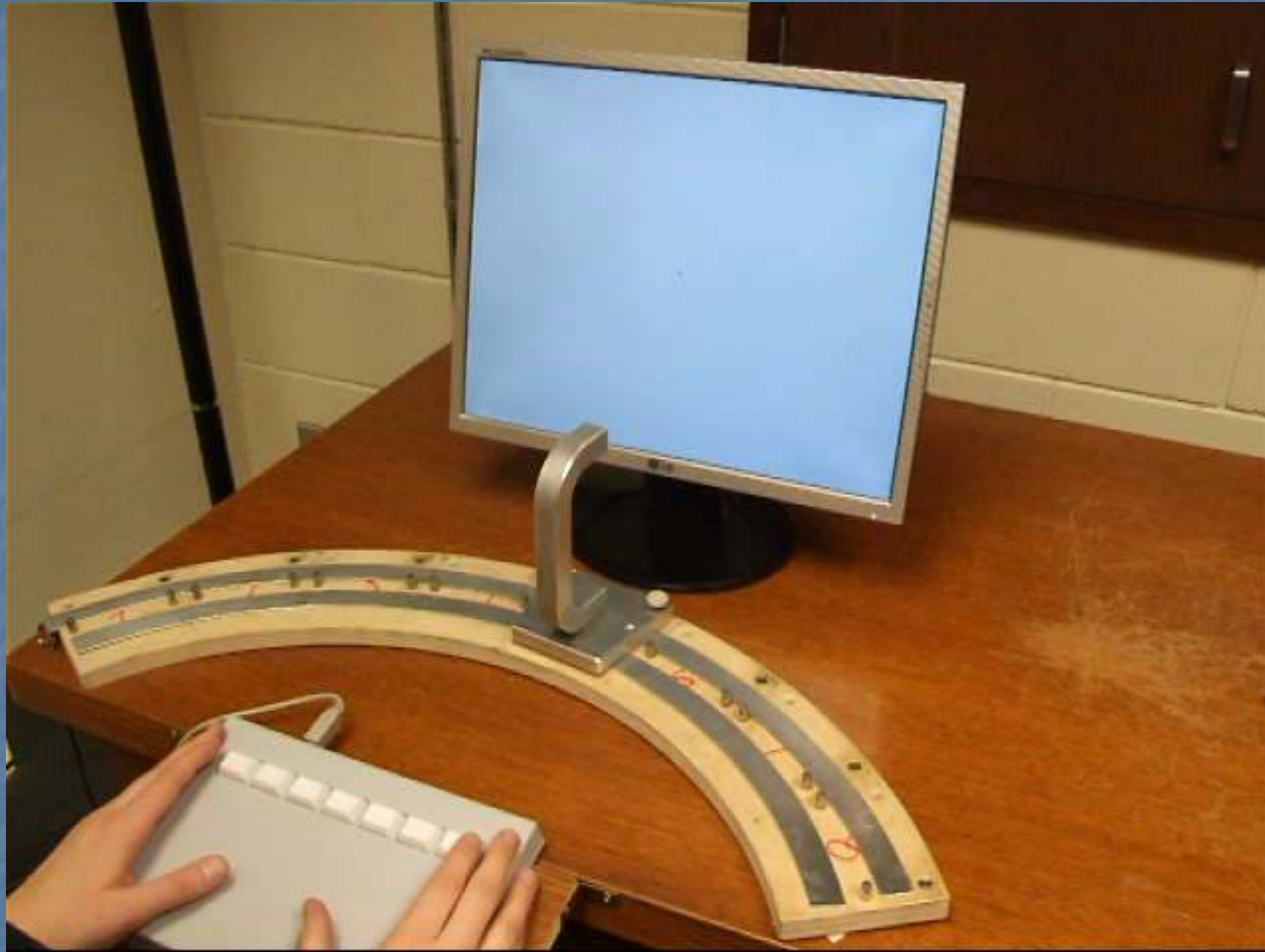
The color-cued action is the *intended action*.

After training, the color cue is presented in the context of a handled object, with the handle facing left or right.



We assume the irrelevant handled object automatically evokes hand action representations.

Competition: The arm producing the intended action conflicts with the side matching the evoked action.



The dynamics of alignments effects:

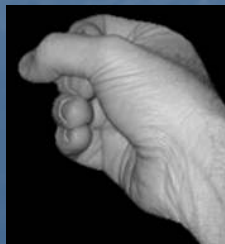
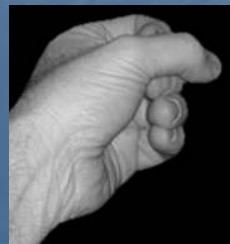
We either present the color cue at the same time as the onset of the handled object

