

How Inferential Is Seeing?

**Cognitive Penetrability of Perception
& the Role of Philosophy in Cognitive Science**

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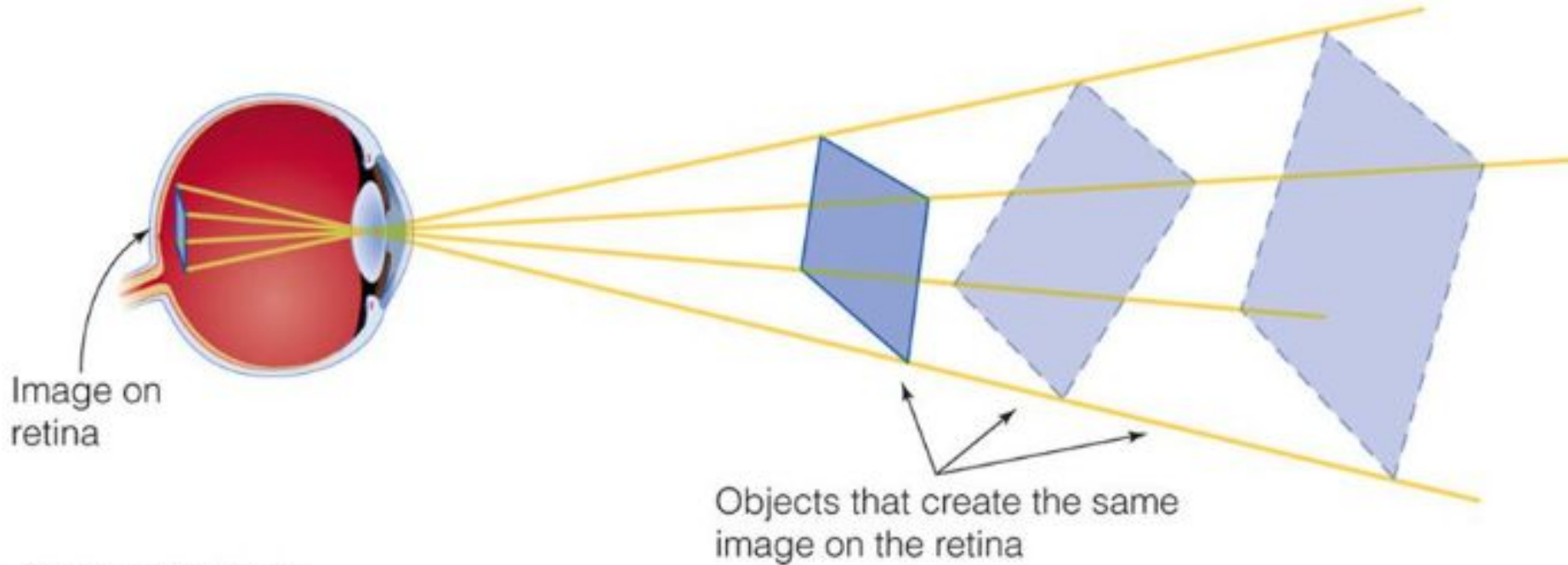
National University of Mongolia
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Overview

1. The idea of seeing as a type of perceptual inference
 - a. Direct vs indirect theories of perception
 - i. Historical debates
 - ii. Modern twists
2. Cognitive penetrability of perception
 - a. Philosophy of CPP
 - b. Empirical battles
3. Perception vs. cognition division – why bother?
 - a. Philosophical reasons to do so
 - b. Some (hopefully quite cool) cases peppered in!
 - c. How it fits in the bigger picture of cognition?
4. Open problem: reason to ponder the role of philosophy in modern CogSci

