The 26th Kanizsa Lecture

Perception and Past Experience 50 Years After Kanizsa's (Im)possible Experiment

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Giornale italiano di psicologia

Rivista trimestrale

Presentazione Informazioni Indicizzazione e valutazione

Da oltre quarant'anni, il *Giornale italiano di psicologia*, diffondendo la migliore ricerca psicologica svolta in Italia, si qualifica come la più autorevole rivista italiana di psicologia. La rivista presenta contributi originali di ricerca, rassegne, interventi, articoli bersaglio e approfondimenti nei vari settori e fornisce un quadro aggiornato ed esaustivo dello stato della disciplina in Italia e all'estero. Essa informa in modo critico anche i lettori non specialisti sulle più recenti tendenze e offre una sede di dibattito su diversi aspetti della psicologia: i fondamenti teorici, i rapporti con le discipline limitrofe, la politica della ricerca, la ricerca come progettazione e verifica di interventi sociali, le istituzioni formative, i ruoli e i profili professionali.

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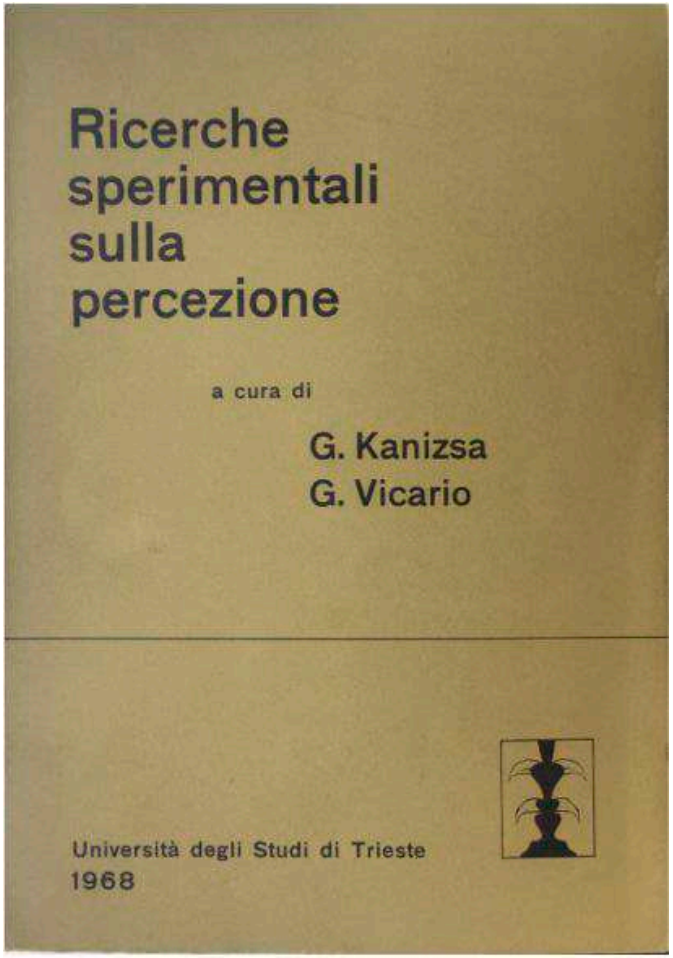
  trimestrale

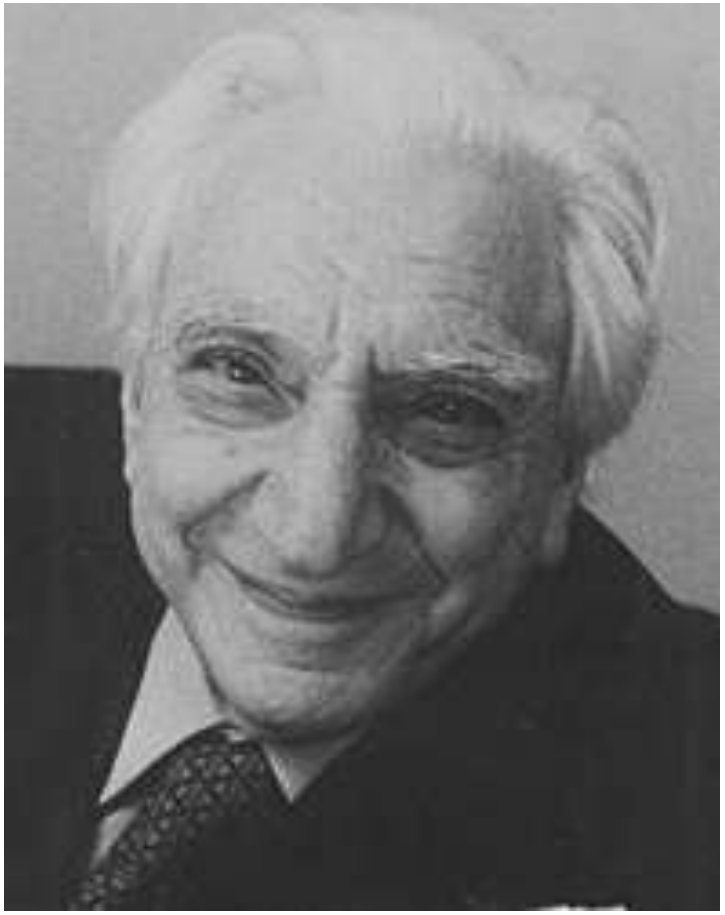
1968



- a volume to celebrate Musatti's 70th birthday
- Kanizsa's opening paper: *Percezione attuale, esperienza passata e l'«esperimento impossibile»*
- a reply to Musatti

Musatti 1958/1964

[*Structure and experience in perceptual phenomenology*]



Cesare L. Musatti 1897-1989

- a crucial experiment proving that perception depends on structural factors rather than past experience – or vice versa – does not exist
- this is an impossible experiment

Musatti 1964

[prefazione a *Condizioni dell'esperienza e fondazione della psicologia*]

"… prendendo lo spunto dagli esperimenti di Ames, e dalla polemica da essi suscitata fra psicologi della Gestalt e psicologi transazionalisti, ho sostenuto che tale polemica è priva di senso, perché l'esperimento cruciale che dovrebbe decidere tra una e l'altra tesi è un esperimento impossibile.

Ho così ripreso in certo modo la tesi già sostenuta nei confronti della *Gestaltpsychologie* in *Forma e assimilazione*, per ciò che riguarda la impossibilità di isolare in modo assoluto l'azione dei fattori naturali di strutturazione percettiva dai fattori empirici o assimilativi."

the context

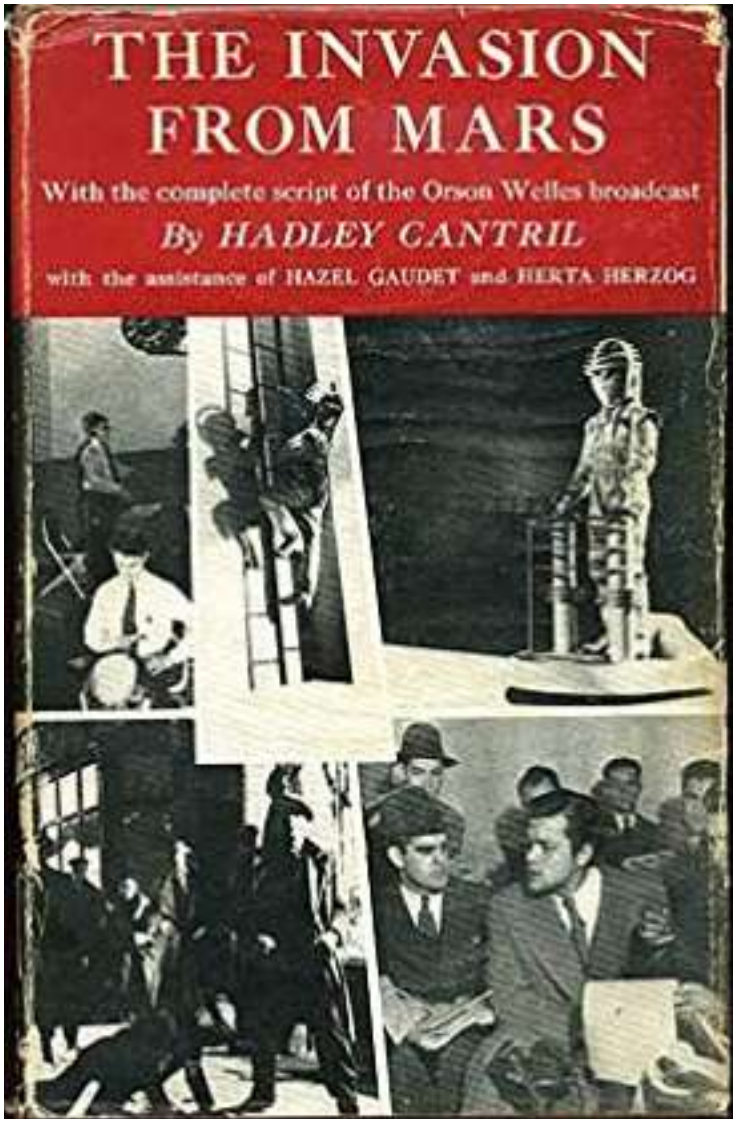
Ames demonstrations in *Gateways to the mind* (1958)

www.youtube.com/watch?v=9AAdjpGer7k

Hadley Cantril (1906-1969)

- *They saw a game* (Hastorf & Cantril 1954)

Orson Welles in *The War of the Worlds* (1938)



I edizione (1940)

esperienza passata

- plausibile per spiegare l'oscillazione della finestra (in modo che a trovarsi vicino all'osservatore sia sempre il lato verticale lungo)
- implausibile se si bada al modo in cui la barra rotante "attraversa" la finestra oscillante
- ma l'ideologia empirista prevale

Musatti's argument

- bias toward rectangularity: compatible with both maximal homogeneity and past experience
- a crucial experiment is impossible because highly regular (maximally homogeneous) forms are familiar
- and familiar forms are – to some extent – regular
- matter of opinion, not science

Kanizsa 1968

Gaetano Kanizsa 1913-1993

- logical counterarguments
- but mainly demos
- valid experiments are possible (though never crucial)
- when opposed, autochthonous factors overcome past experience

when?

- Kanizsa recognized obvious effects of memory (sense of familiarity, meaning)
- and focused on object formation, shape, color, size, motion
- to show that they do not depend on past experience

underlying theory

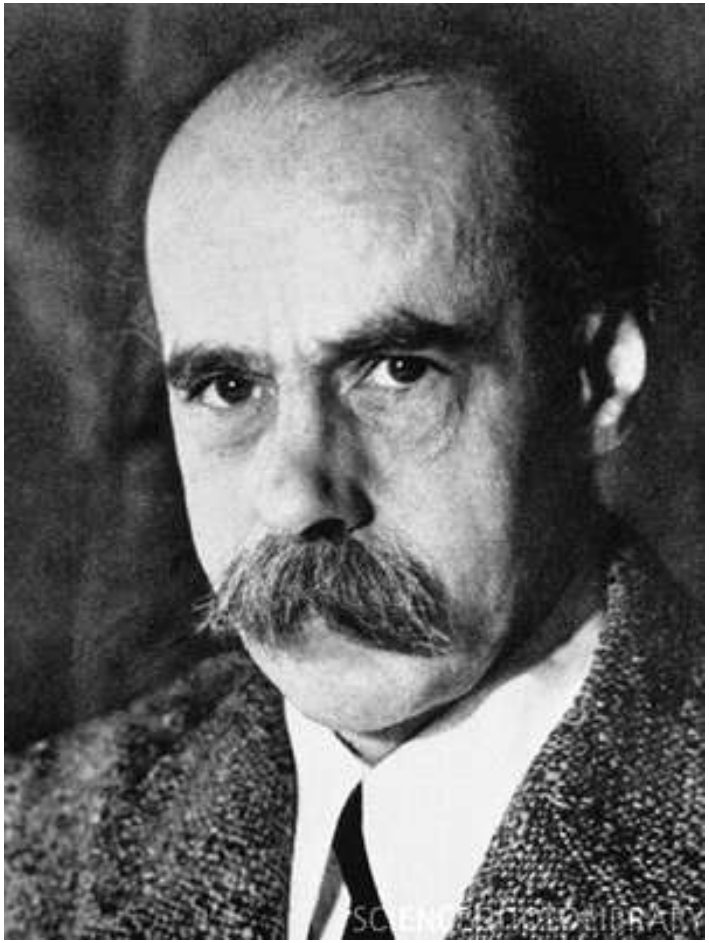
- *a Gestaltist visual system that focuses on internal efficiency seems to yield external veridicality as a side-effect* (Wagemans, Feldman, Gepshtein, Kimchi, Pomerantz, van der Helm, & van Leeuwen 2012)
- mostly but not always
- Kanizsa looked for instances of non-veridical perception; or better, against likelihood

object formation

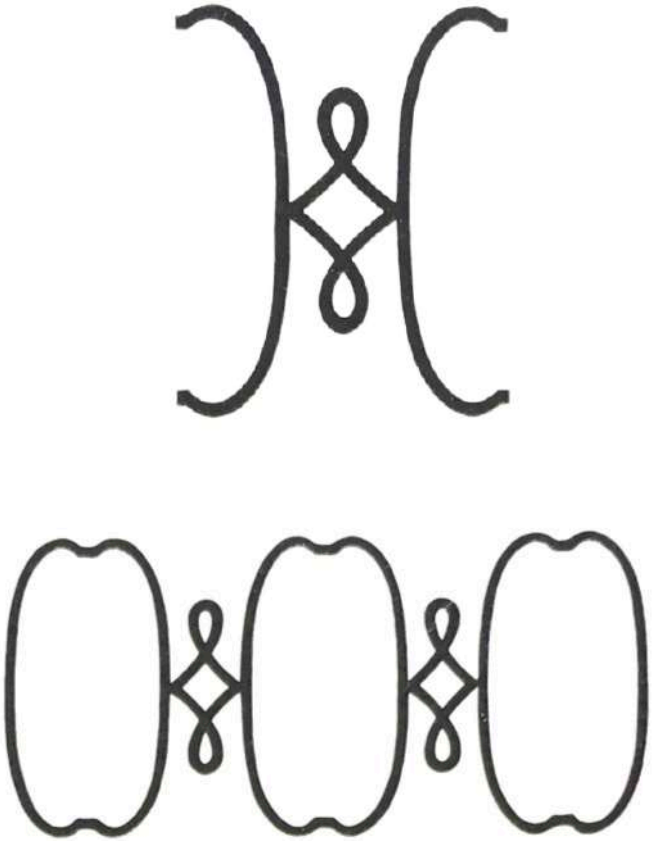
(and masking)

camouflage by mirroring

(Wertheimer 1923)

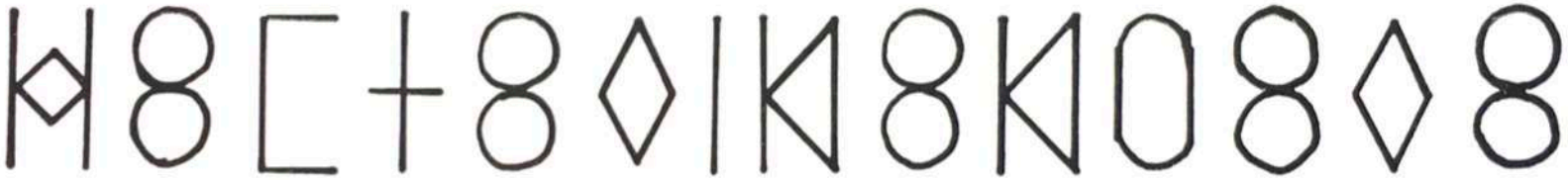


Max Wertheimer (1880-1943)



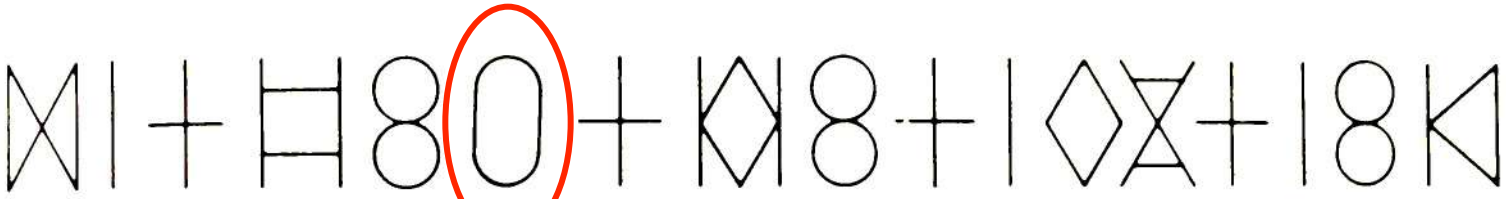
camouflage by mirroring

(following Wertheimer 1923)



camouflage by mirroring

(following Wertheimer 1923)