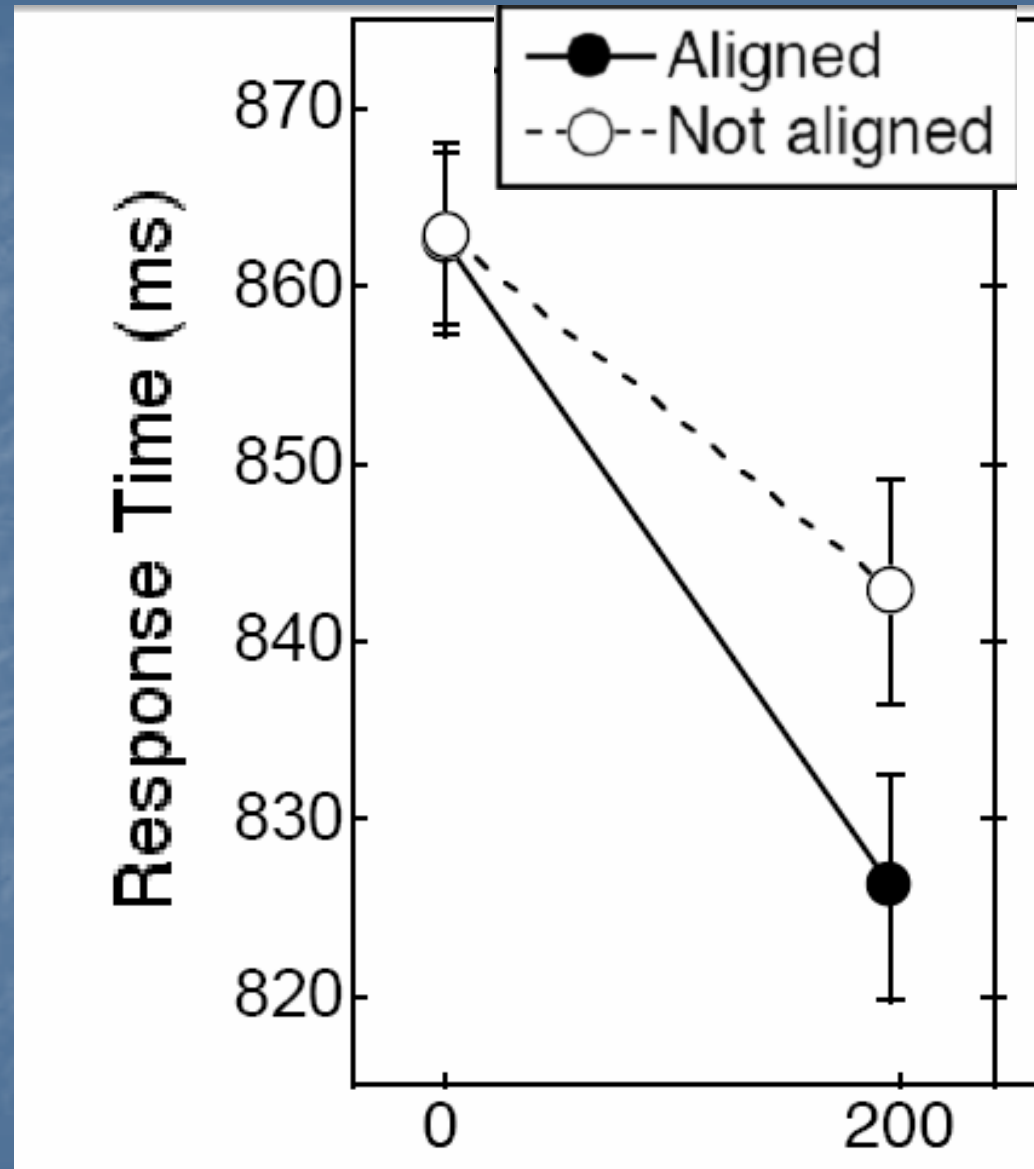
or

The object appears first in grey scale and then changes color after a short delay.