Direct vs. indirect theories of perception – perceptual inferences

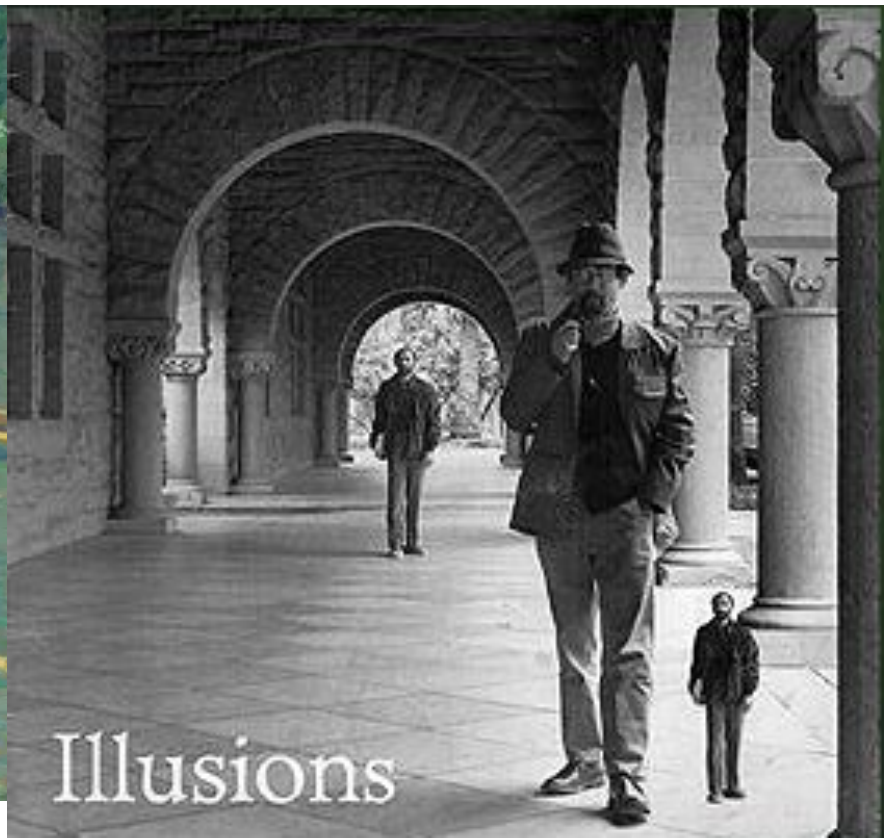
The inverse problem of perception



Size-constancy



Skiffs on the Yerres River, 1877 by [Gustave Caillebotte](#)



The origins

- ❖ Received view of perception: passive (e.g. Lockean ring & wax theory)
- ❖ Hermann von Helmholtz and his theory of *unconscious inferences* (*contradictio in adiecto* for a good Kantian then) in perception appears (Hatfield 2014)
- ❖ Underdetermination » ambiguity of the stimuli
 - depth perception (e.g. inverse problem)
 - size constancy
 - binocular rivalry (see: bottom right)
 - many more
- ❖ The *poverty* of the stimuli, too? Temptation of constructivism - a **‘filling out’ the blanks** model of perception. And isn’t knowledge, assumptions... inferences for that?
 - Alternative: **ecological (Gibsonian) account!** Information is aplenty in their view. Perception is just about filtering the flood!
- ❖ But is inferential seeing veridical? Constructivism is counterintuitive. Perception seems to like rigidity (=being shockproof).
 - **Persistence of illusions** is a prime argument
 - But: Anil Seth (predictive processing proponent): **‘perception is controlled hallucination**
 - ‘In other words: **bottom-up vs top-down theories**



Holistic processing - the importance of context

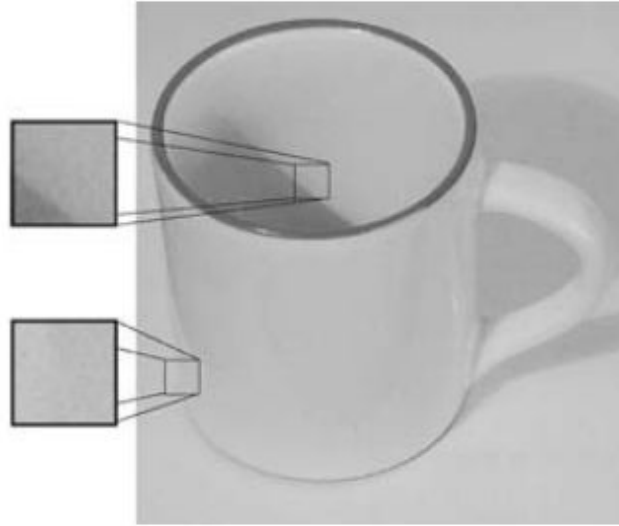
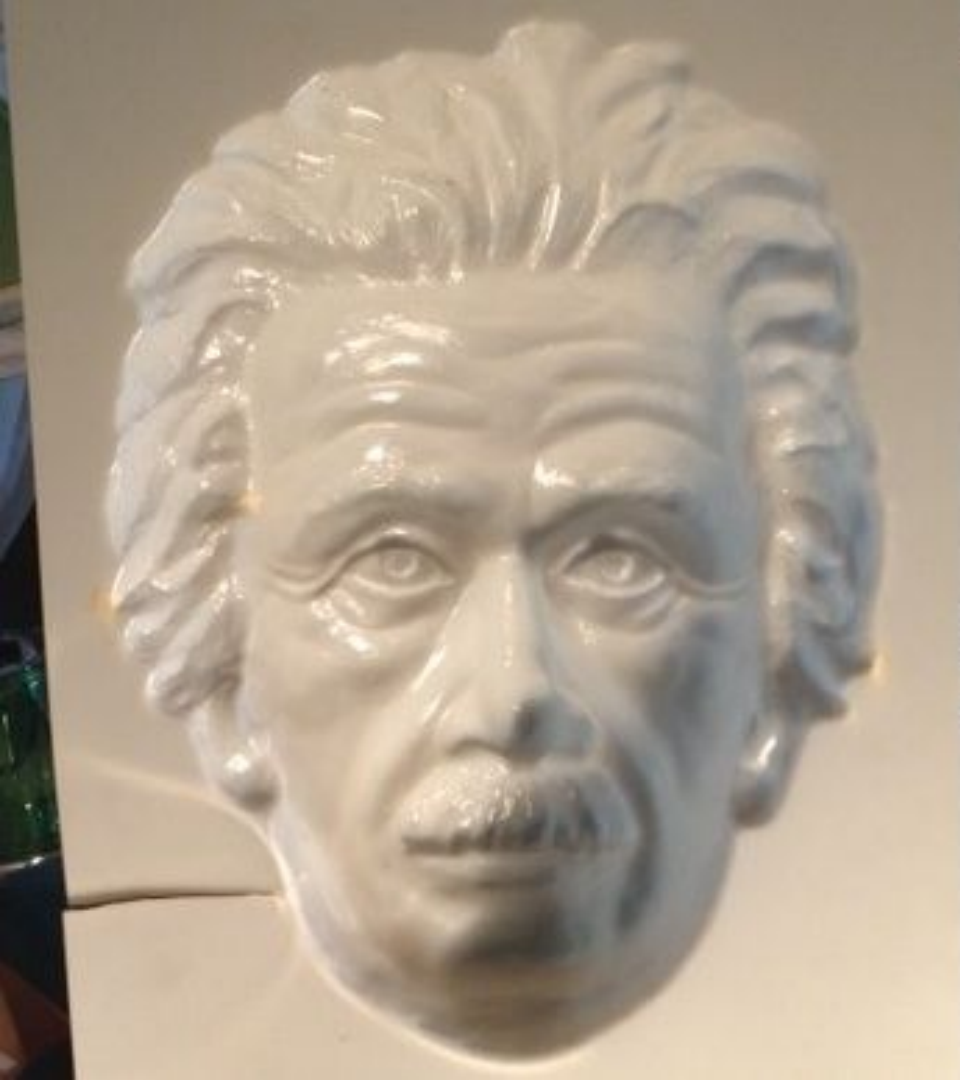