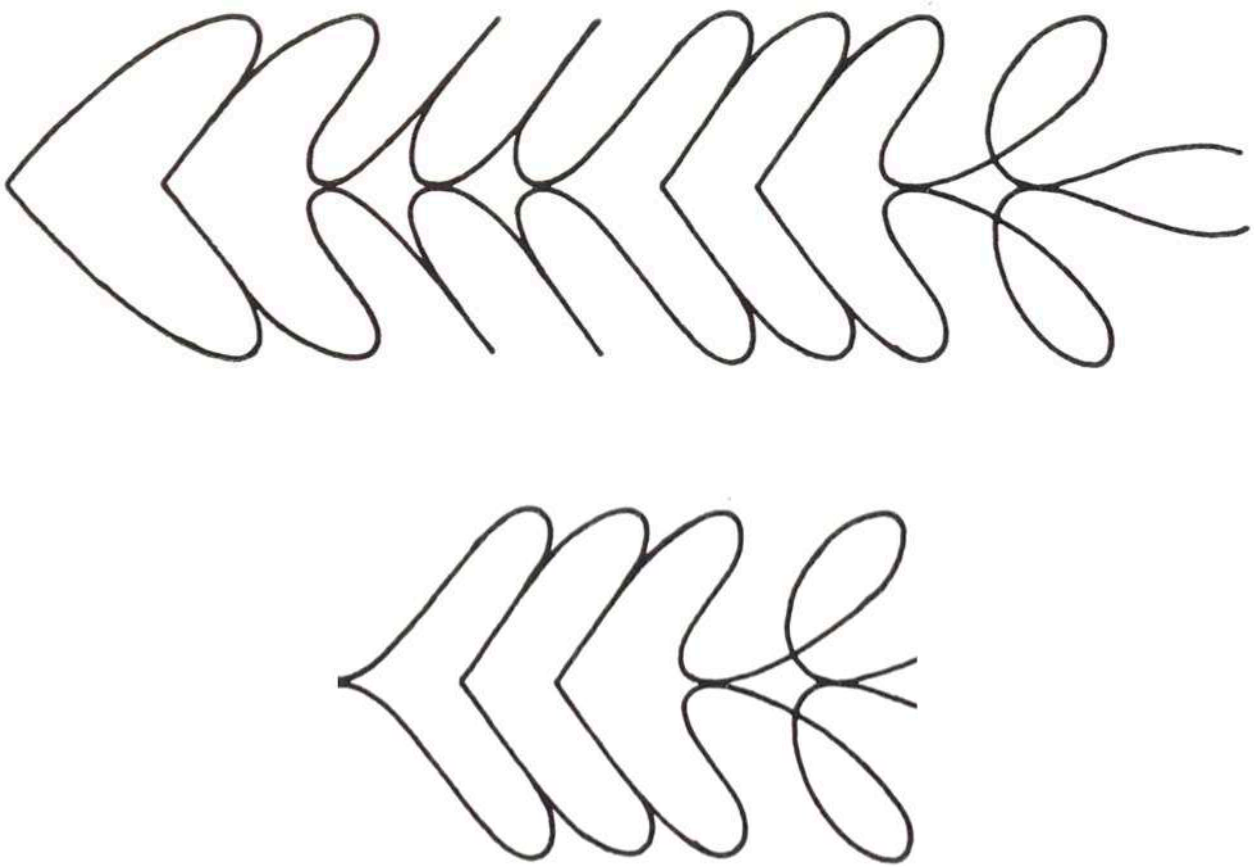
- past experience against itself?

7.5%

2.8%

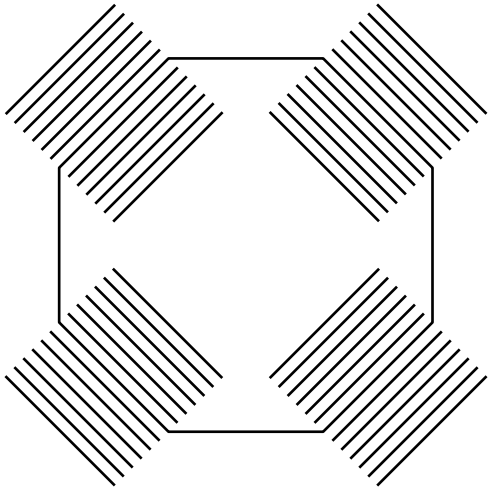
camouflage by mirroring

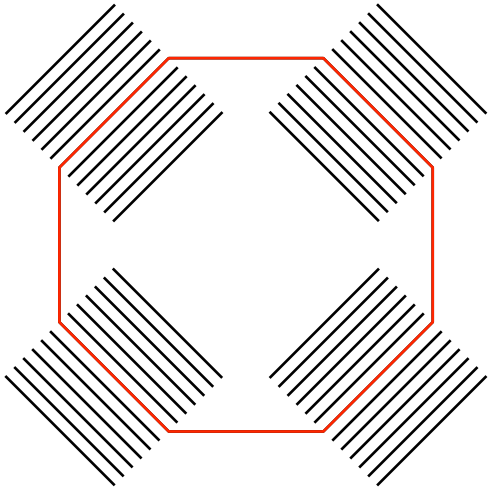
(following Wertheimer 1923)



camouflage by contour embedding

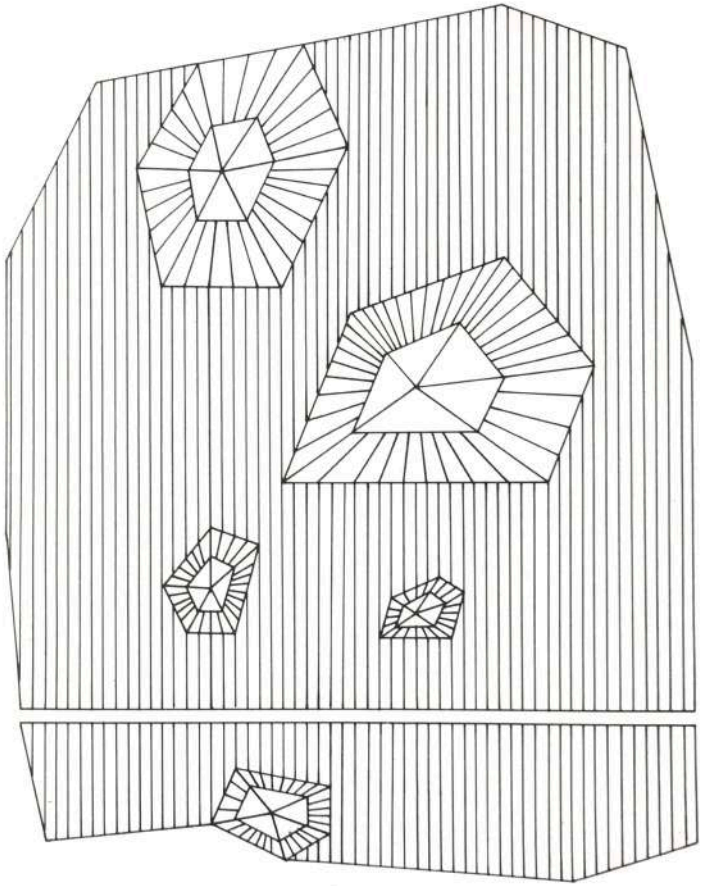
(Galli & Zama 1931)

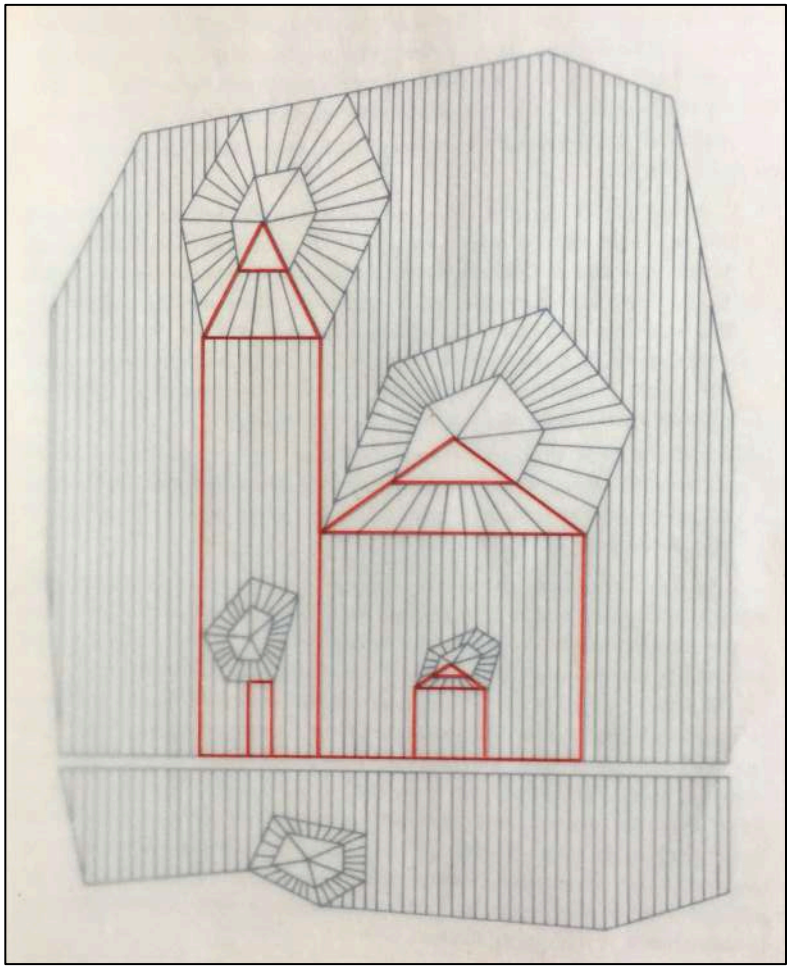




- embedding squares are familiar (like the embedded octagon)
- hence, Kanizsa asked whether a “perceptually ordered” (though not symmetric) unfamiliar context can absorbe a familiar object

yes





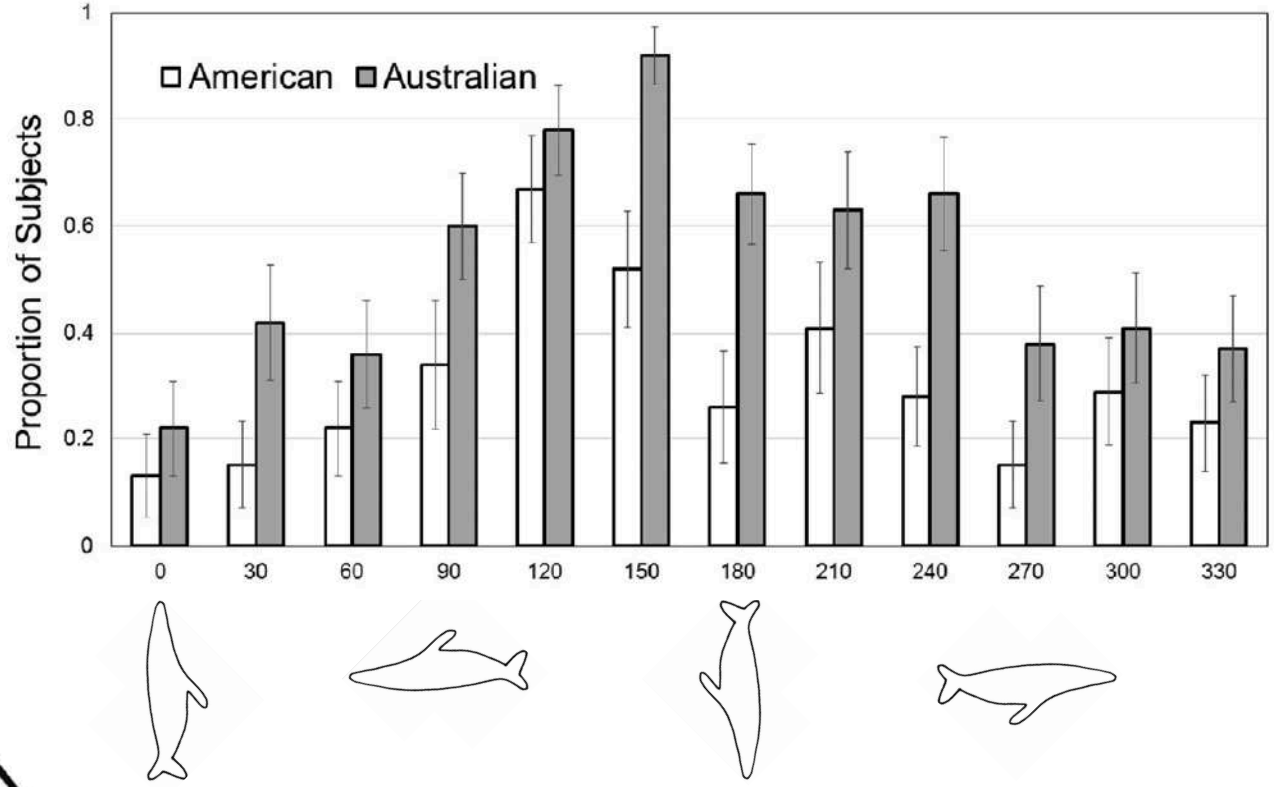
two types of camouflage

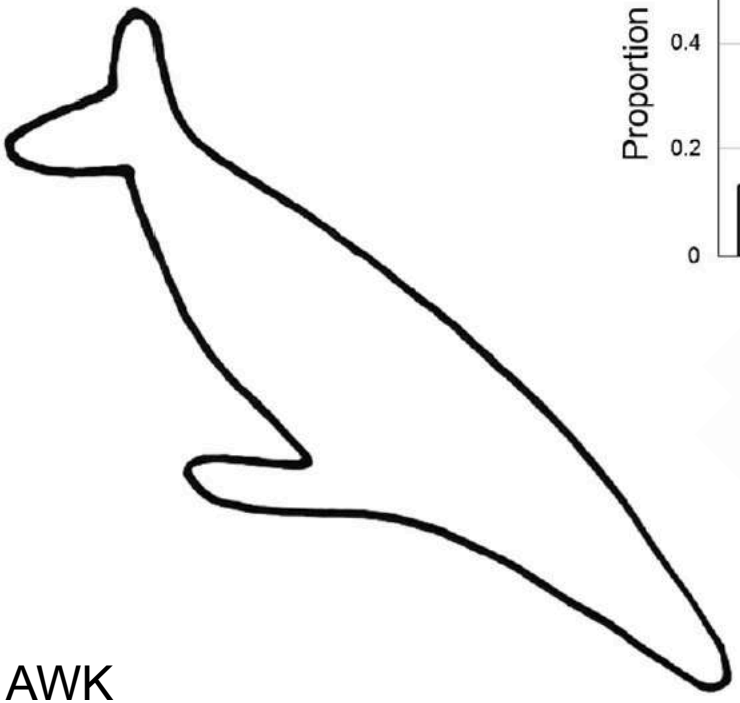
(Kanizsa & Vicario 1982)

- by organization, in ambiguous patterns (sensitive to memory)
- by textural absorption, with target revealed only by scrutiny or coloring (insensitive to memory)
- past experience matters in the first, not in the second

discovery by experience

(Kihlstrom, Peterson, McConkey, Cranney, Glisky & Rose 2018)