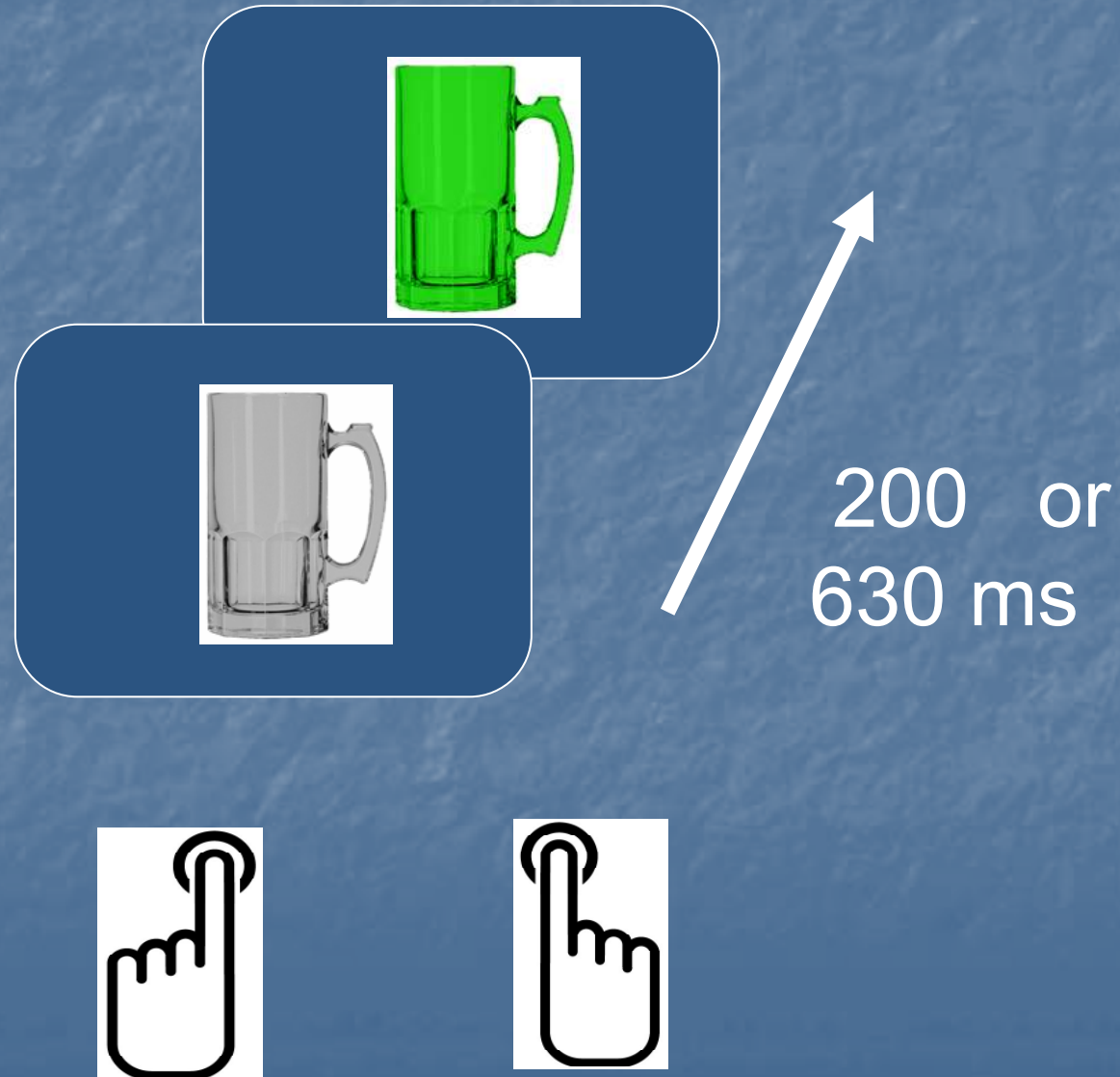


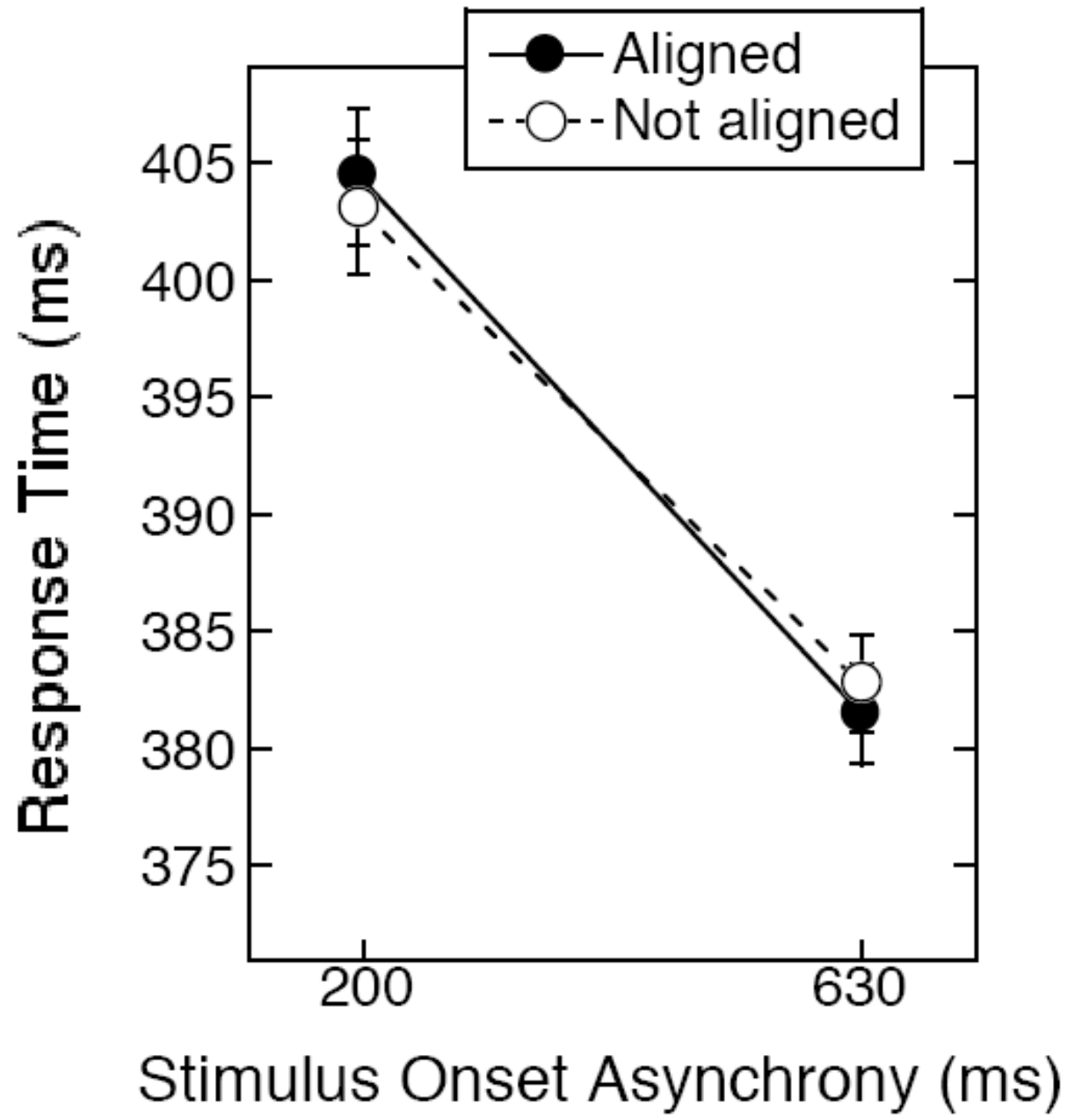
0 or
195 ms





Experiment 2: Alignment effects depend on the intention to reach and grasp



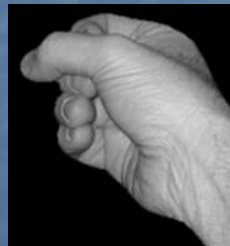


Alignment effects clearly occur (if observers plan and execute a reach and grasp response) but they are delayed somewhat after the onset of the irrelevant object.

Apparently the competing action is evolving over time.

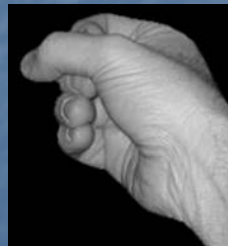