Fig. 1.4 This image of a cup demonstrates that physical contours and image contours are often very different. The physical edge of the cup near the *lower-left corner* of the image yields practically no image contour (as shown by the magnification). On the other hand, the shadow casts a clear image contour where there in fact is no physical edge

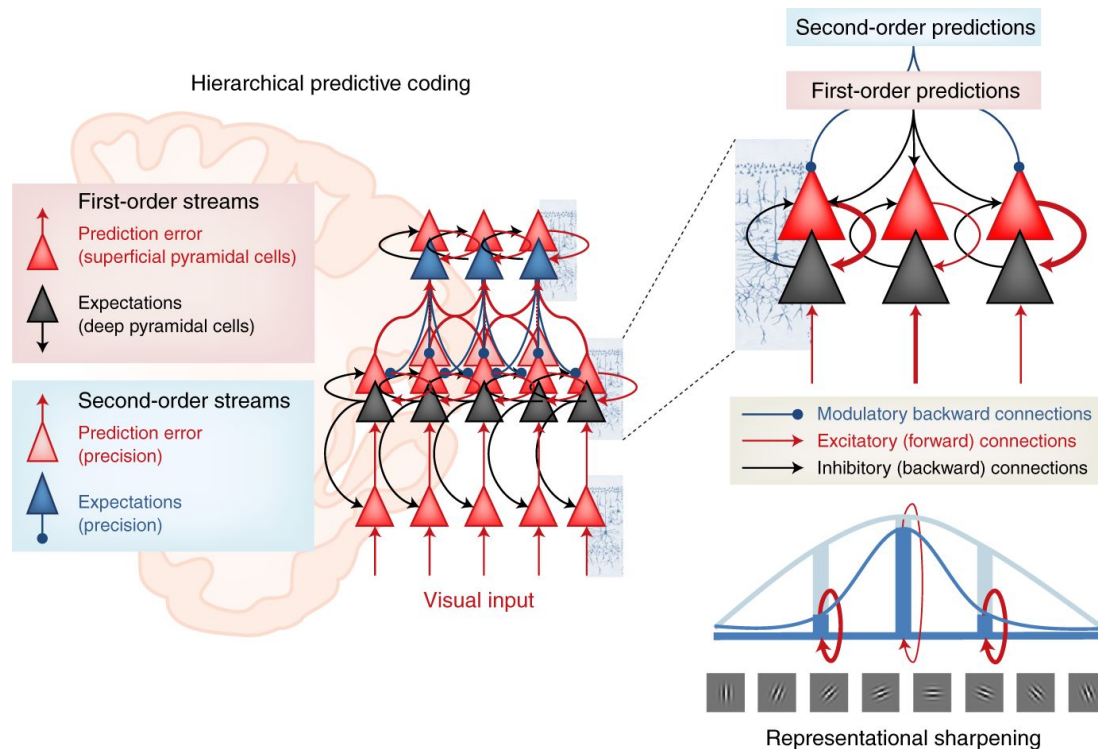


**Passive reception or
opportunistic guesswork?**



The inferential accounts of perception

- ❖ Inferentialists (New Look) vs. Noninferentialists (direct perception theorists)
- ❖ Vision as a Bayesian inference (Hohwy 2013)
- ❖ Cue: hierarchical generative models (Clark 2014)
- ❖ The battlefield that is predictive processing (Friston 2018, Miłkowski & Litwin 2020)