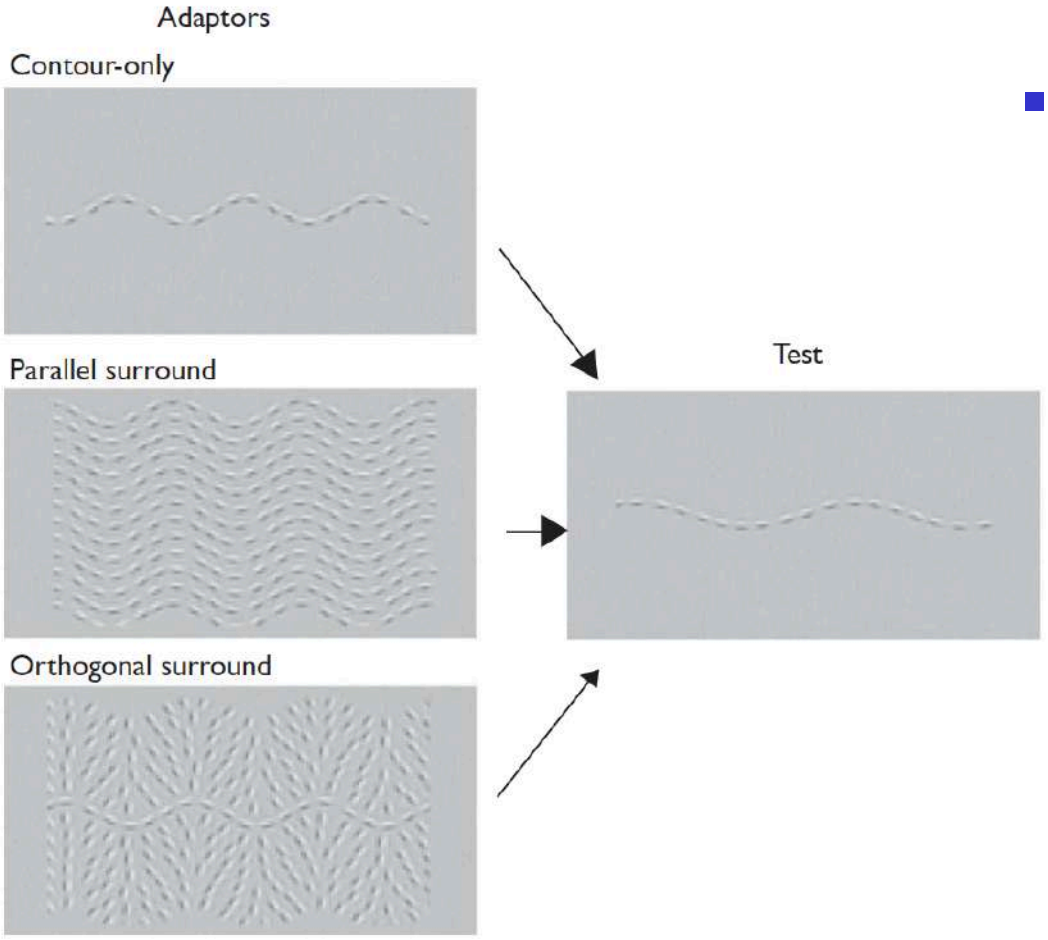
AWK
the Arizona whale-kangaroo

- 54% Australians (N= 1099) vs.
  31% Americans (N= 944)
  saw also the kangaroo

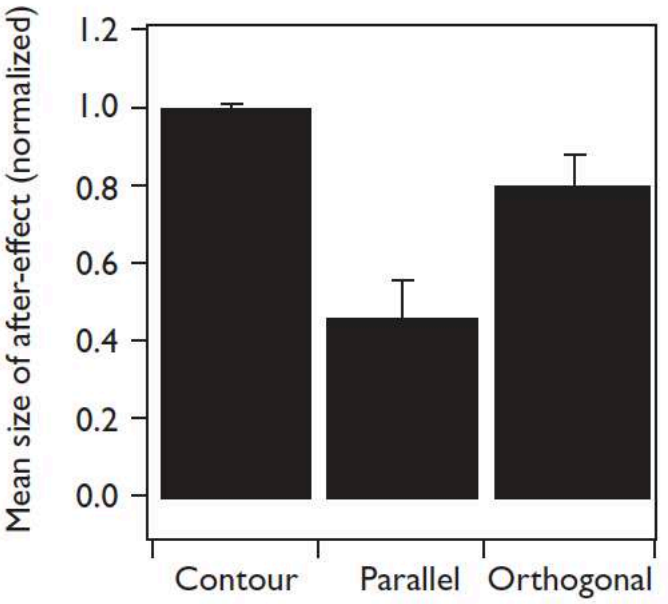
TSSCS

(Kingdom & Prins 2009; Gheorghiu & Kingdom 2017)

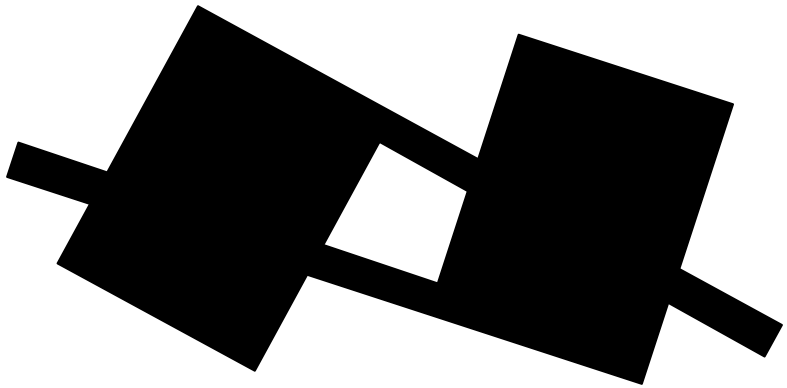
- texture-surround suppression of contour-shape



- mediated by neurons with ERFs (extra classical receptive fields)

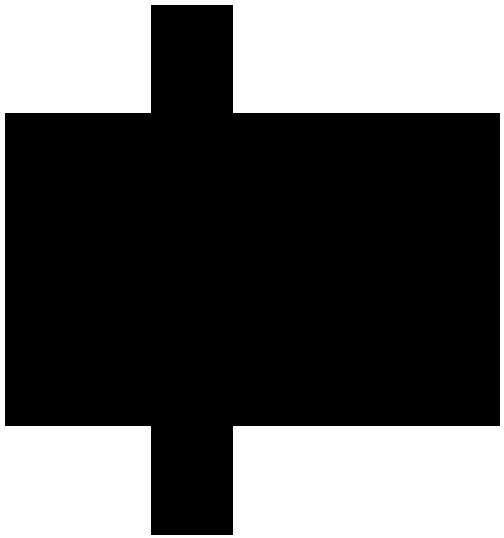


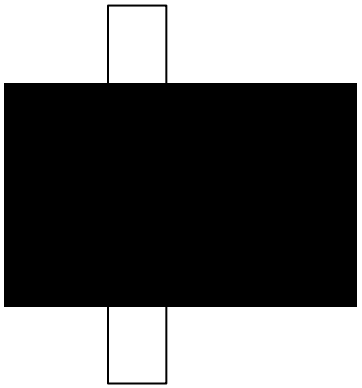
depth order

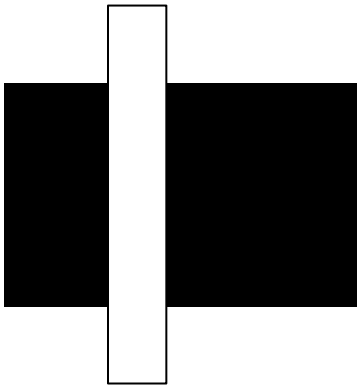


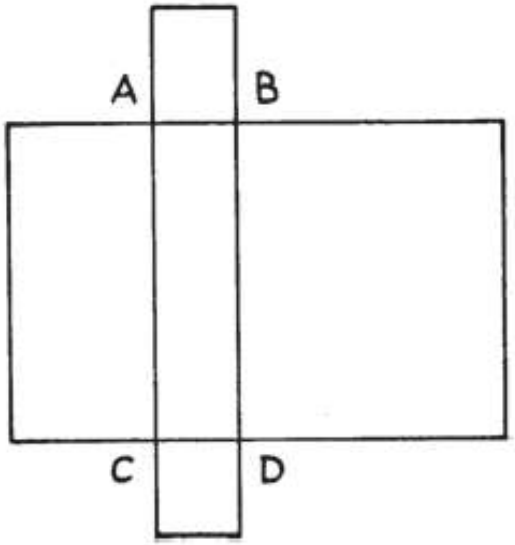
Petter's rule

(from Petter 1956)









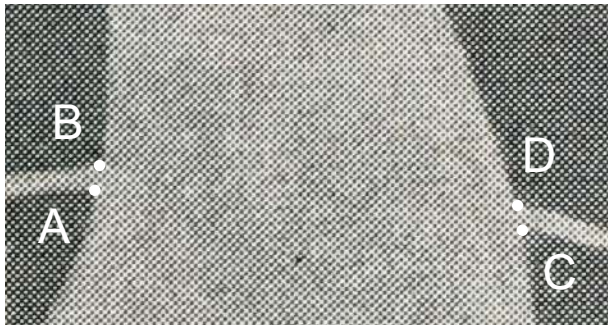
(AB+CD) < (AC+BD)

paradoxical Petter's effect

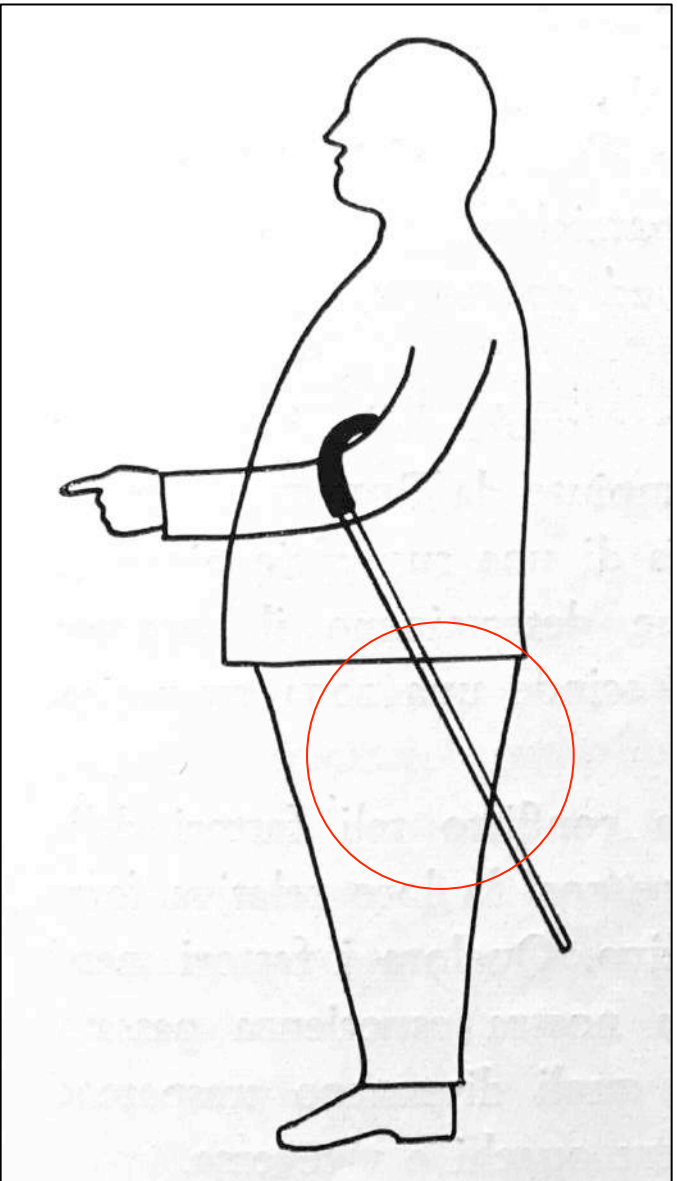
(from Petter 1956)

- fishing pole behind sail, against expectations

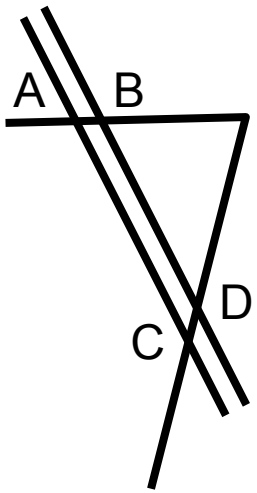
- different costs of modal vs. amodal completions



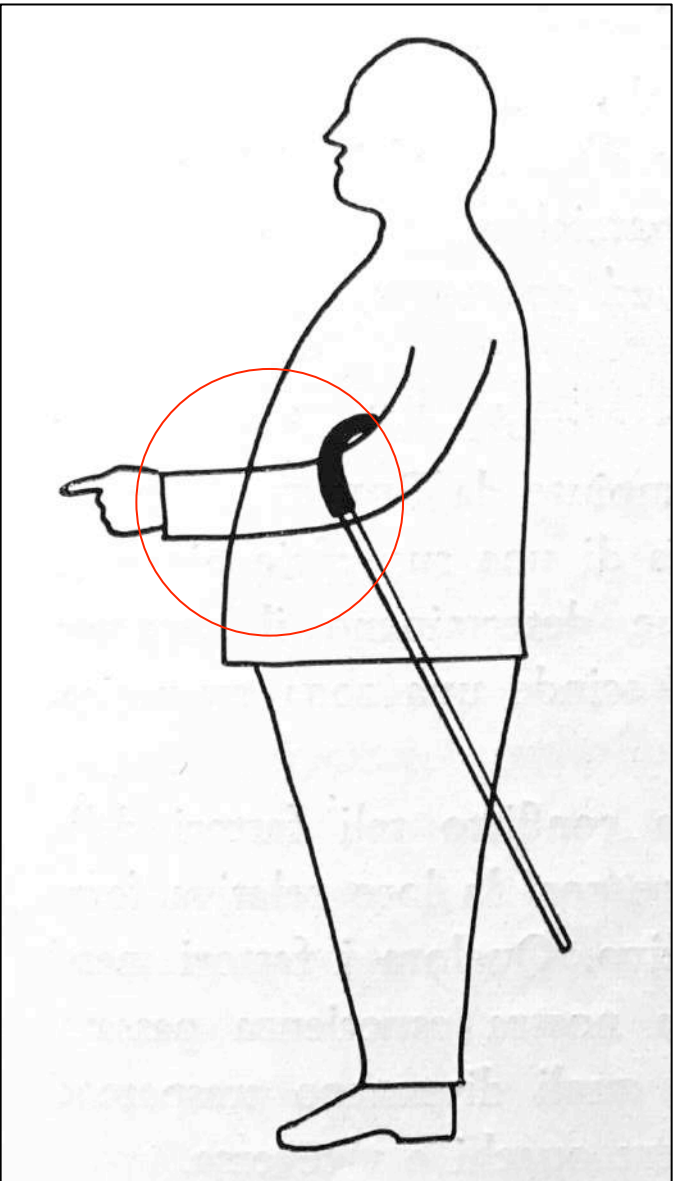
outline man with a stick



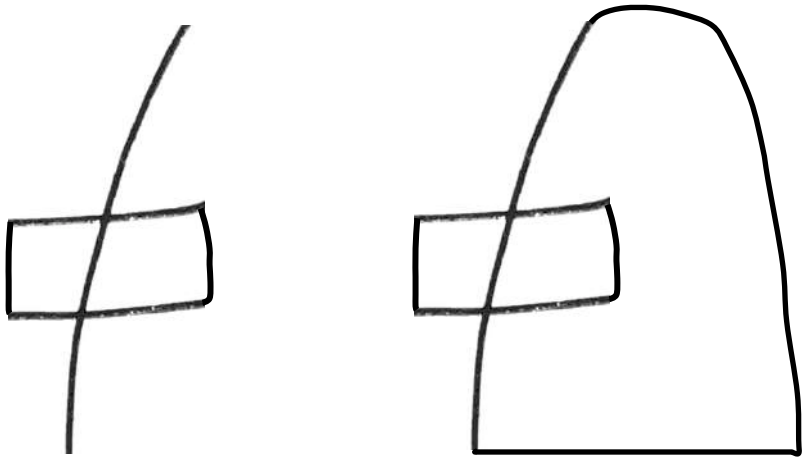
- no modal/amodal completions
- thick in front, thin behind
- depth order correlated with unification by proximity
- (AB+CD) < (AC+BD)



outline man with a stick



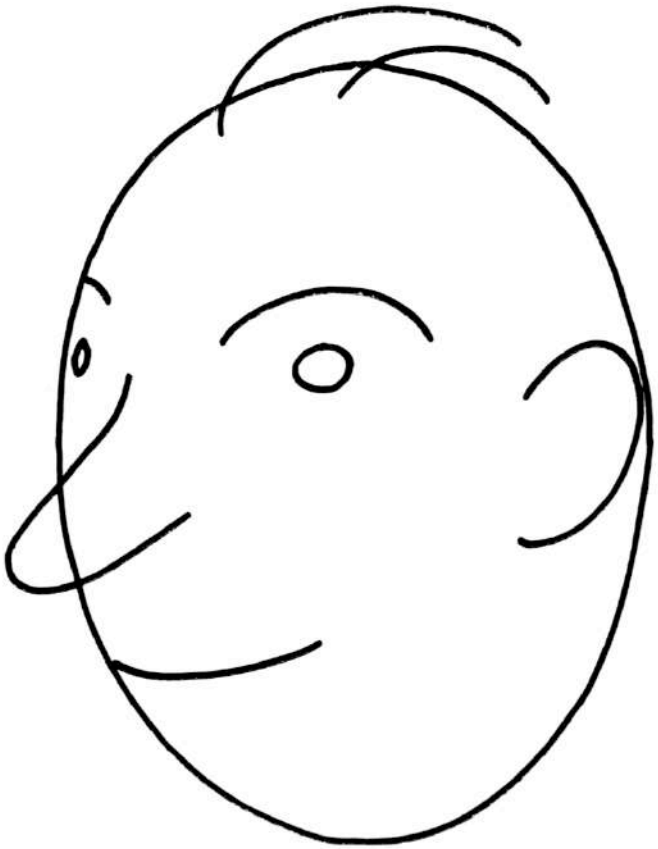
- arm behind, against past experience
- thick in front, thin behind?
- no in A, yes in B