What does this time course tell us about the dynamics of action competition and resolution?

The action afforded by the object really does compete with the intended action cued by color!



Benefit!

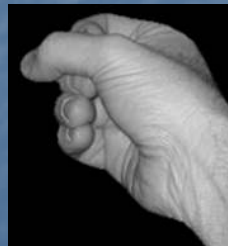
The action afforded by the object really does compete with the intended action cued by color!



Cost!

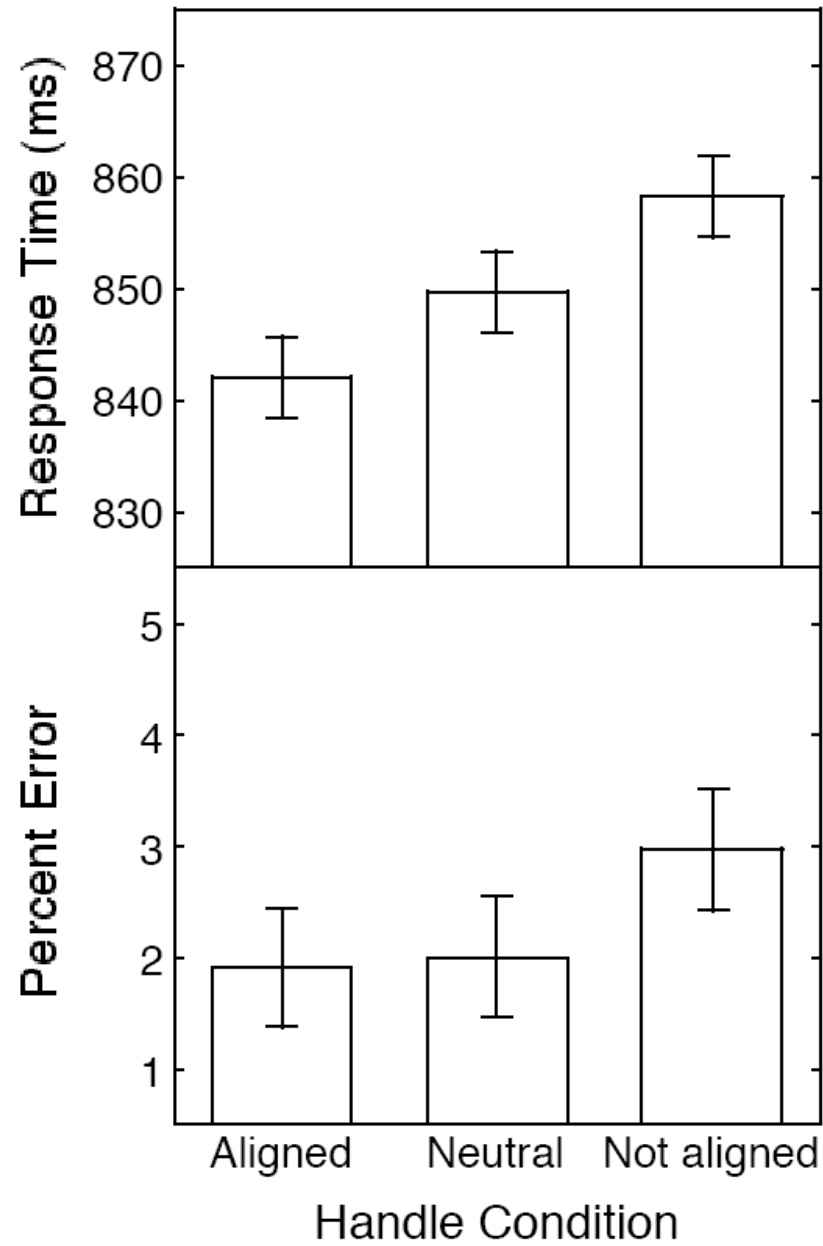


The action afforded by the object really does compete with the intended action cued by color!