Graphic from: Friston, 2018

Vision as hypothesis-testing, the predictive processing view

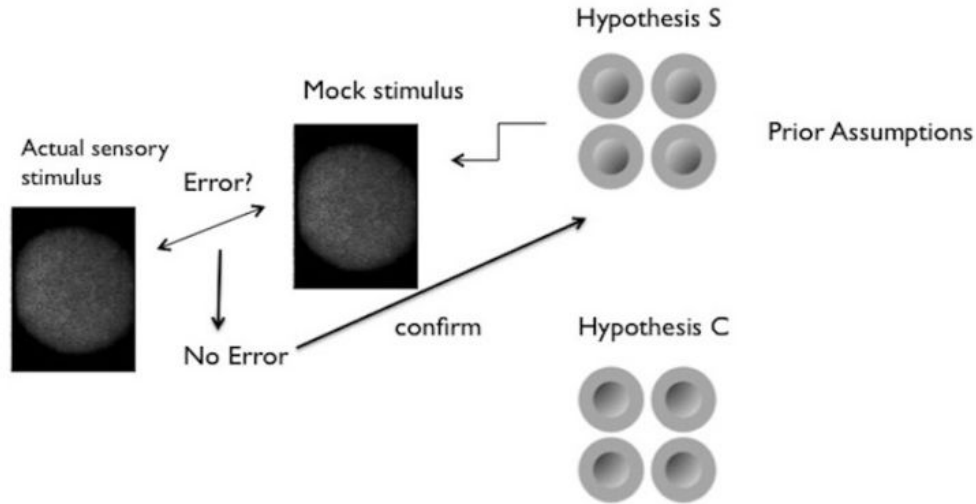
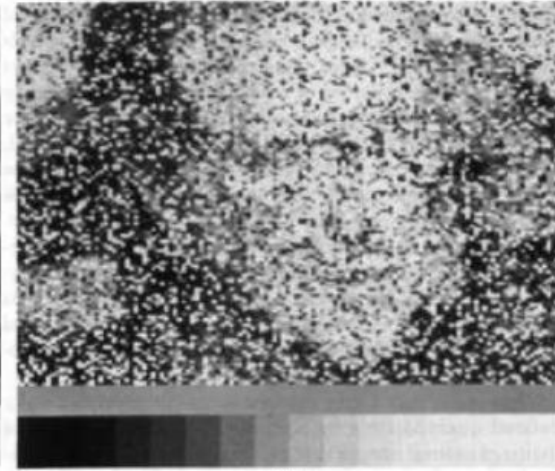


Figure 3: Simplified illustration of hypothesis-testing in vision. The sensory stimulus is a pattern of light projected on the retina.

(Orlandi 2015:5)

What we see is far from random

- ❖ **Regularities = predictability = redundancy;**
- ❖ ‘Real patterns’ (Chaitin, Dennett)

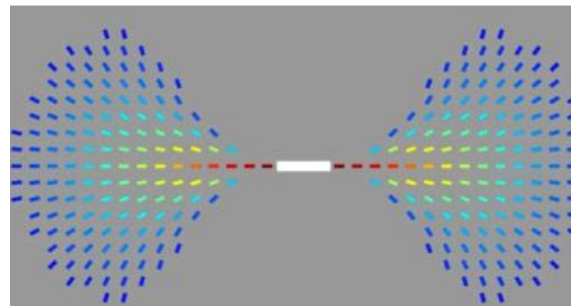
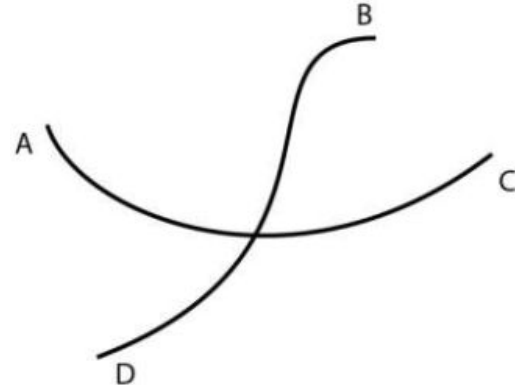


(Kersten 1987 - redundancy rate up to 74%)

- ❖ Information-theoretic consequences of that – structure enables compression. **Surprise is more informative** (checking prediction error vs. systematic copying).
- ❖ Regularities in the input itself do not equal the regularities for the agent (saccadic movements, epistemic foraging, attentional processes, differences in receptor density, partial visual field acuity, etc.)
- ❖ How is an agent supposed to take advantage of that and **keep stability and reliability of perception**? NSS: To find out – analyze the environment!