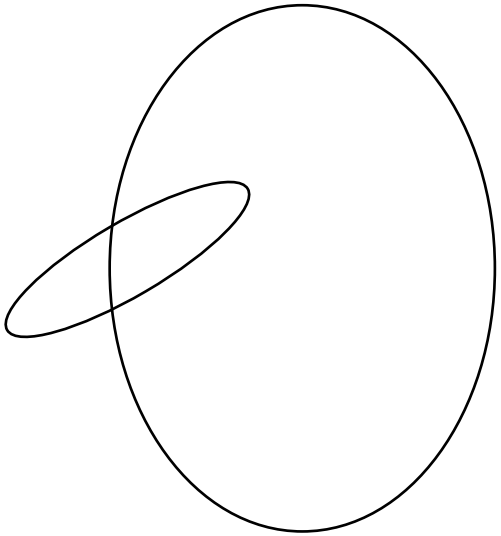


A B

outline head

- nose behind
- large in front, small behind





Petter's rule and relative size

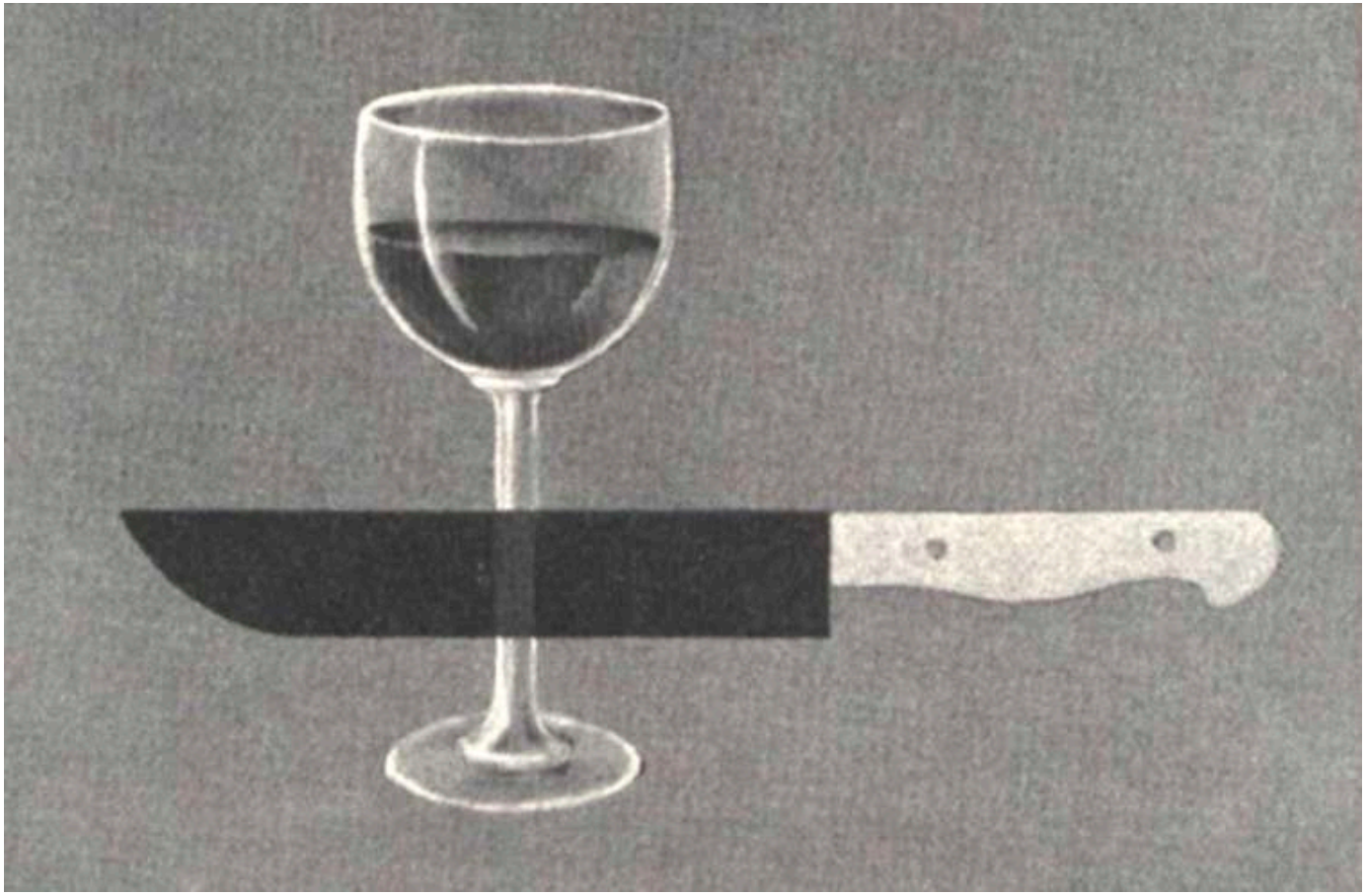
- in self-splitting figures depth depends on the length of modal/amodal completions, independent of global relative size (Tommasi, Bressan & Vallortigara 1995; Singh, Hoffman & Albert 1999)
- outline and transparent patterns differ from self-splitting patterns
- in outline patterns depth depends on relative size (Masin 2000)

relative size

- relative size is a geometric factor independent of / meaning/familiarity
- hence, paradoxical depth orderings can arise
- however, is relative size structural or empirical?

paradoxical transparency

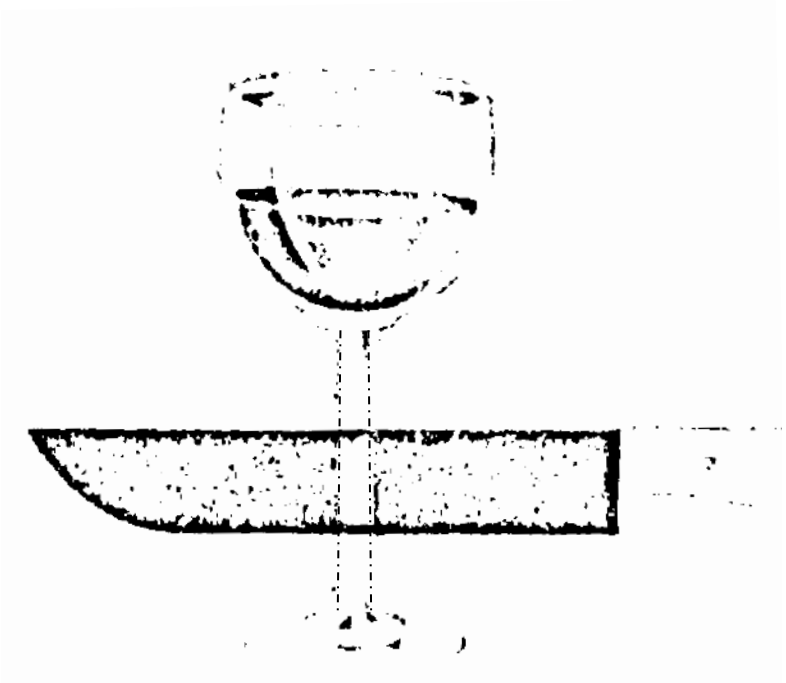
against past experience

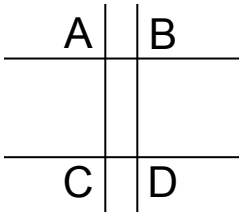


why “knife-in-front”

- two possible determinants
- relative size of objects (and contour lengths)
- intensity relationships (Metelli’s constraints)

knife/glass geometric constraint

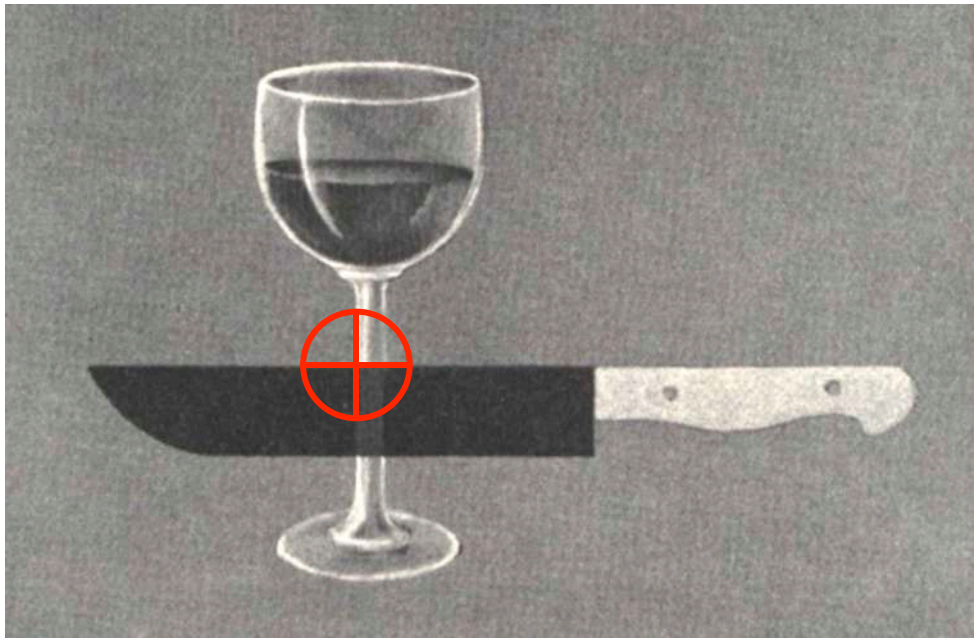




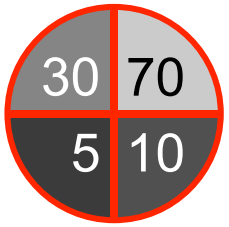
- thick in front, thin behind
- knife/glass length ratio= (AB+CD) / (AC+BD)
- negative log ratio (-0.48) ➔ knife in front

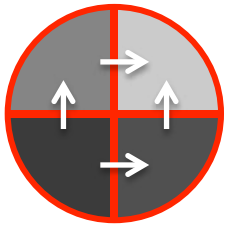
knife/glass photometric constraint

- double preserving X-junction
- consistent with a dark transparent knife (t = .13)



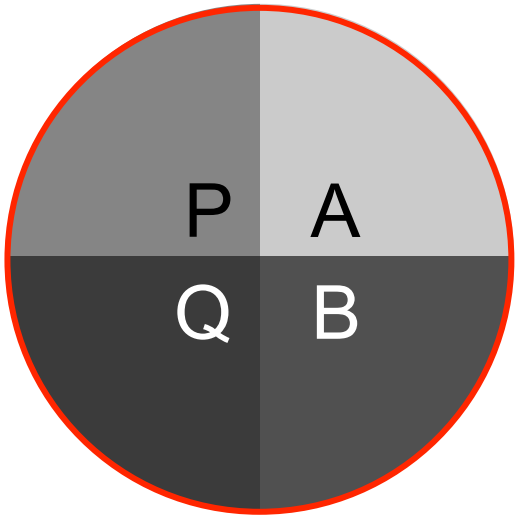
- inconsistent with a light transparent glass (t = 2.40)

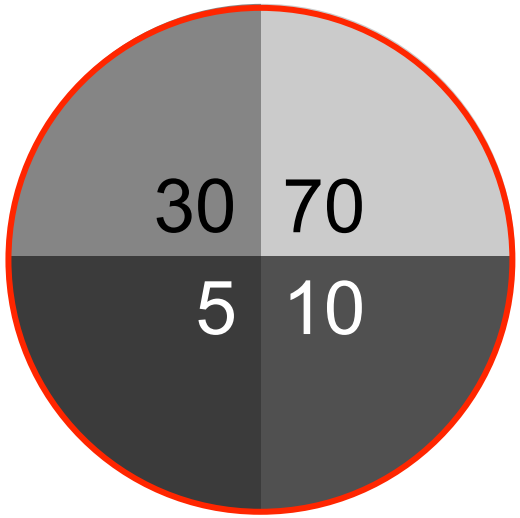


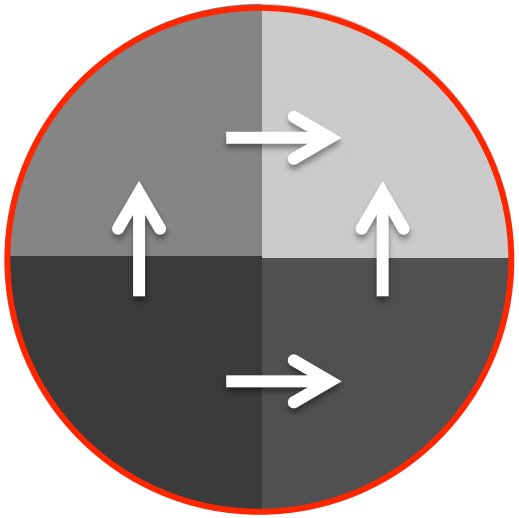


double preserving X-junction

- t_1 = (B-Q) / (A-P) = 0.125 “knife-in-front”
- t_2 = (A-B) / (P-Q) = 2.4 “glass-in-front”
- t_3 = (P-Q) / (A-B) = 0.417 “background-in-front”





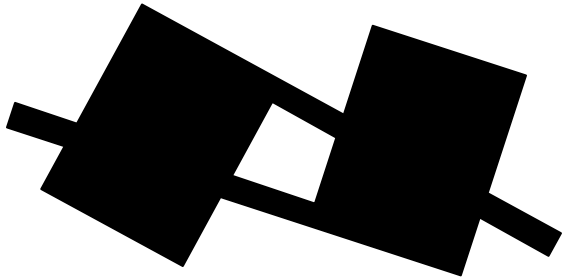


knife-in-front

- supported by geometric and photometric constraints
- relative length favors knife-in-front
- intensity relationships are compatible only with knife-in-front (not with glass-in-front)

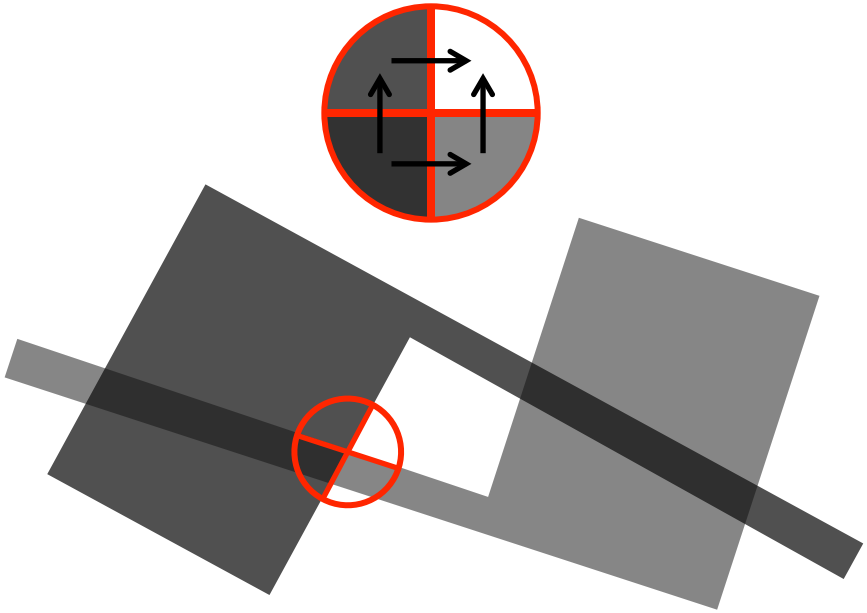
question

- what about depth order in transparency displays?
- does relative length matter when luminance ratios are ambiguous?
- and what happens when relative length and luminance ratios are in conflict?