Neutral!

SOA
between
object and
color =
500 msec

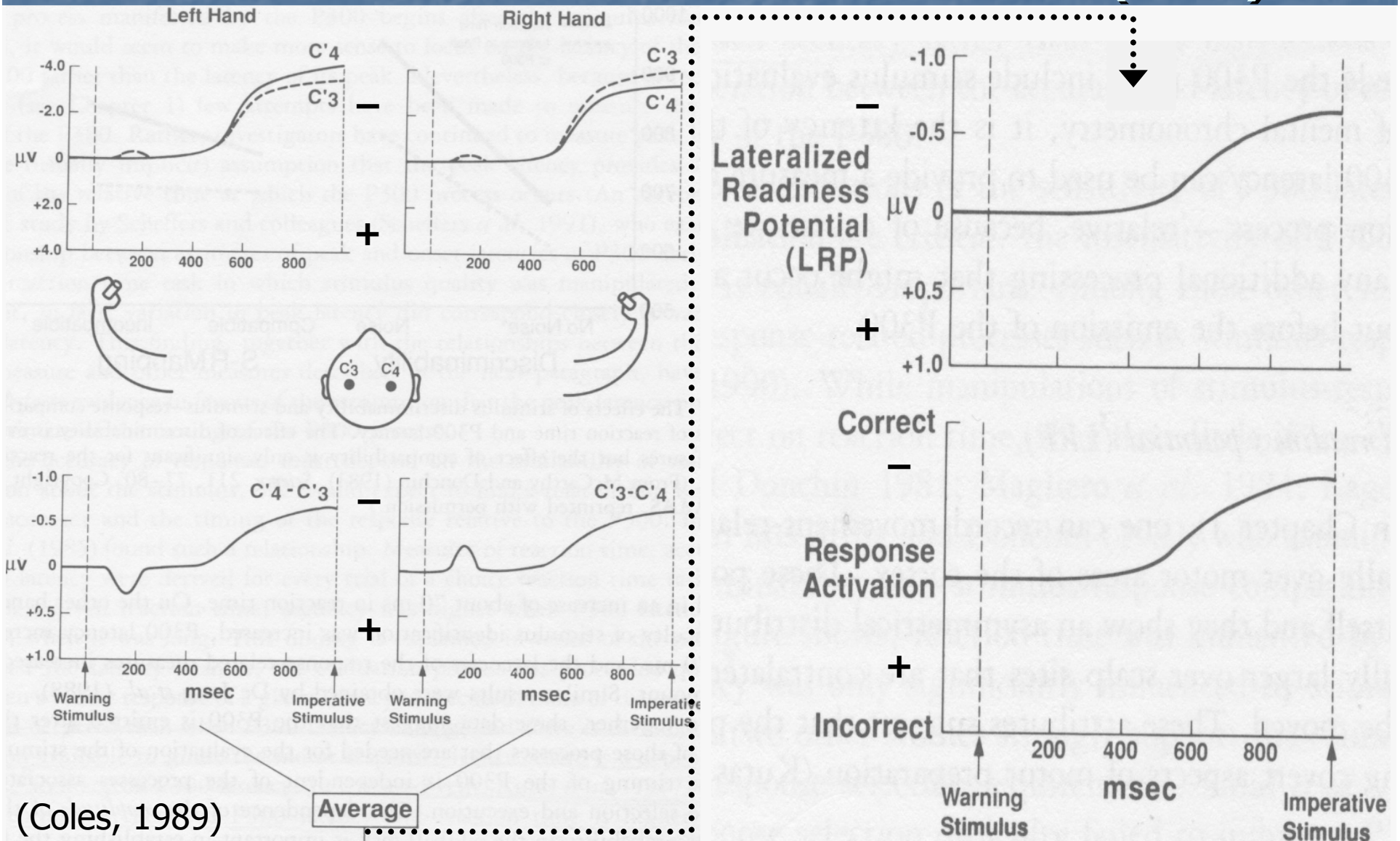


Can we make use of other methods to assess the dynamics of hand actions produced from one or the other side of the body?

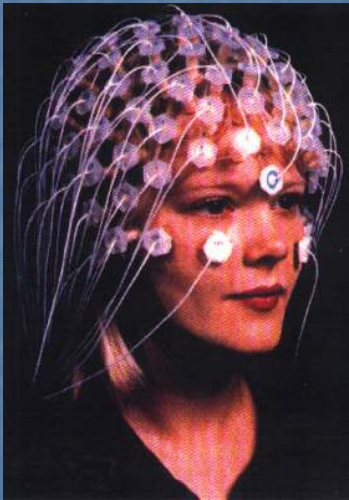
Are evoked actions driven by the object before the cue to act or do they only occur when the color cue is processed?

Recruiting the lateralized readiness potential.