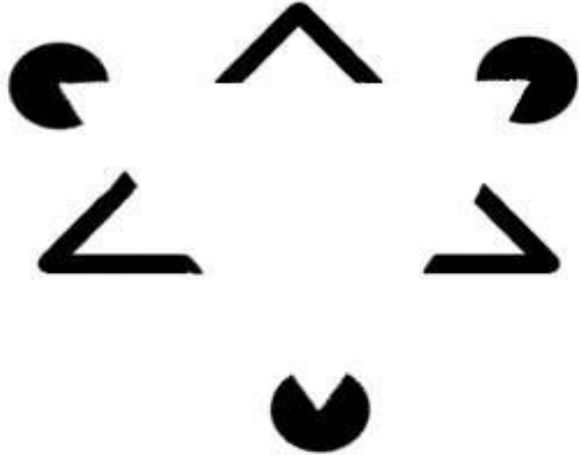
Cases of implicit prior information usage

- ❖ Light generally comes from above (⇒ convex/concave; illusions)
- ❖ Luminance > colour (⇒ colour sampling in JPEG compression)
- ❖ Autocorrelation of pixels (intensity)
- ❖ Stable power spectrum of spatial frequencies
- ❖ Co-circularity (relative orientation ⇒ contour integration and the Gestalt law of closure)
- ❖ Filling out the blanks (e.g. blind spot; Gestalt law of closure)
- ❖ Higher order hypotheses? ⇒ Scene categorization,
- ❖ Maybe only some are built-in? Idea of ‘core cognition’
- ❖ **But general idea is that we do not need any sophisticated, high-order, explicit, semantic (cross out what one does not like) system to explain a lot in perception**



Geisler et al., 2001

Gestalt law of closure



Law of Closure:

Objects grouped together are seen as a whole.

We tend to ignore gaps and complete contour lines. In the image above, there are no triangles or circles, but our minds fill in the missing information to create familiar shapes and images.

- ❖ We, as cognizers, yearn to **fill in the blanks!**
- ❖ Sometimes we tend to overachieve and see patterns where in reality there are none.
- ❖ The principal (though somewhat special) case is **face-recognition**.



Quick mid-summary of the battlefield

- Two camps: Helmholtzian **constructivists** (inferentialists) vs. **anti-constructivists** (Gibsonians; Orlandi 2014)
- Question: how to reconcile the existence of **rules, assumptions, *knowledge*** in perception vs. '**mere**' **regularities** in the signal (the world) + view that basic (perceptual) representations simply attune to these (see: Burge 2010, ch. 3)
 - Do we need both? Either? Neither?
- **Lots of labels for these barricades. Active vs. passive perception.** Hierarchical vs convolutional. **Top-down** vs. **bottom-up**. Generative vs. discriminative. System 1 vs System 2 (Tversky; J. Krakauer).
- **In the middle of this bundle: Perception / Cognition boundary**



Cognitive Penetrability of Perception (CPP)

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[Stokes 2013; Zeimbekis 2015; Litwin 2017]

- ❖ All the previous examples undermine the ‘passive’ account of perception that assume that information transfer is bottom-up, but not top-down
- ❖ This might happen on many levels, but specially interesting case is crossing the perception/cognition boundary
- ❖ **When one postulates there is *active causal modulation* of perceptual states by higher-order cognitive states, then one subscribes to the reality of the *cognitive penetrability of perception*.**
- ❖ More informally: at stake is whether our beliefs, desires, and possibly our emotions affect how we see the world. **Does cognition control or at least seep into perception at all?**
 - Intuition pump; Sapir-Whorf hypothesis, but generalized
 - A tad more formally: broad theory-ladenness (Putnam) of perception.

CPP still



- ❖ The axis of the dispute is the *informational encapsulation* of certain parts of the perceptual system. Proponents claim some mind modules (following Fodor and Pylyshyn [1999]) cannot take input from higher-order levels, as it would defeat the purpose of their veridical detection. **Wishful seeing is no seeing**, post-Fodorians claim.
- ❖ On the other hand, proponents of CPP (e.g. Gary Lupyan. Karl Gegenfurtner) disagree, subscribing to the view of malleable, highly modulated and convoluted perception/cognition bundle where information is trafficked both ‘upward’ and ‘downward’ and the **modulation concerns content of perceptual states**.
- ❖ But this seems like a disagreement to be settled empirically quite nicely right? *Set up the experiments and settle, then! Riiight...?*

So how do these test cases look like and do they reconcile the sides?

Research Article

“Top-Down” Effects Where None Should Be Found: The El Greco Fallacy in Perception Research