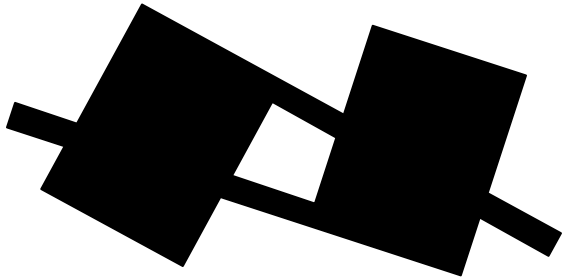
implicit X-junctions

intertwined flags
(according to Petter's rule
based on length ratios)



double preserving X-junctions

intertwined flags
(according to Petter's rule
based on length ratios)



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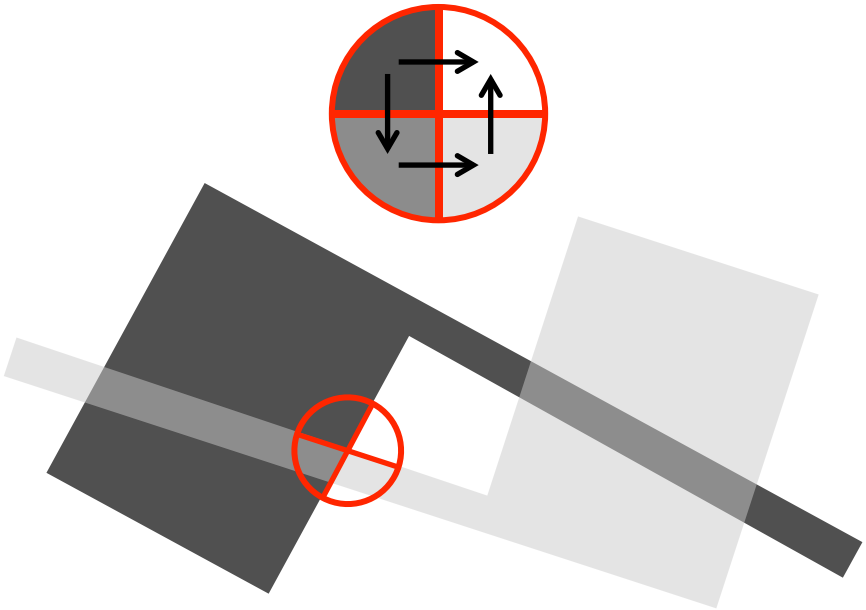


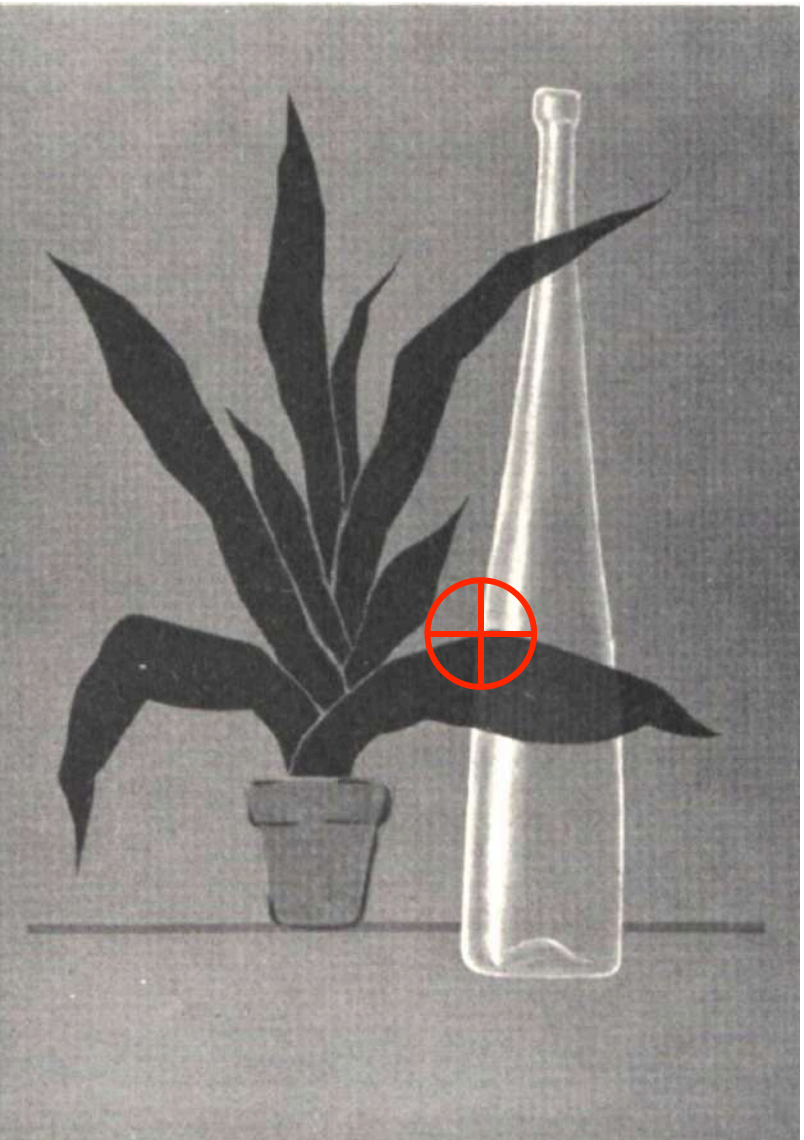
single preserving X-junctions

light flag in front
(according to luminance ratios)

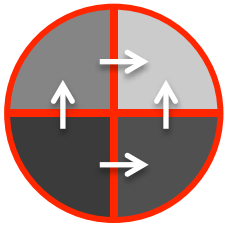
conclusion

- photometry prevails over geometry
  (at least here)

leaves-bottle demo



- two geometric factors favor bottle-in-front
- positive leaves/bottle log ratio (0.12)
- relative height
- photometry prevails over geometry (and past experience)



so what?

- relative size/lengths: representational economy (minimum extent) vs. observational history (statistics of retinal extents)
- luminance at X-junctions: representational economy (minimum contrast) vs. observational history (learned transformations)
- within an empiricist framework, the knife/glass demo shows that general perceptual heuristics prevail over specific object recognition

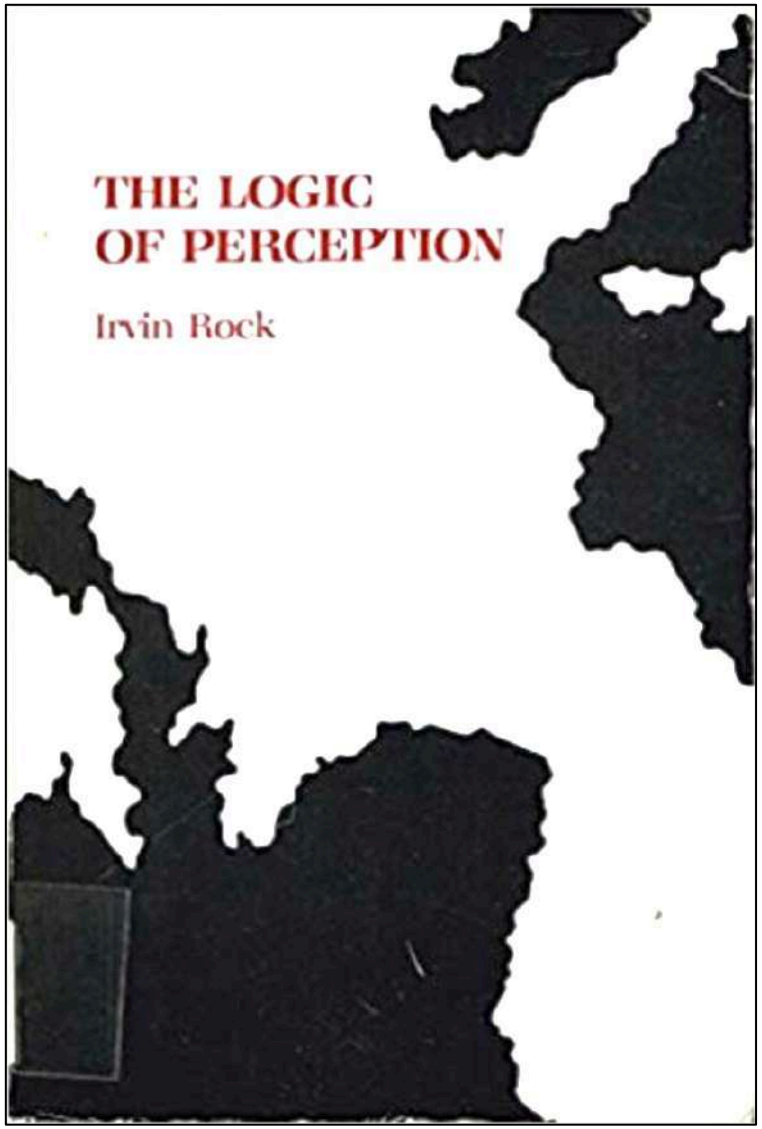
orientation and form

Europe

- inversion and non canonical lighting against shape familiarity

- orientation and lighting direction are usually conceived as empirical factors

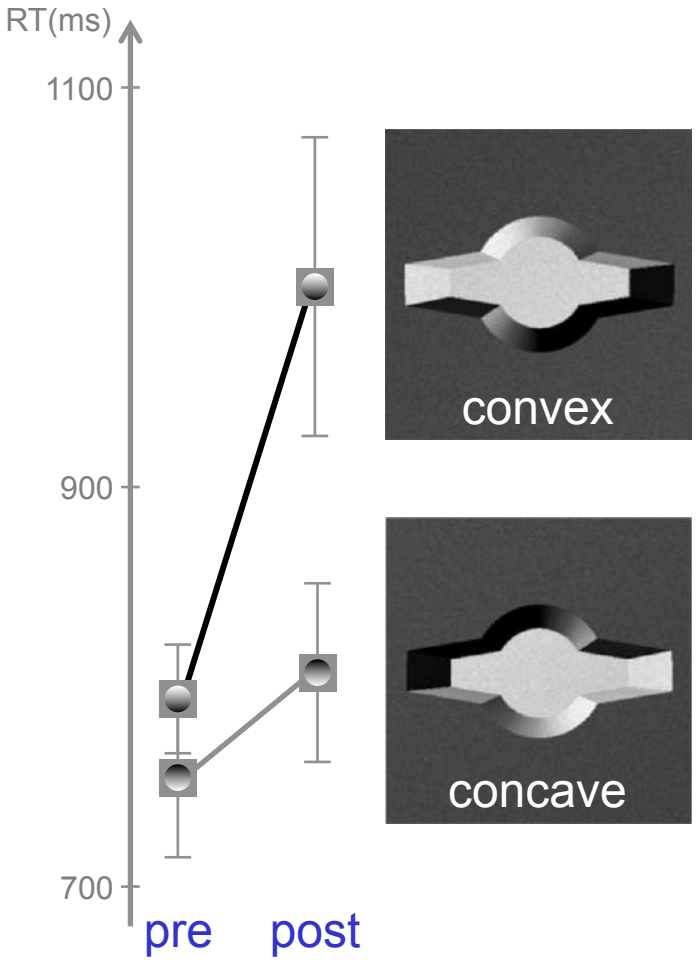
misoriented Europe

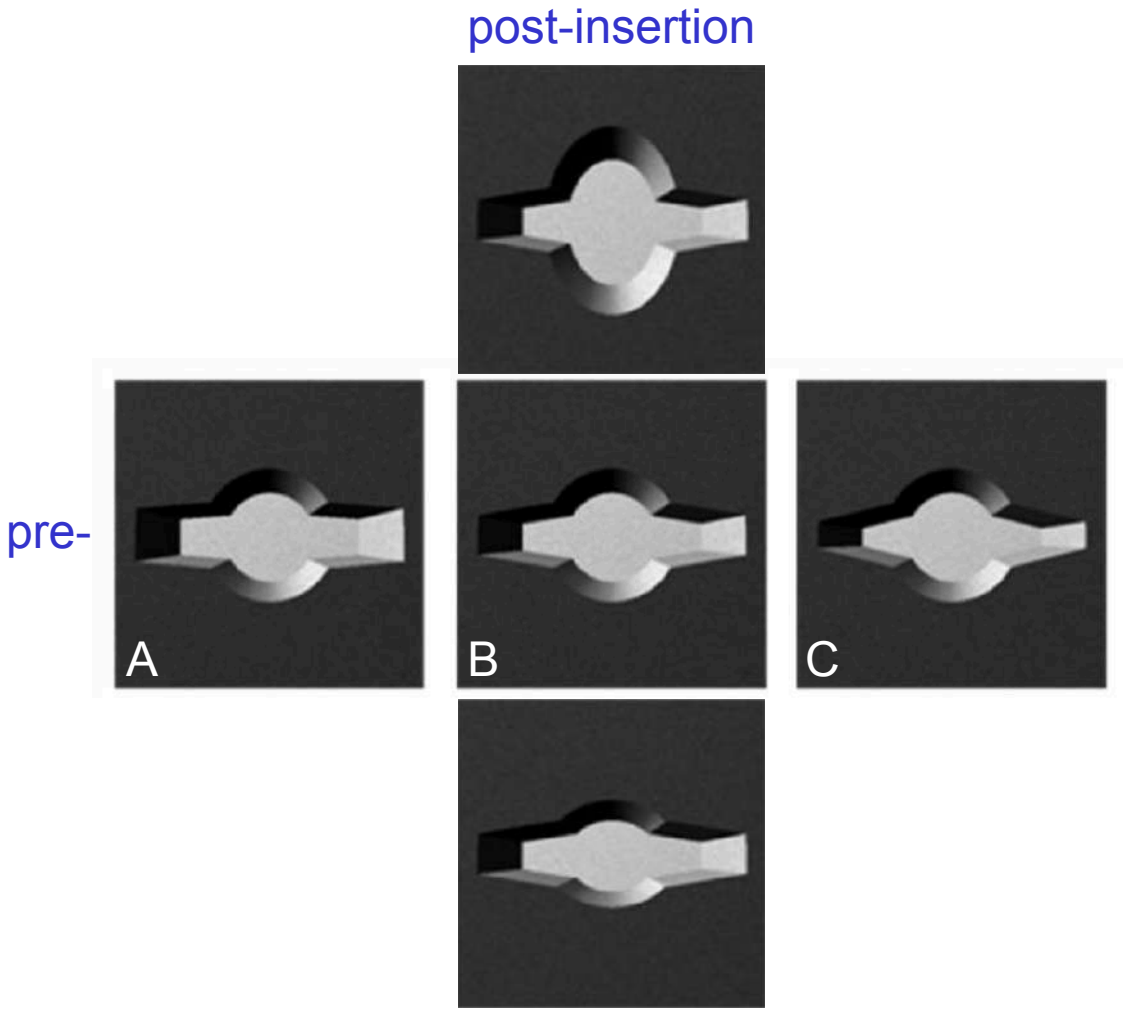


- unfamiliar orientation
- figural assignment according to minimum area

shading and recognition

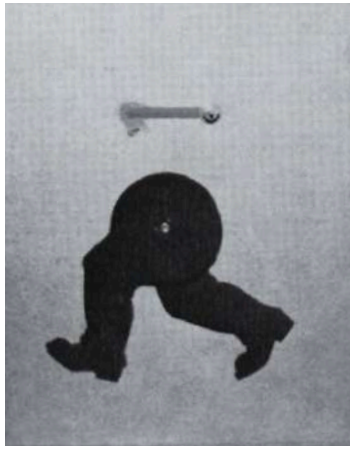
(Cate & Behrmann 2010)



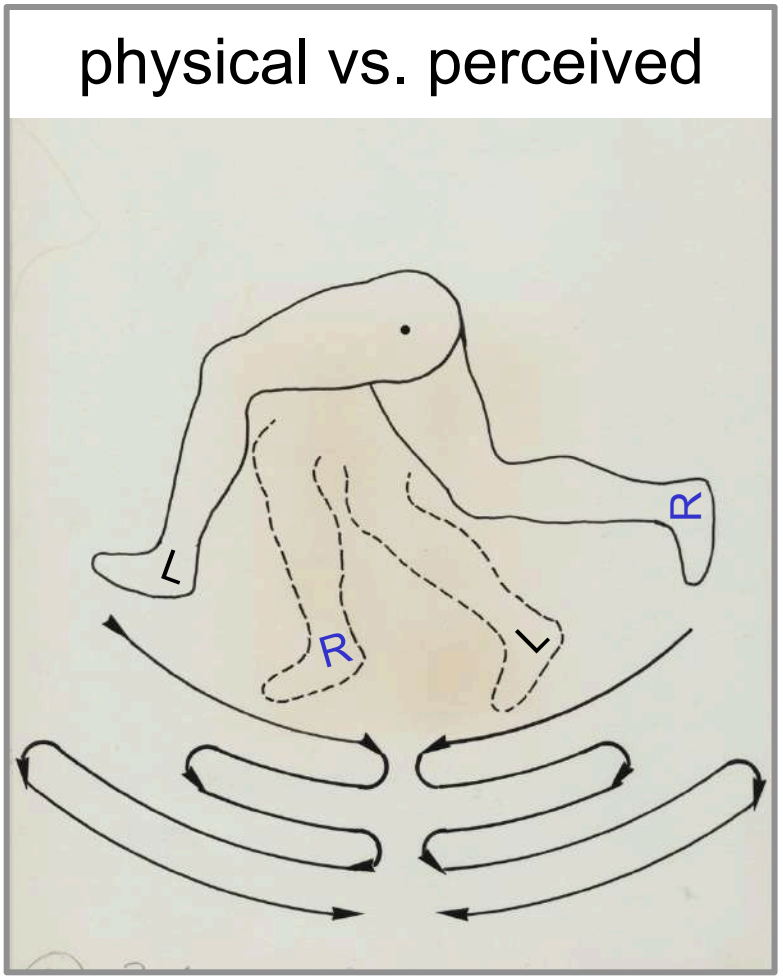


motion

the dancing little man



- funny hopping rather than familiar running



a robust effect

- leg bouncing resists ball transfer

the dancing ostrich

stream/bounce ambiguity

(Metzger 1934)

- prevalence of bouncing over streaming depends on several factors
- a pause at coincidence favors bouncing (Sekuler & Sekuler 1999)
- leg thickness may be responsible for bouncing prevalence