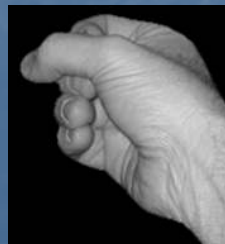
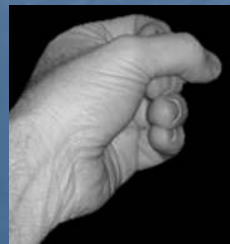
Lateralized Readiness Potential (LRP)

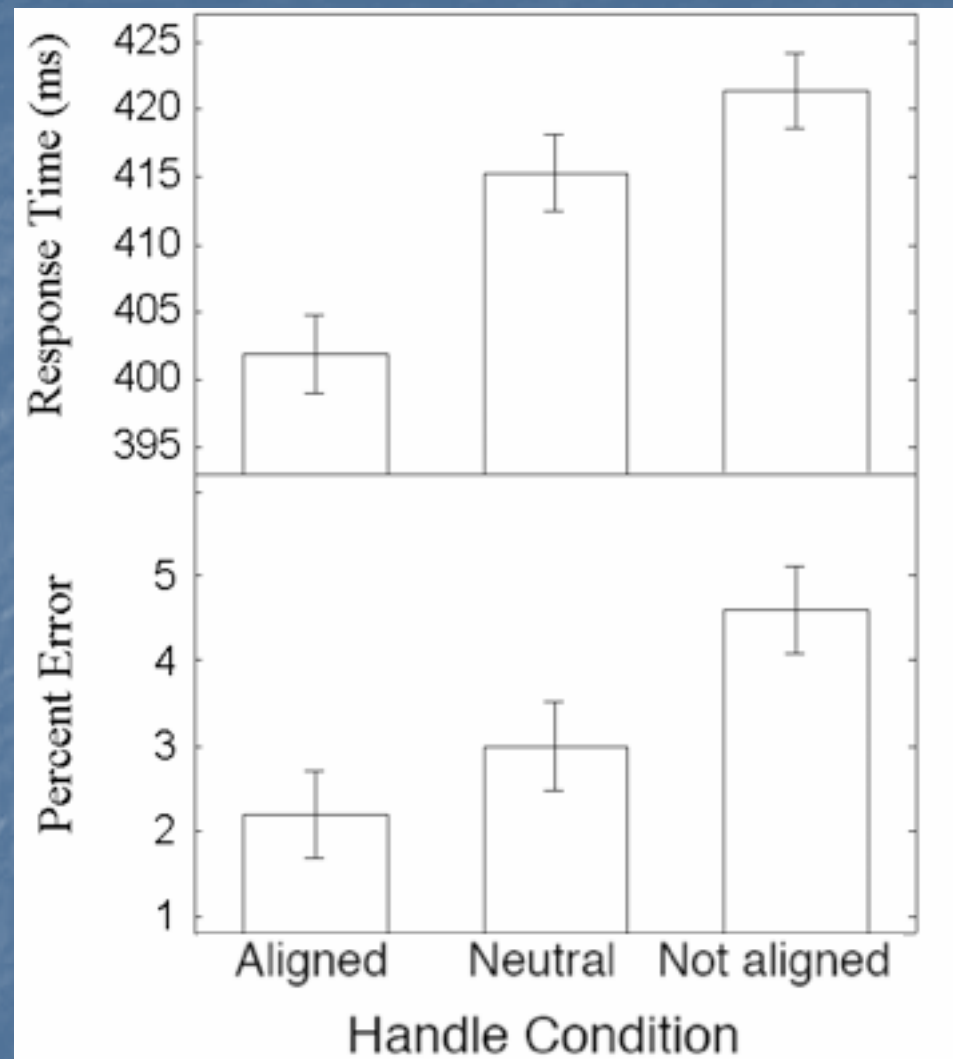