Chaz Firestone and Brian J. Scholl
Yale University

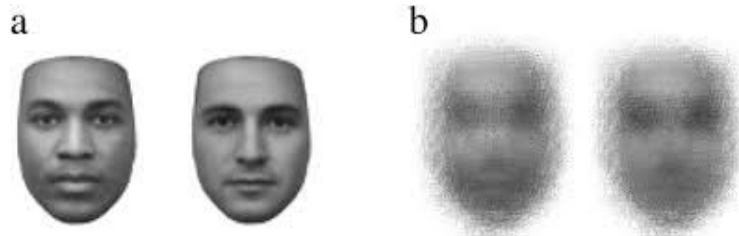
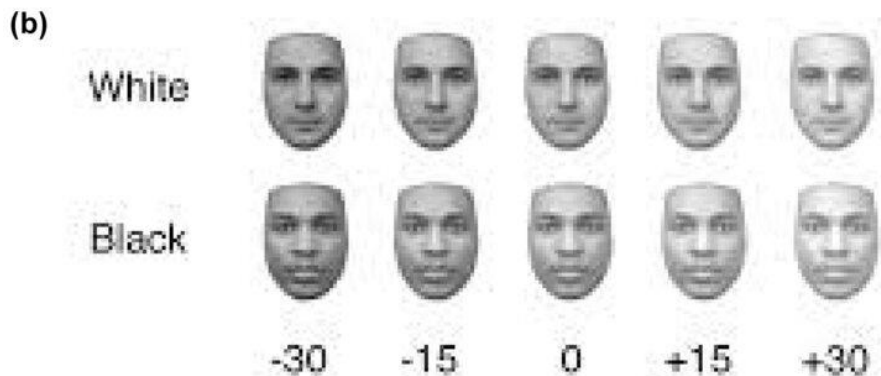
“a tidal wave of recent research purports to have discovered countless circumstances in which **otherwise extraperceptual states penetrate visual processing to literally and directly affect how things look**. For example, it has been reported that **wearing a heavy backpack makes hills look steeper** (Bhalla & Proffitt, 1999), that learning color-letter associations makes the letters appear tinged with that color (Goldstone, 1995), that holding a wide rod makes potentially **passable apertures look narrower** (Stefanucci & Geuss, 2009), and that reflecting on **negative words or actions literally makes the world look darker** (Banerjee, Chatterjee, & Sinha, 2012; Meier, Robinson, Crawford, & Ahlvers, 2007). These and dozens of similar reports offer a contrasting view of what perception is and how it works, according to which **beliefs, desires, moods, and abilities play direct top-down roles in shaping what people see**” (Scholl & Firestone 2015:39)

Levin & Banaji vs Firestone and Scholl - the coloured faces bout



Left: L&B original study;

down: F&S rebuttal. Another round:
Baker and Levin 2014; F&S replied again
– 2015; for philosophical summary:
Calzavarini & Voltolini 2022



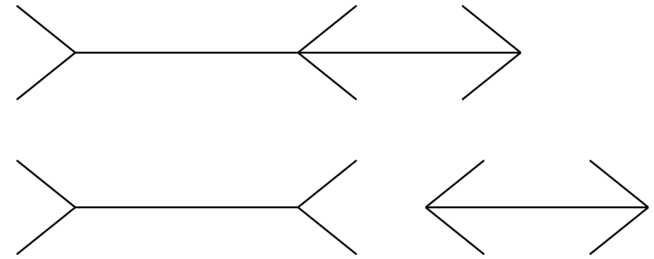
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Distortions in the perceived lightness of faces

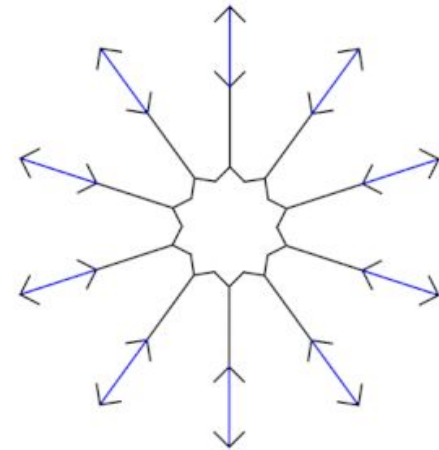
DT Levin · 2006 · Cytowane przez 337 — Citation: Levin, D. T., & Banaji, M. R. (2006). Distortions in the perceived lightness of faces: The role of race categories. *Journal of Experimental ...*

Intercultural differences in cognitive import

- ❖ Susceptibility to **Müller-Lyer illusion** - case study
- ❖ Could be strong evidence that certain higher-order states can influence the perception of the lines (and their illusory assessment)
- ❖ Studied cross-culturally (most notably **Segall, Campbell & Herskovitz** 1963 - on 17 cultures).
- ❖ Hypothesis: people from less-urbanized areas are less susceptible (**'carpenteredness'**), but rival explanations included 'flatness' of the environment (the Bushmen people are very resistant, but also low-level ones: e.g. pointin at the eye-pigmentation ratio)
- ❖ But, **Ahluwalia (1978)** study from Zambia reported higher susceptibility among city-dwellers within the same country



Sarcone's Dynamic Müller-Lyer Illusion



Jury is out, but jury is hung

- ❖ Bafflingly, disagreement remains (or even galores). **Even when we set aside the replication problems.**
- ❖ No common ground how to interpret certain influences: e.g.. *attentional modulation*. Both sides concede their importance, but disagree whether how to detect it and whether it clears the bar for genuine contentful top-down influence.
- ❖ Both camps **sometimes mobilize same studies to argue for opposing sides** (Fodor vs Prinz). That lead to voices that the debate may have reached a dead-end (Cermenno-Ainsa 2020)
- ❖ So maybe let's just scrape it? Most empirical scientists find it baffling and unoperational anyway! Only philosophers (and hardened psychologists) seem to care about joust in these antiquated tourneys. **R. Poldrack: we are still stuck in Jamesian terminology**, imagine any other modern science doing that!
- ❖ So I really wanna press the question now - **why do we still do it?** Are we mad?