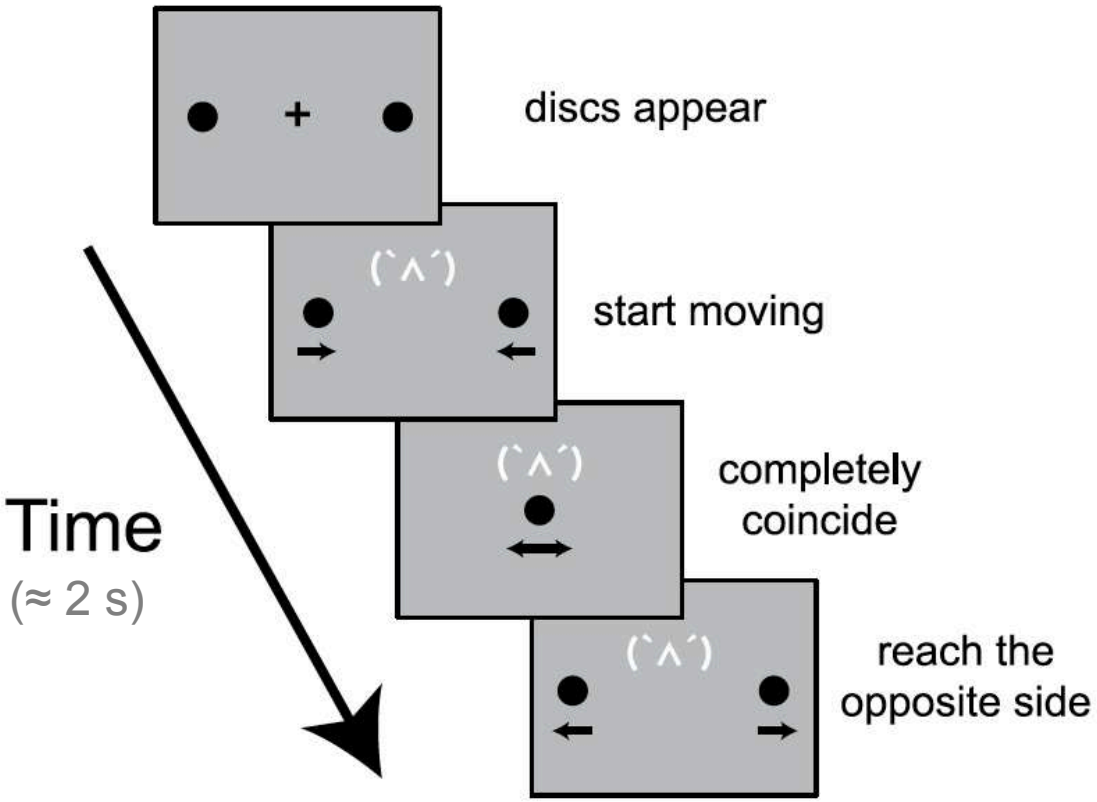
stream/bounce ambiguity

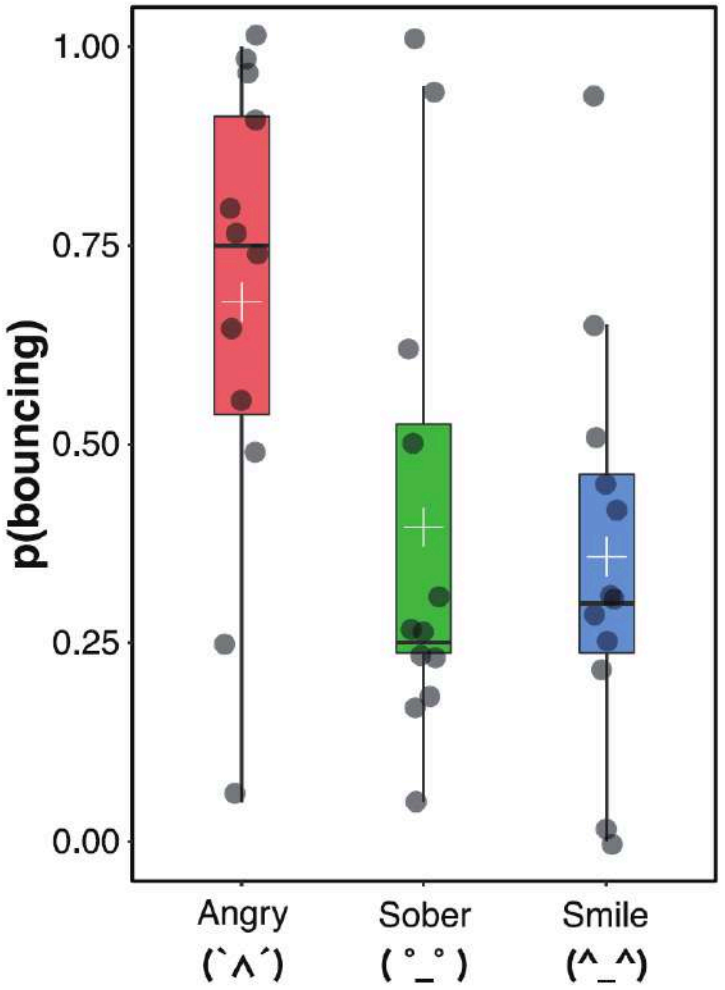
- oscillating sectors (see Quicktime movies)
- variable thickness (6, 12, 24 deg)
- compare the dominance of bouncing over streaming in the three conditions

emoticons affect bouncing

(Gobara, Yoshimura & Yamada 2018)

- priming, not attentional capture



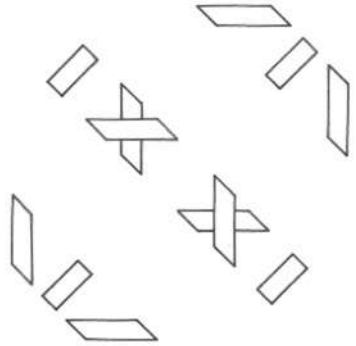


amodal completion and past experience

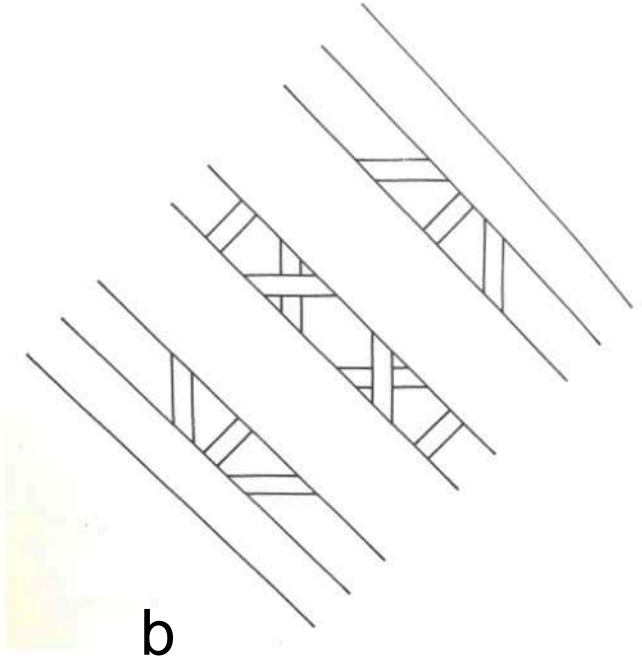
(the Bregman-Kanizsa effect)