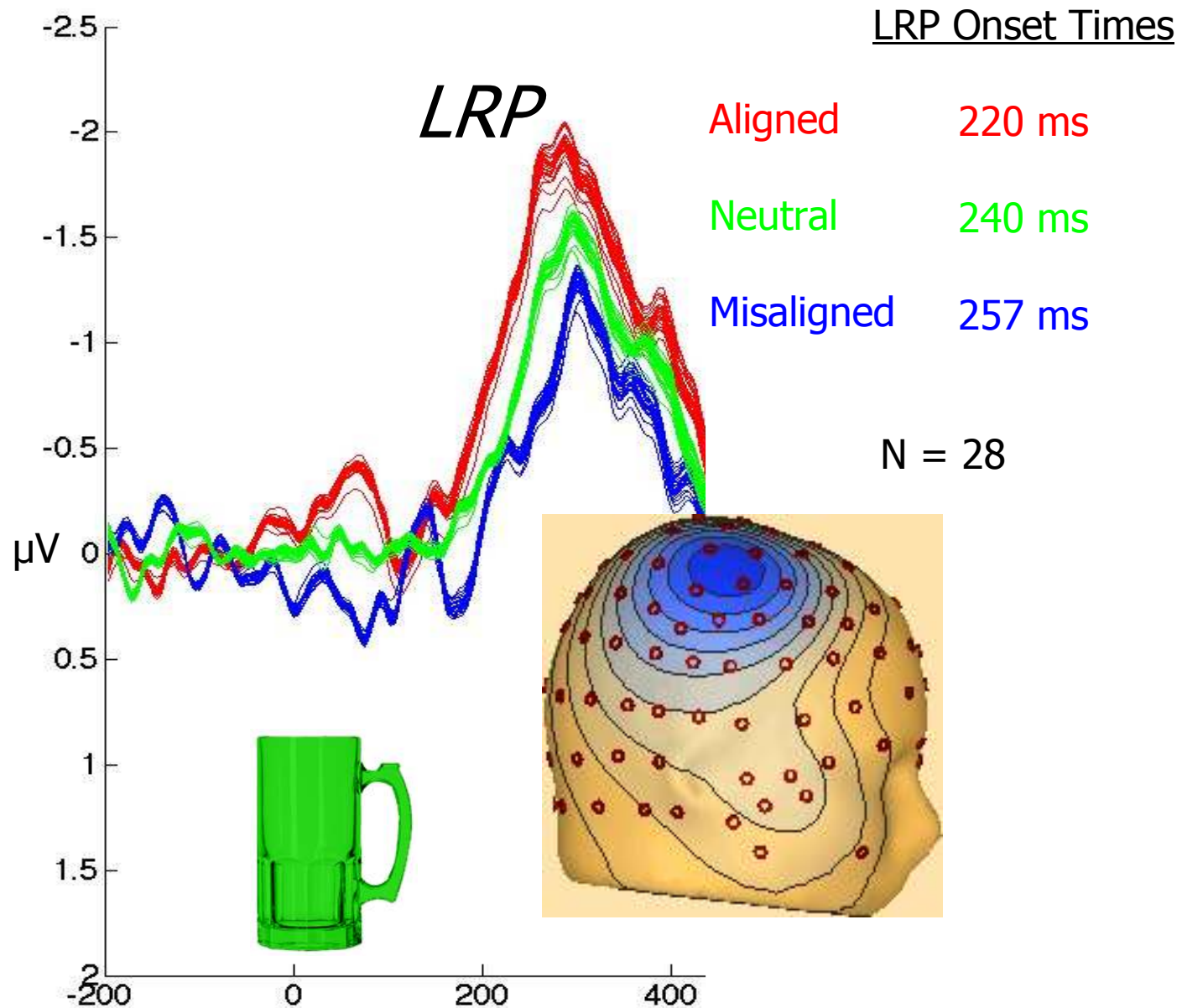
ERP Design



445 - 545ms
(randomly varying)





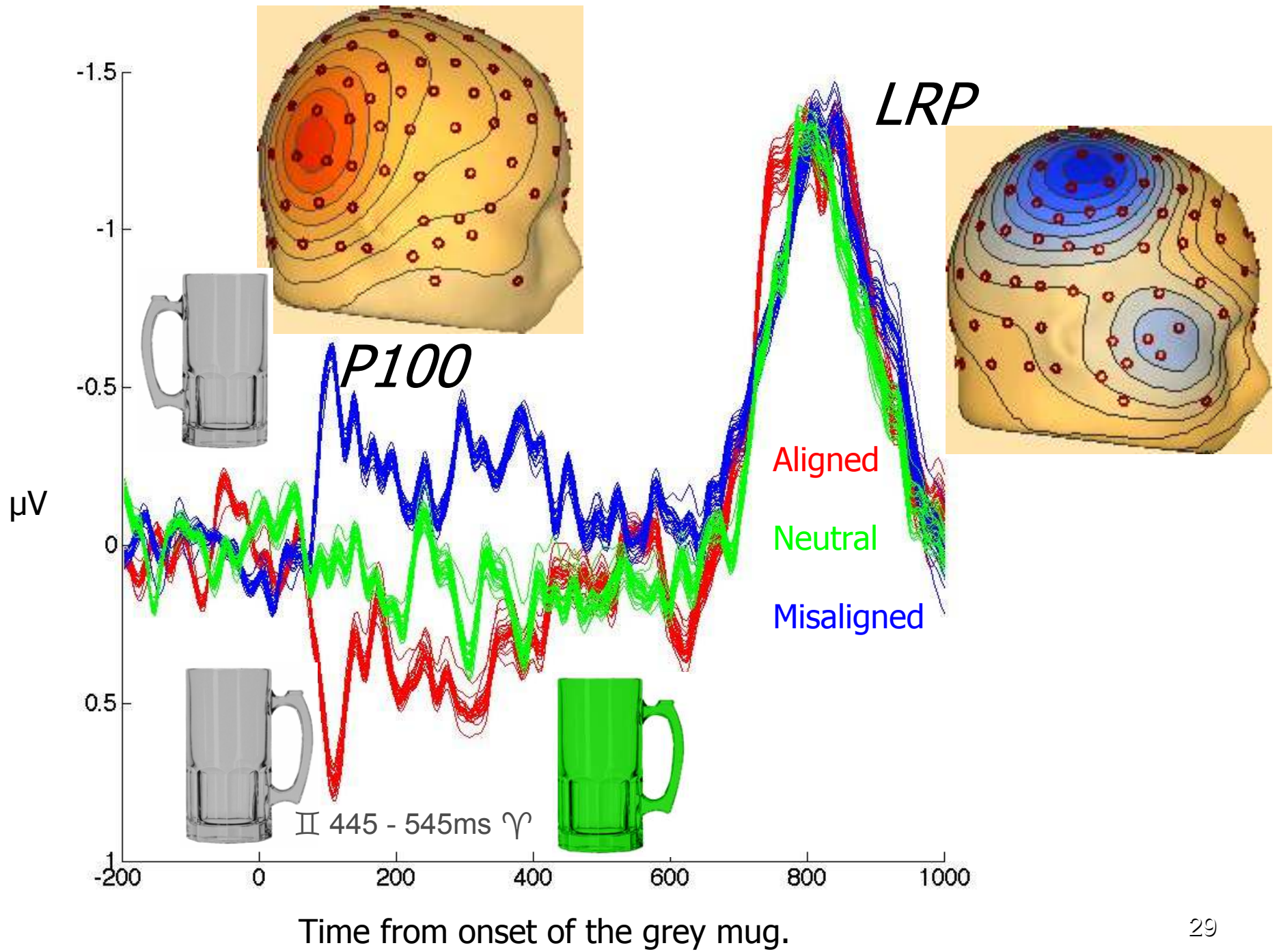


Time from onset of the colored response-defining mug.