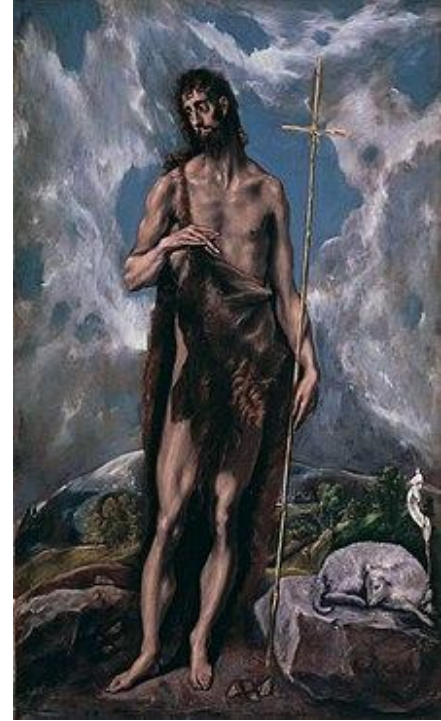


Positive & negative (neglected) evidence

When backpack-wearing subjects were given a compelling cover story justifying the backpack's presence (involving the need for heavy equipment to record ankle-flexion signals), the effect disappeared

In general, the predictions that can be used to test experimental hypotheses can be crudely divided into two types: **First, you should observe an effect when your theory calls for it; second, you should not observe an effect when your theory demands its absence.**

Unsurprising[ly] that **the vast majority of empirical studies claiming top-down effects on perception fall squarely into the first category:** Some hypothesis is put forth that an otherwise extraperceptual state can affect perceptual processing, and then such an effect is observed. In this article, we explore the second category of evidence. We show how testing predictions about when top-down effects must not occur can help adjudicate disputes over the relationship between perception and cognition. Our particular research strategy in this vein is especially well illustrated by the art-historical reasoning error that inspired it: the so-called “El Greco fallacy. (F&S 2015)



The El Greco Fallacy (Irvin Rock 1966)

Famously, the Spanish Renaissance artist El Greco painted subjects with oddly elongated figures. In works such as *Saint John the Baptist*, *The Repentant Magdalen*, and even a self-portrait, for example, the main figures inexplicably appear unusually long and thin (Fig. 1). Art historians had long puzzled over the meaning and origin of this idiosyncratic style, but in the early 1900s, a simple explanation was advanced: Perhaps El Greco suffered from uncommonly severe astigmatism (an ocular defect in which the cornea is slightly ellipsoidal instead of spherical; see Fig. 2), which distorted his perceived environment as if by vertically stretching it. If El Greco experienced a vertically stretched-out world, it was reasoned, then perhaps he simply painted what he saw.

Careful reflection on this theory reveals a conceptual confusion: If El Greco truly experienced a stretched-out world, then he would also have experienced a stretched-out canvas. In that case, the distortions should have canceled each other out: Just as El Greco would have seen real-world figures as elongated, so too would he have seen his paintings as elongated, and so the real-world distortions he experienced would never have transferred to his reproductions. The distortions in El Greco's paintings, then, must have some alternative explanation beyond a literal perceptual distortion. Thinking otherwise has come to be known as the “El Greco fallacy” (ibidem)



At least three positive (I think!) examples

1. Motivates better **theoretical work** to help demarcate distinctions.
2. Kickstarts better **empirical work** that could strive to provide more decisive testing grounds.
3. We definitely need both. But, additionally, careful thinking about the ‘cognition’-ladenness of perception opens up the links to more **grander philosophical theorizing** about the mind and cognition in general.

Theory of P/C

Perception vs Cognition border (P/C)



- ❖ Deep reasons to think there is an important difference
- ❖ Intuitive understanding: **it's different to be seeing the Gobi desert and imagining/memorizing you see it or desiring to do so**
- ❖ Also, the persistence of hierarchical processing view as an explanatory strategy ('counting layers in the onion' is CogSci go-to strategy since Marr).
- ❖ **Phenomenal difference** (e.g. in terms of vividness, detail, control)
- ❖ **Causal history** is different, too. Perception in *prima facie* strictly tied to direct stimuli being present or almost present (temporally). Cognition, conversely, is flexible, detached (also counterfactually).
- ❖ History of philosophy certifies the importance of this. *A lot* of effort was taken to disentangle one from another (e.g. Kantianism & apperception).

P/C border patrol - important not only on its own

- ❖ But there are also major corollary reasons to debate this.
- ❖ For instance, this distinction holds the fort for disagreements about **epistemic justification** [Siegel 2017: *epistemic downgrade* of top-down modulated perception].
- ❖ **Implicit bias** is a very important branch-out of this problem!
- ❖ It potentially opens up the entire field research **intercultural import** on perception!
- ❖ Reasoning is discursive, perception not necessarily. Traditionally also only the former is **inferentially involved** (see: Sellars or McDowell).
- ❖ Ramifications for the **content question**, too. Can absence be the subject matter of a perceptual act? Or do we need higher-level interference to explain it?
- ❖ Ethical/political considerations closely follow epistemic ones. Eyeballing is clearly different than speculating. as any lawyer would concede. Implicit bias has obvious consequences for understanding discriminatory practices.