Kanizsa 1979

Kanizsa 1979

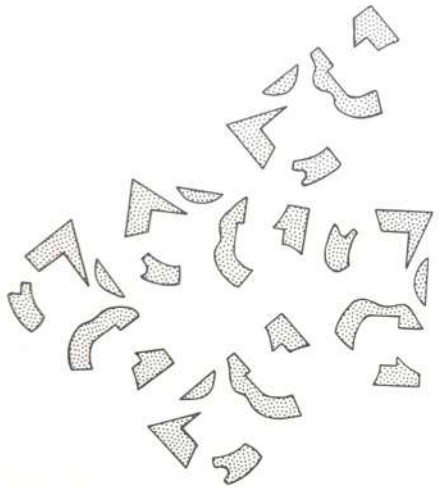


a

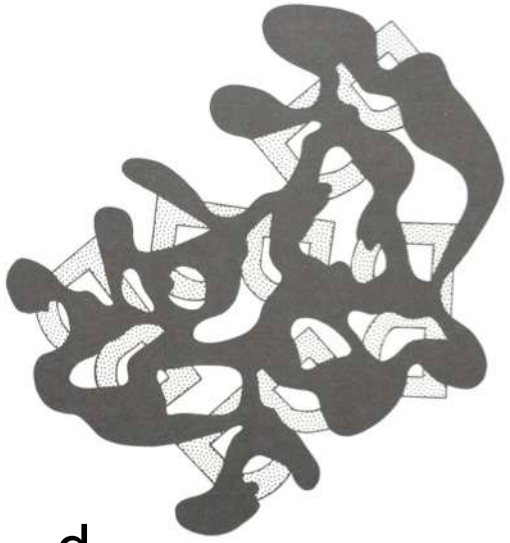


b

Bregman 1981

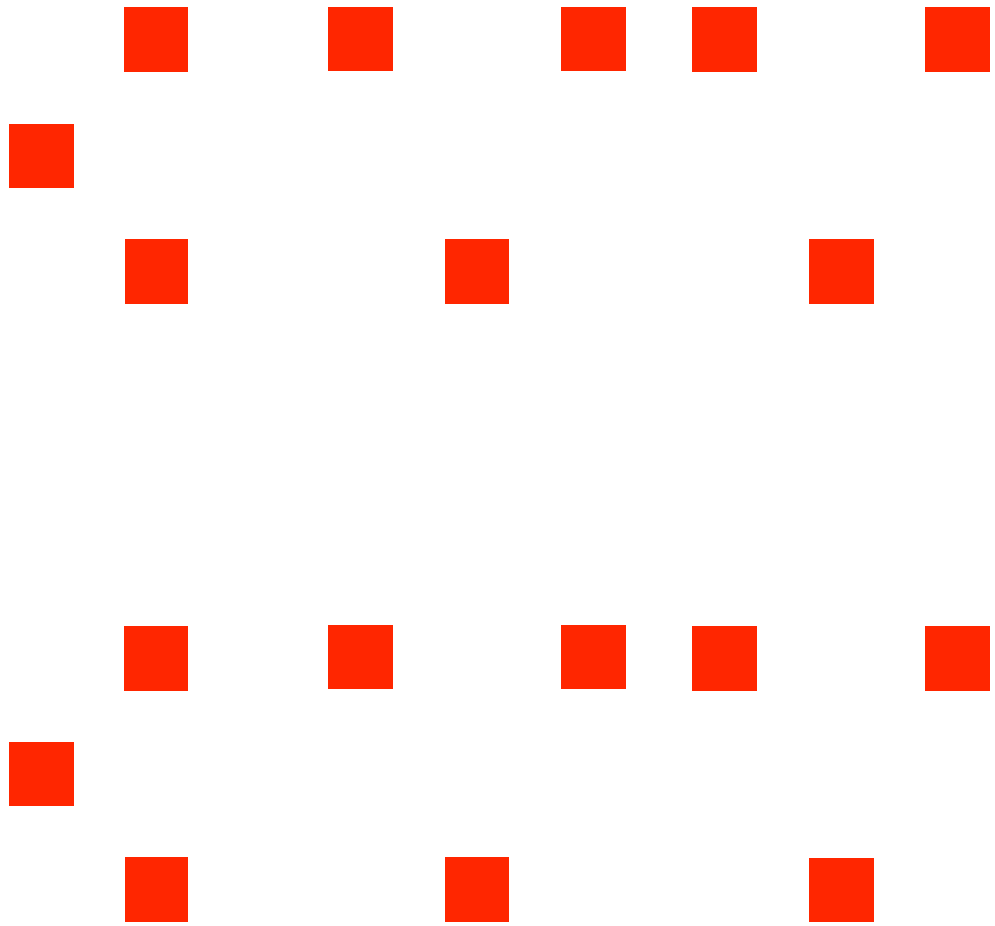


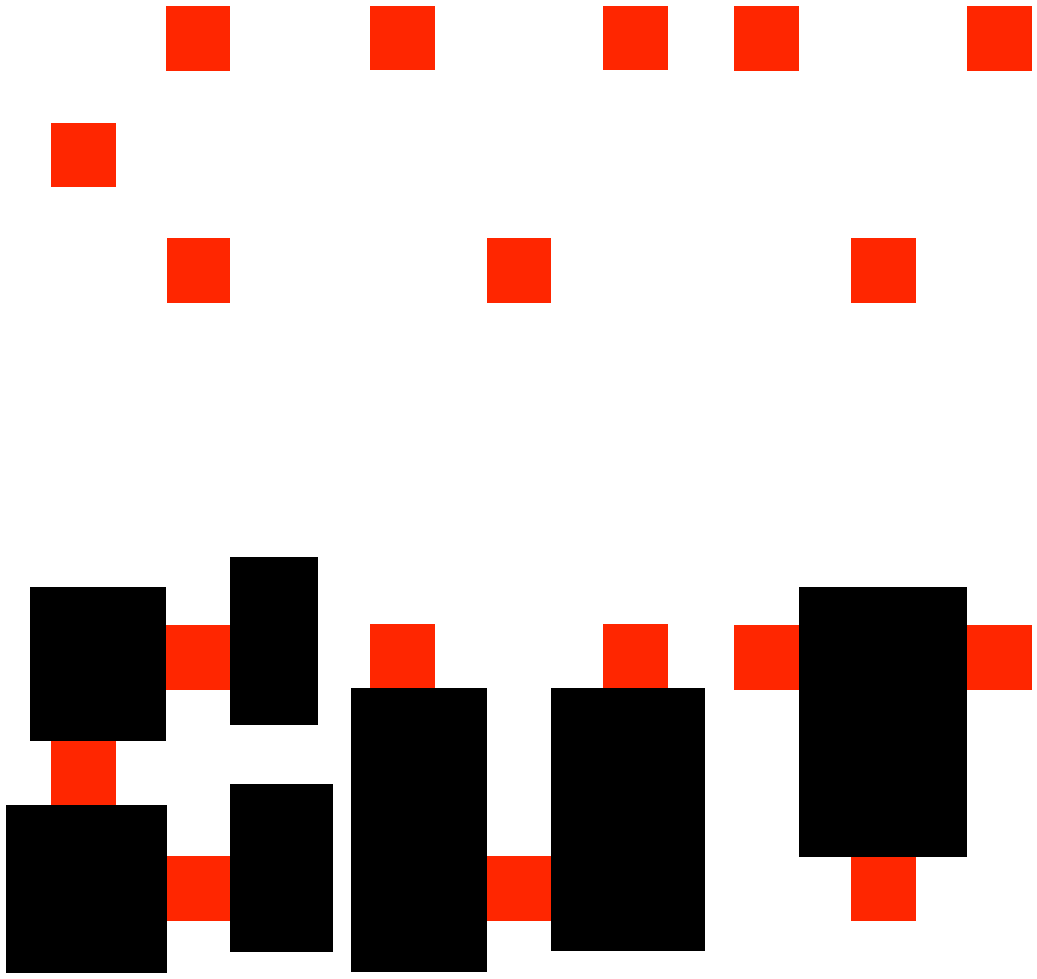
c

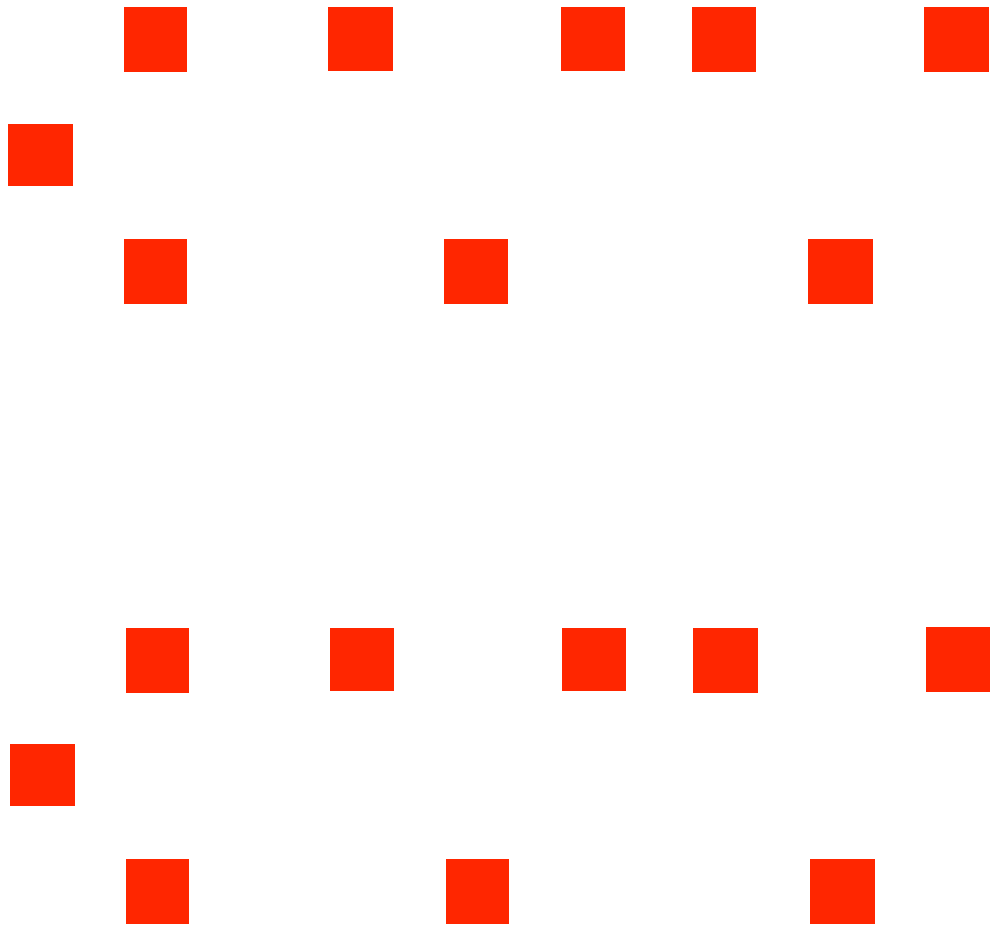


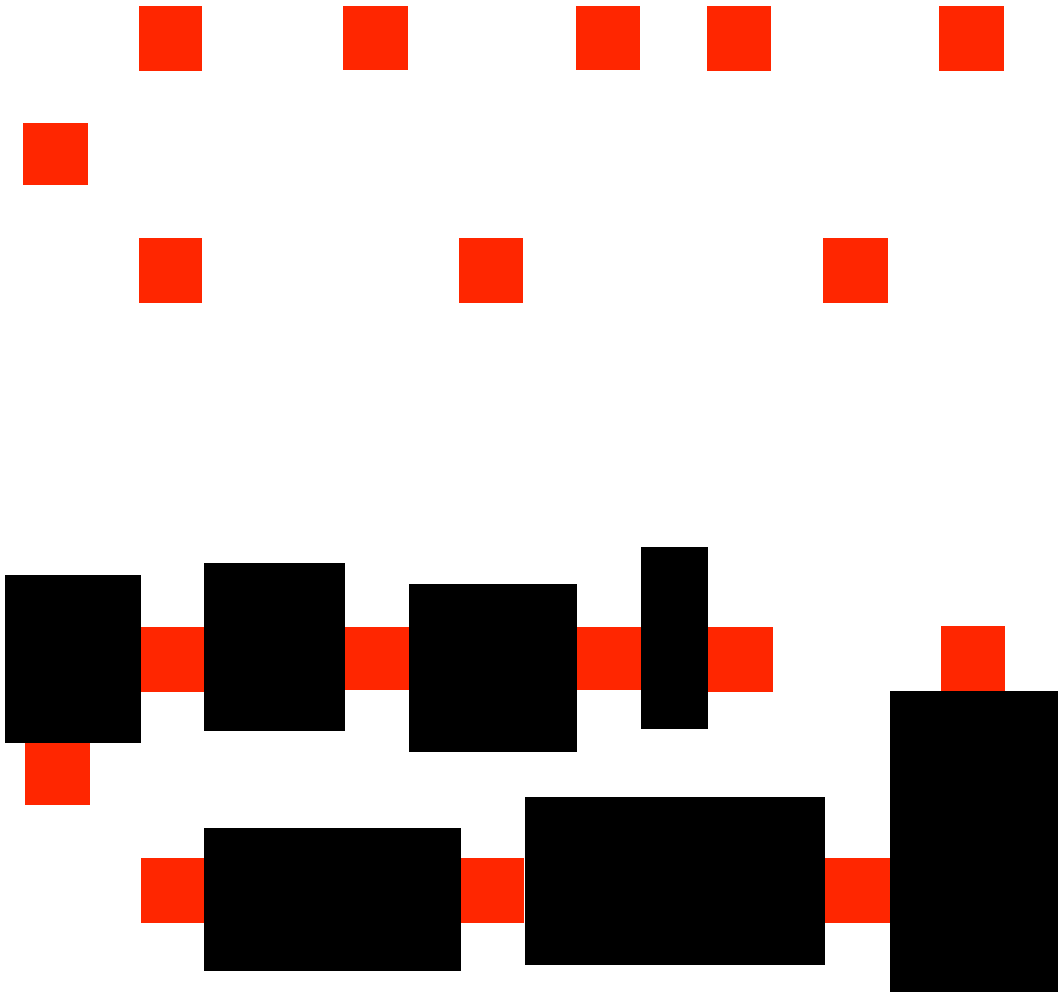
d

same pieces
different shapes
(from Kanizsa & Gerbino 1982)

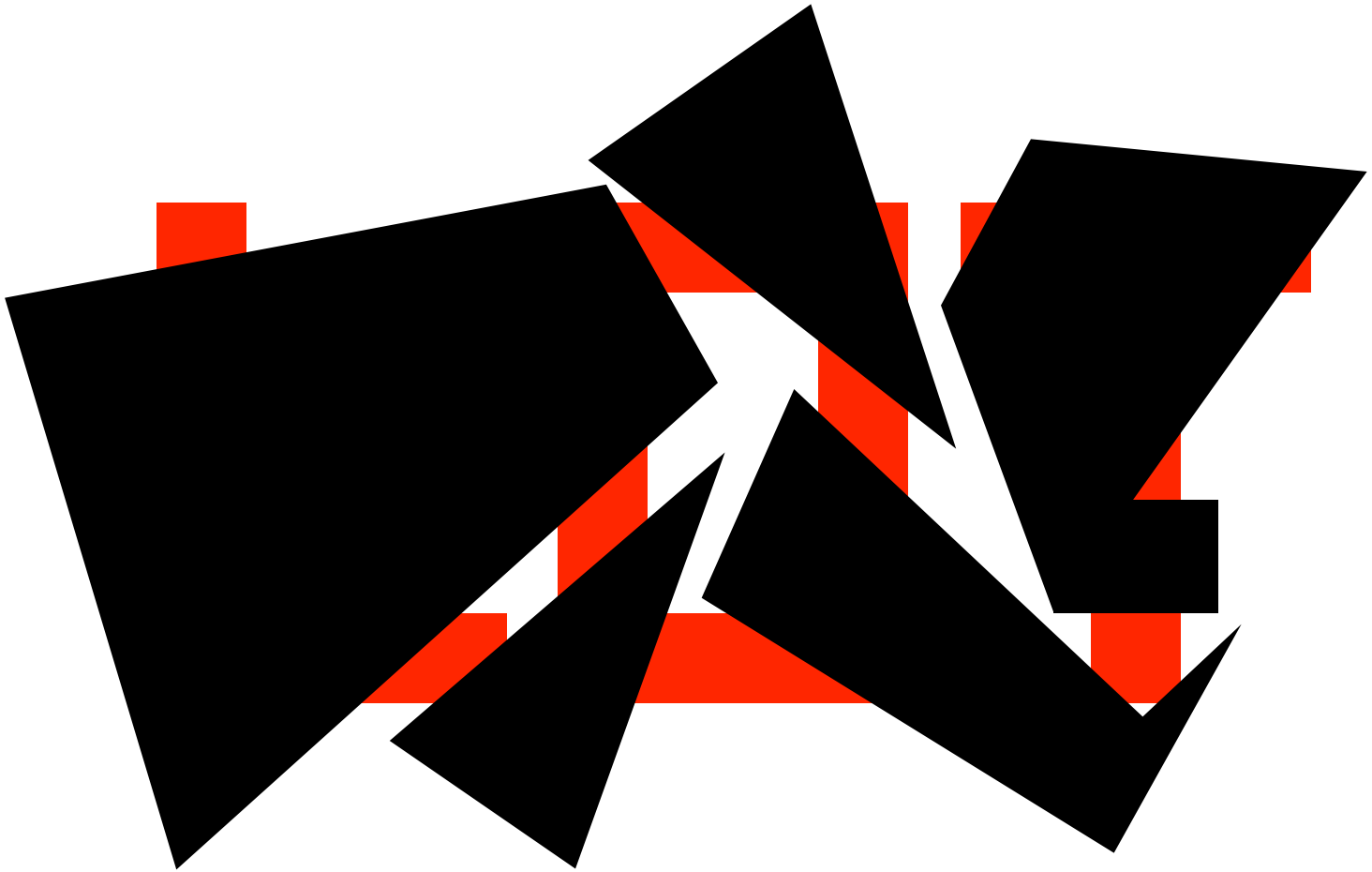


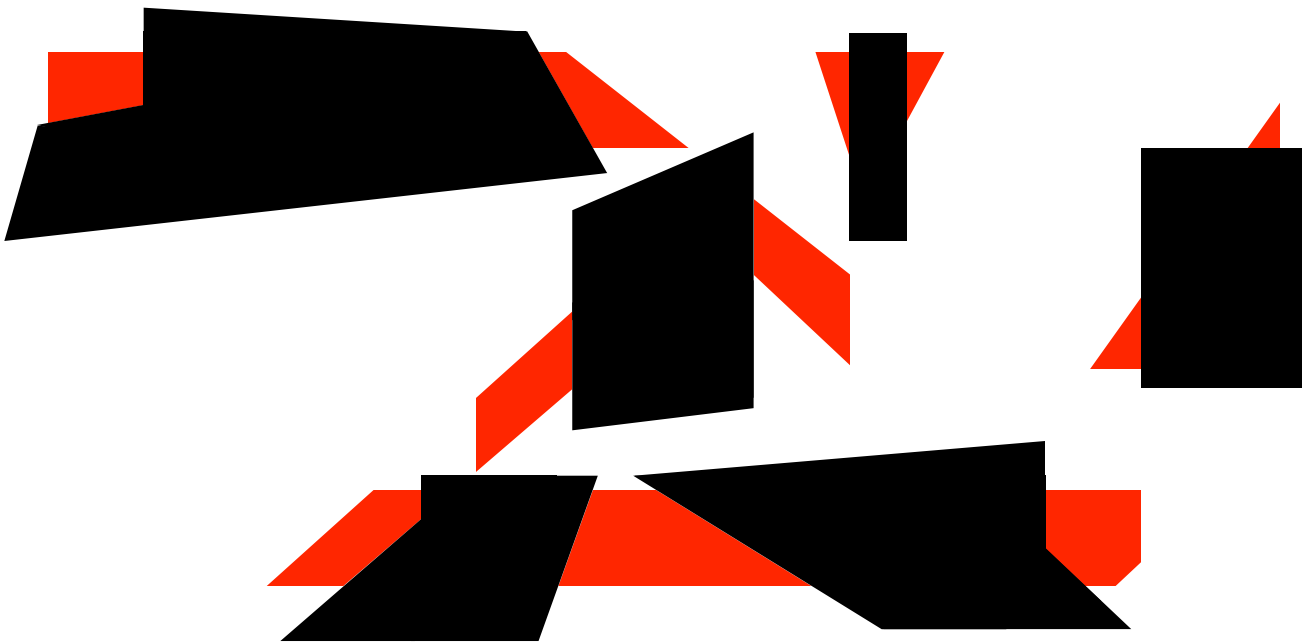






less familiar fragments

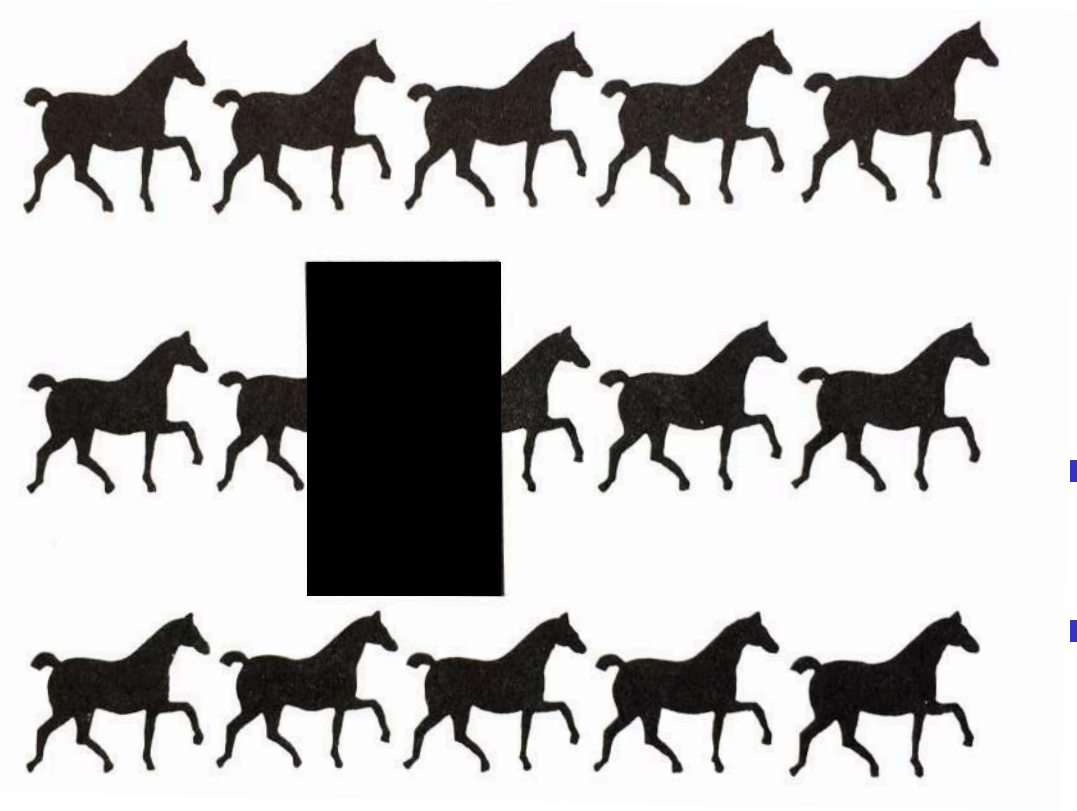




amodal completion and past experience

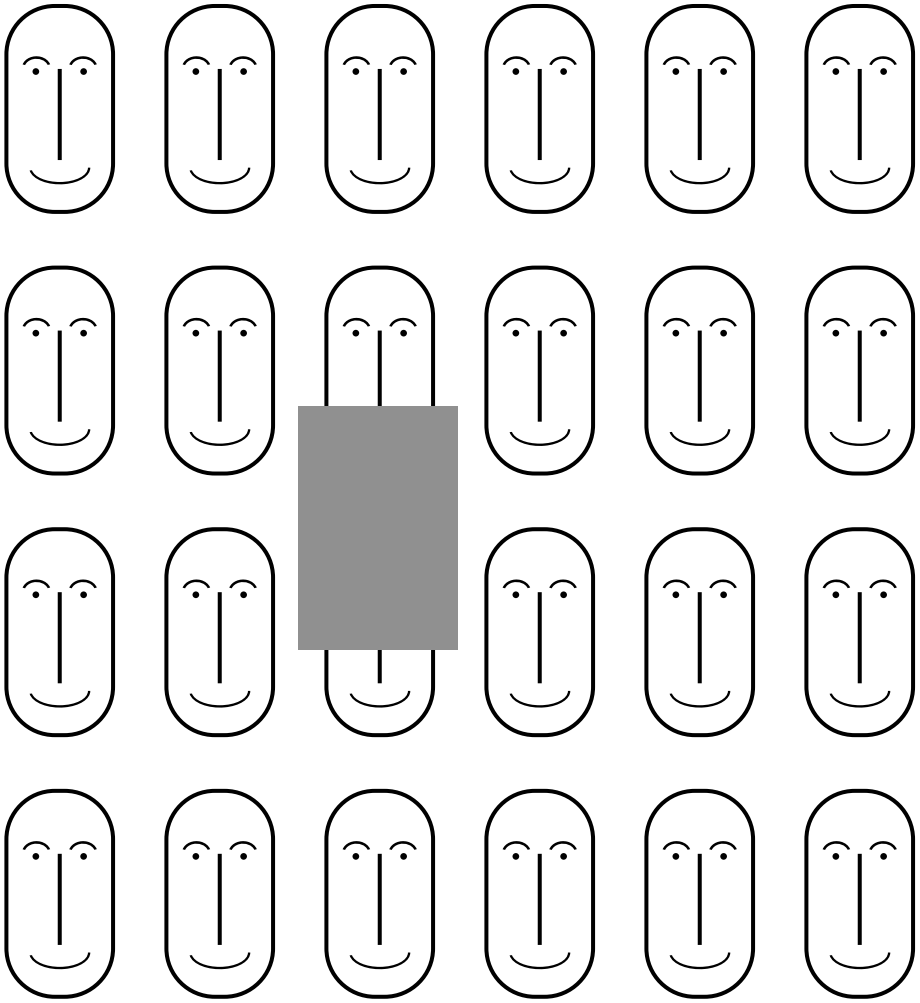
(the horse illusion)

Kanizsa 1970/1979



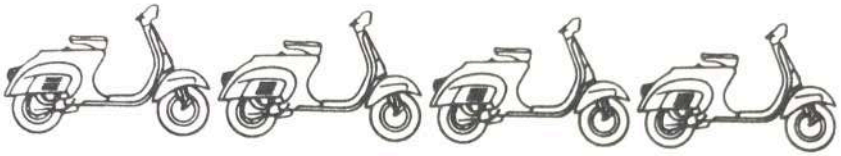
- a long horse
- against iteration and past experience