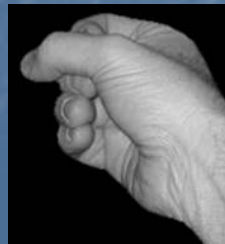
Following the colored mug, LRPs indicate that response preparation was faster for aligned than misaligned conditions.



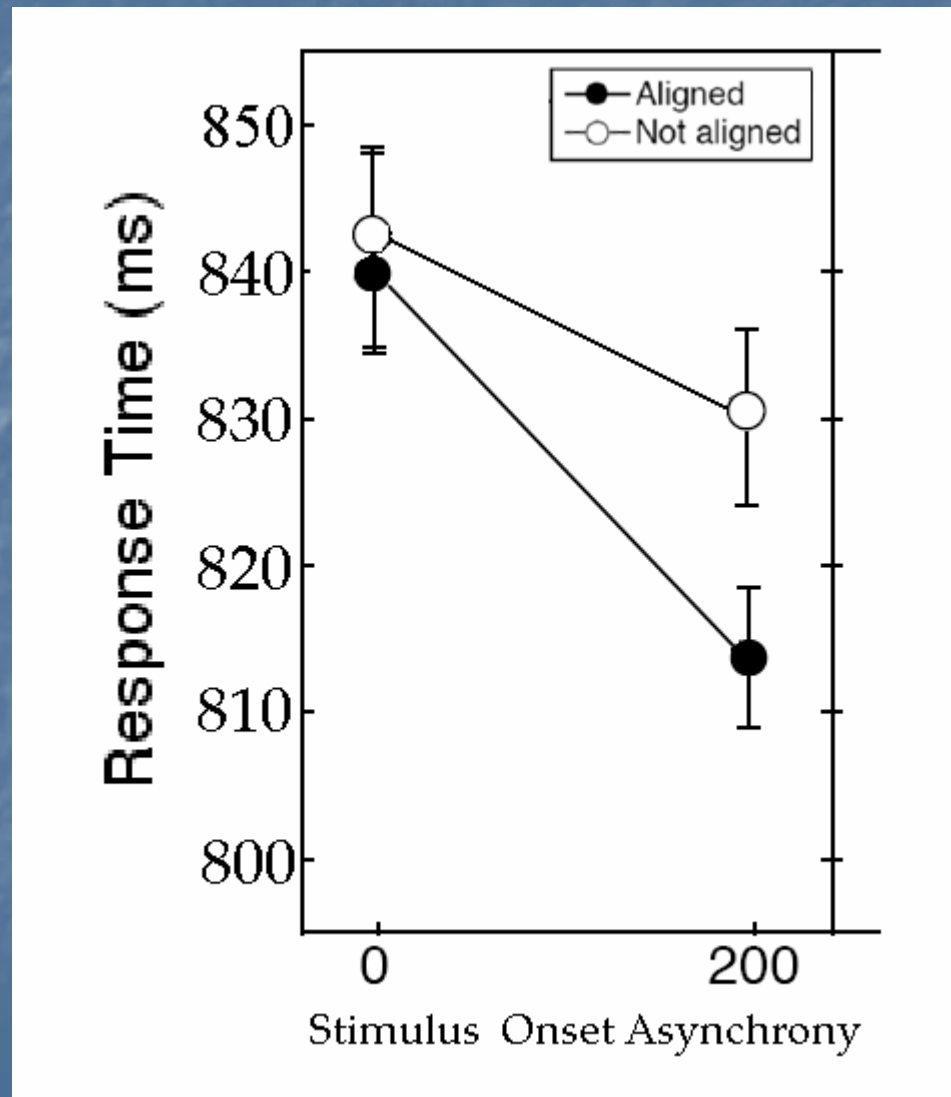
Are evoked actions driven by the object before the cue to act or do they only occur when the color cue is processed?



Next Experiment



N=11



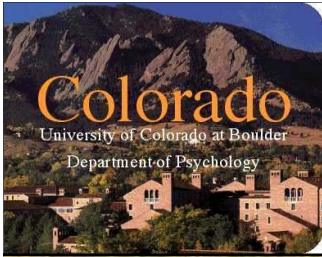
Conclusions

Handled objects evoke spatially determined action representations that affect reach and grasp responses cued by color.

The time course of interference effects indicates that competition evolves after the onset of the object.

Is the action representation evoked before the color cue signals the response hand?

Further work using LRP's should provide a definite answer.



Thank you from me!



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James S. McDonnell Foundation





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And thank you from him!



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