Kanizsa 1970

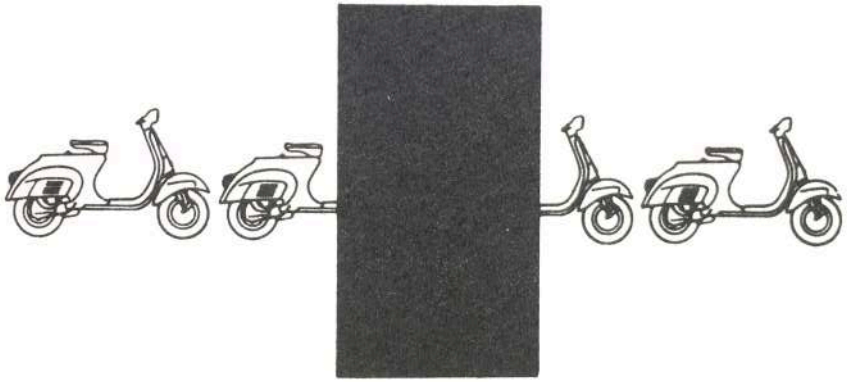


- a long face

Kanizsa & Gerbino 1982

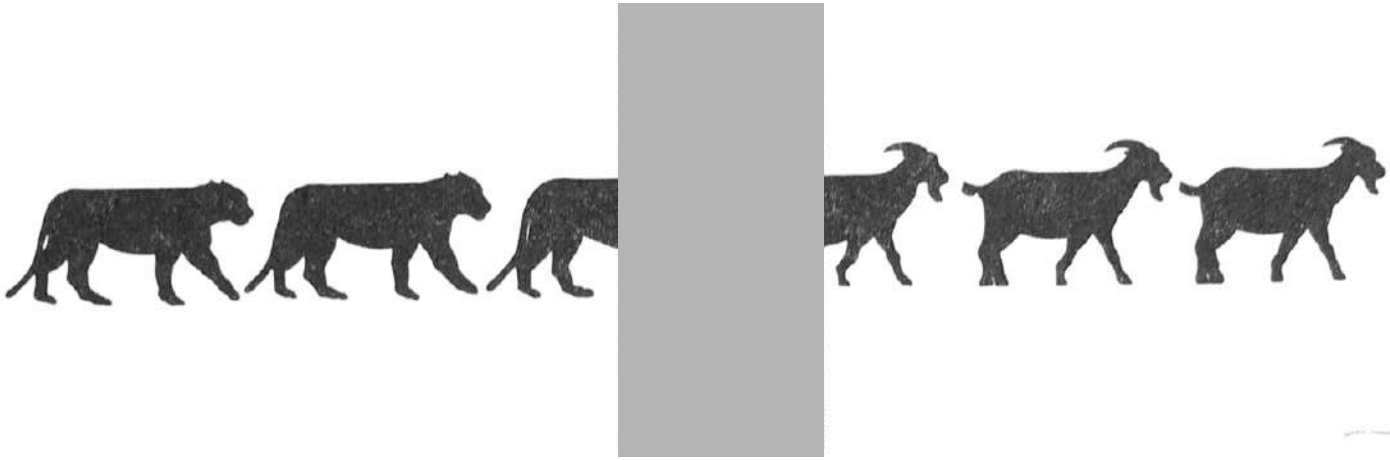


- a long scooter



- not so unlikely

Kanizsa & Gerbino 1982



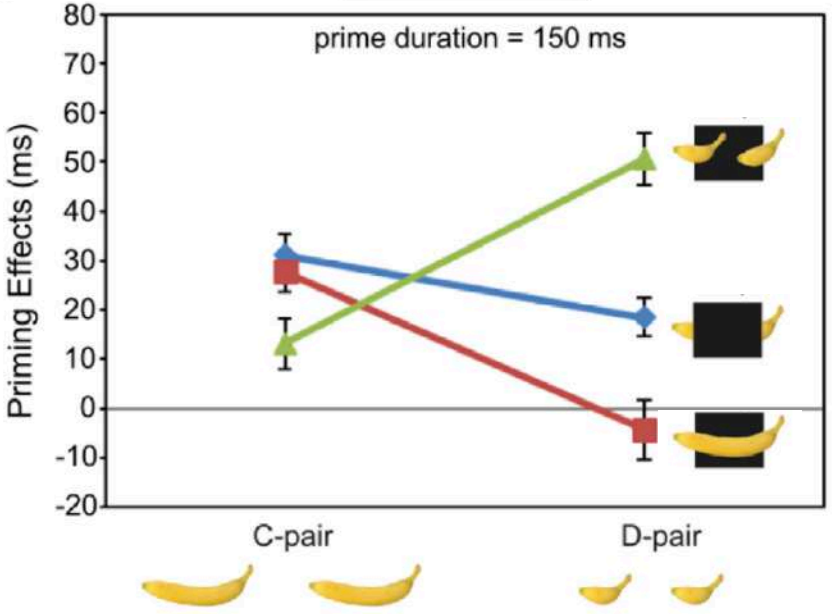
- a long goather?

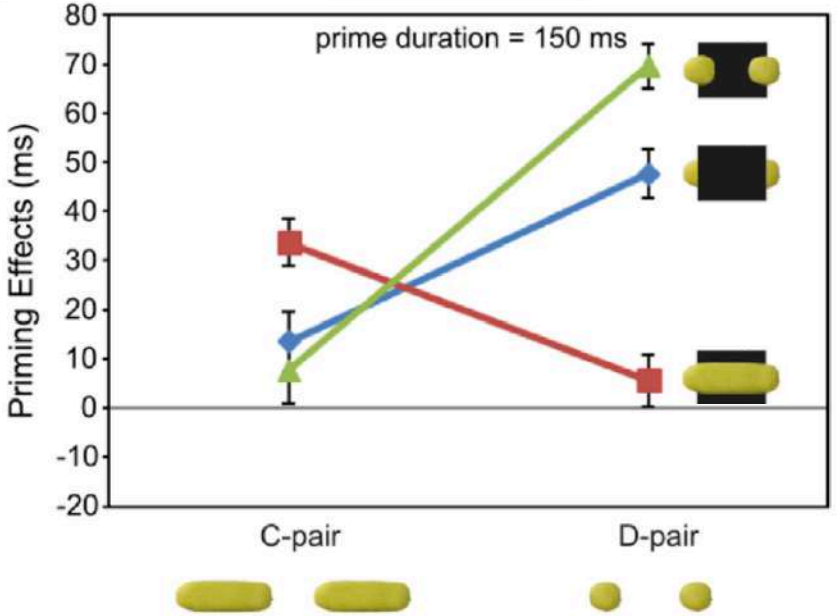
past experience matters

(Yun, Hazenberg & van Lier 2018)

- priming by displays where good continuation and past experience may converge or diverge

vs.



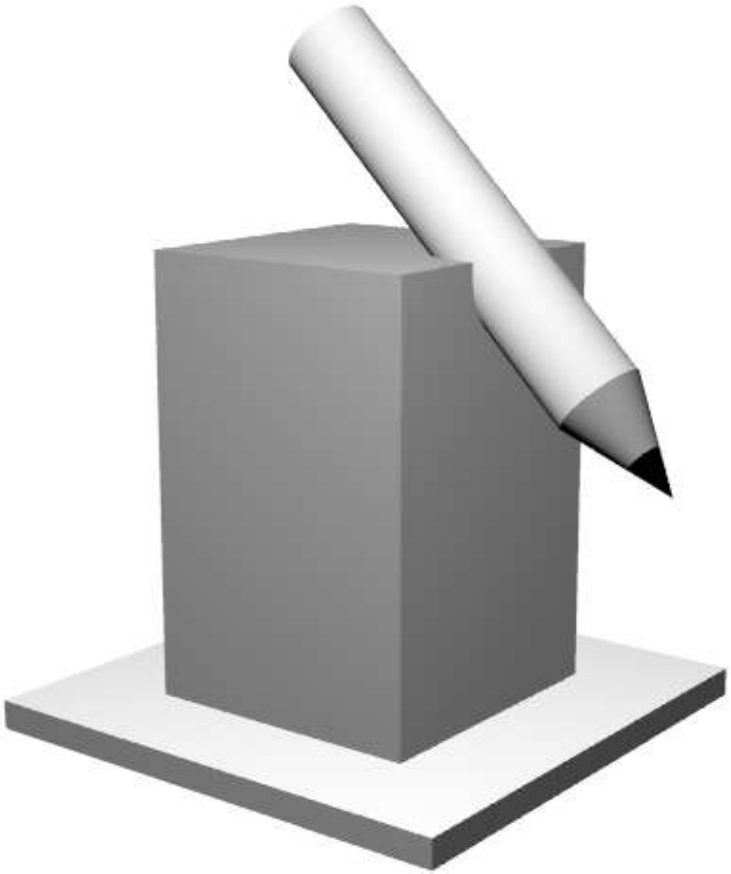


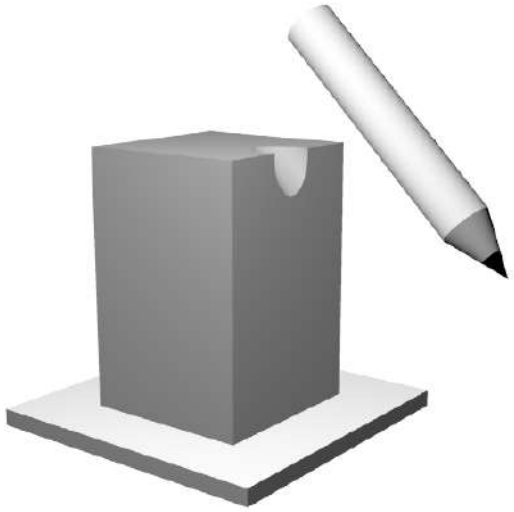
amodal completion and past experience

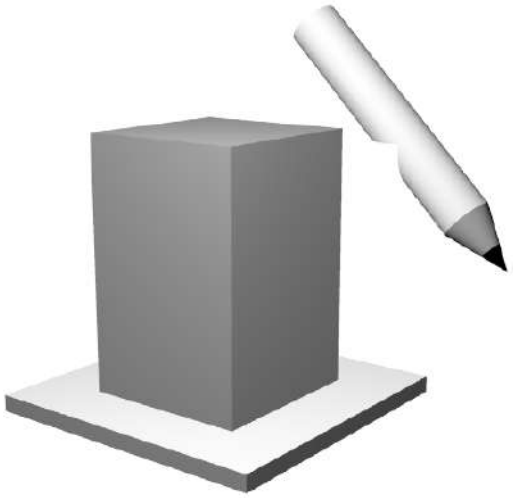
(the joint)

pencil-in-the-block

(Gerbino & Zabai 2003)



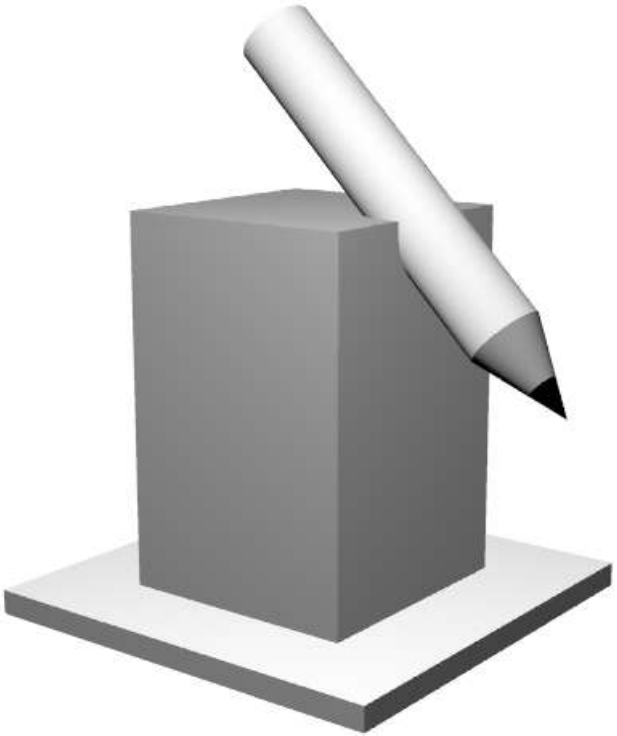


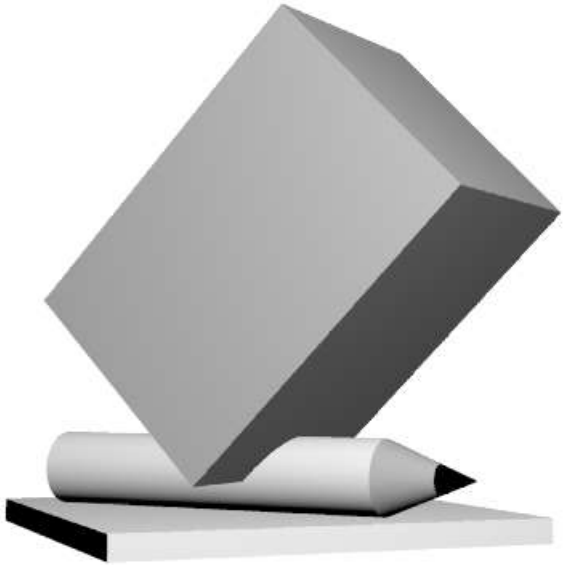


- intact vs. notched
- the intersection volume is underdetermined

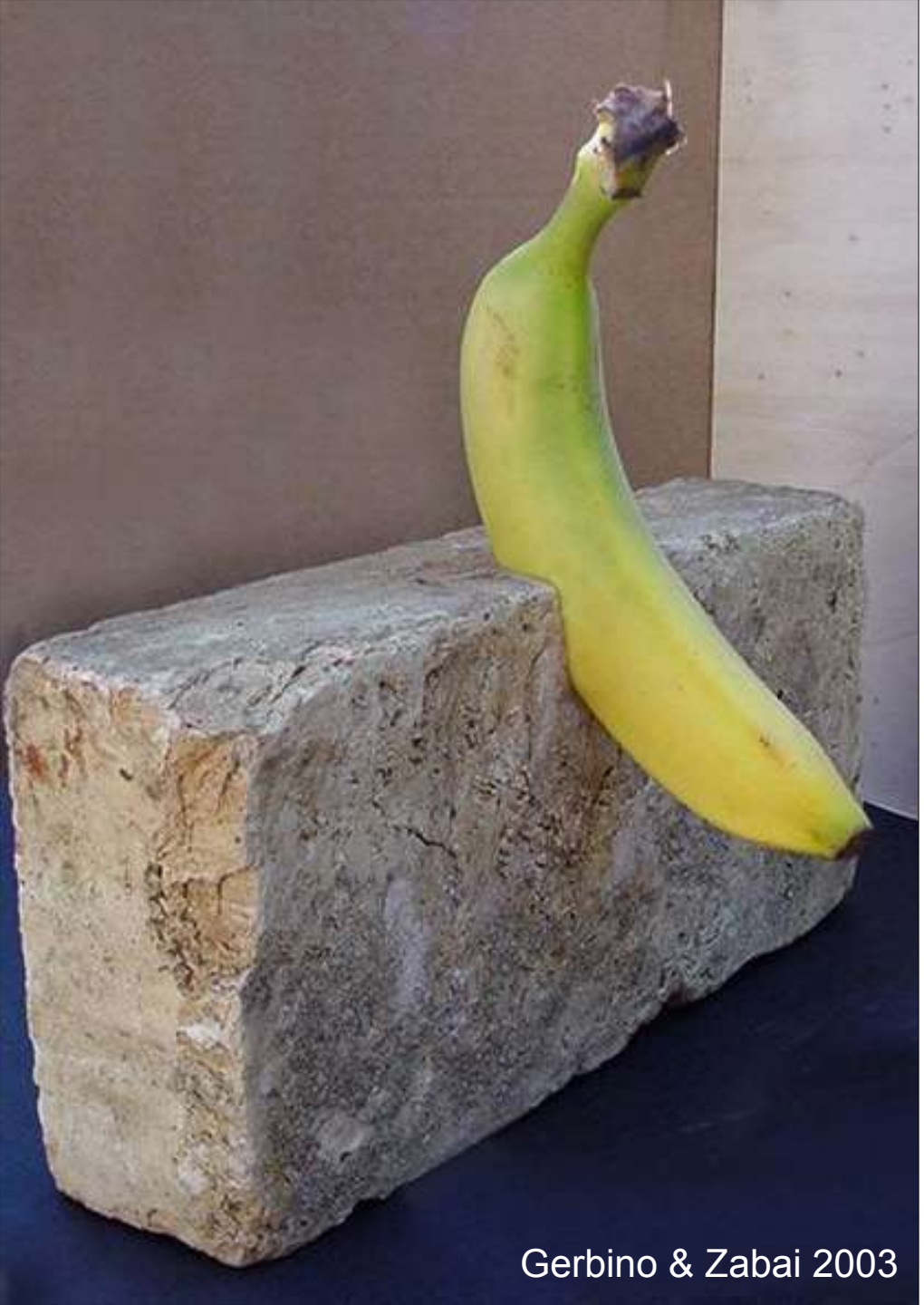
pencil-in-the-block

(Gerbino & Zabai 2003)





- orientation and relative position



- banana-in-the-brick
- against knowledge of materials

impossible experiment?

- in his later years Kanizsa thought that Musatti was right
- but in his research assumed that valid experiments on structural vs. empirical factors can/must be conducted
- disentangling the two components remains a fundamental goal, despite disagreements on the interpretation of results

thanks