Candidates for the demarcation criterion (Clarke & Beck 2023)

- ❖ Deflationism (null hypothesis)
- ❖ Phenomenology,
- ❖ Revisability,
- ❖ Modularity,
- ❖ Format
- ❖ **Stimulus-dependence (Beck 2017; Beck & O'Callaghan [in preparation])**



S-D SIMPLE: Ψ is perceptual if, necessarily, all veridical occurrences of Ψ are stimulus-dependent; otherwise, Ψ is cognitive.

Beck 2017:5

Counterexamples

- ❖ **Illusions** – failures of *attribution*. Object is there, but ‘looks’ different (properties are false)
- ❖ **Hallucinations** – failure of *reference* (objects is not there at all) [Burge 2010, ch 2]
 - **Exogenous** – still causally sustained by proximal stimuli (e.g. imagine there is a hologram of Batu-Khan on the podium here)
 - **Endogenous** – if I inject LSD and hallucinate Batu Khan – that’s not proximally sustained; SD-simple would not classify it as perception (and we intuit it ought to)
- ❖ **Perceptually Grounded Demonstrative thoughts** (PGDT; intuitively cognitive, misclassified by SD-simple as perceptual)
 - ‘This monument is huge’ [when I refer to the Tsonjin Boldog complex I saw on Sunday, and it visually grounded my demonstrative thought I token now]

Remedies

- ❖ Solutions?
 - Illusion » we need **all elements criterion**
 - Hallucinations » **need all occurrences**
 - PDGTs » **we need function**
- ❖ Note the strategy here: discuss counterexamples + offer resolutions (additional criteria) to accommodate them » arrive at a tightened definition.
- ❖ The upgraded definition: (Beck 2017:12)

S-D FULL: Ψ is perceptual if, necessarily, all occurrences of all elements of Ψ have the function of being stimulus-dependent; otherwise, Ψ is cognitive.

Practice of P/C

Can you hear silences? (Goh et al. 2023)

<https://www.perceptionresearch.org/silence/>

- ❖ **Absence of perception $\neq$ perception of absence** (absence as a content of a perceptual state vs. **'failure to hear' and then infer we failed**). **Please note that there is plausibly no stimulus-dependence here!**
- ❖ Let's check it through treating it as a part of experience – mimicking illusions induced by 'gaps' in the case of vision
 - **('one-is-more illusion [Yousif 2019] unseparated stimuli are judged as when equidistant; scandalously: longer even if in reality summarically shorter!)**
- ❖ Hypothesis: if silences can induce these illusion, they are directly perceived as objects (become contents of perception) – then there is genuine perception of absence, not only absence of perception (nor failure to perceive + inference)

One-is-more illusion (Yousif & Scholl 2019)

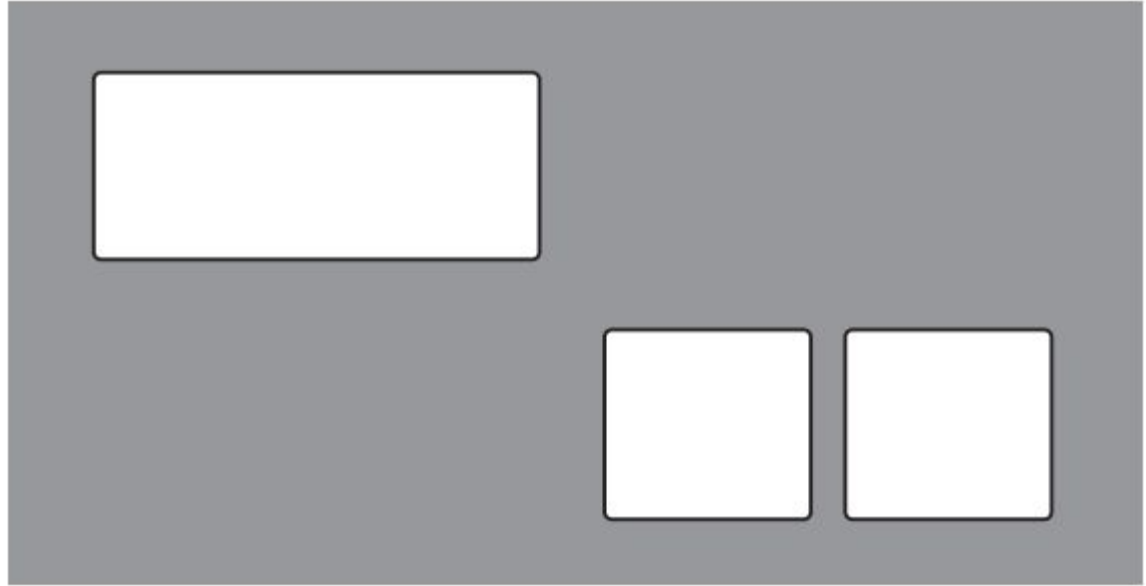


Fig. 1. Depiction of an example display from Experiment 1a. Observers compared a single continuous shape (i.e. the rectangle in the upper left quadrant) with an equivalent set of multiple discrete shapes (i.e. the two rectangles separated by a gap in the lower right). These two stimuli are equally wide (from their leftmost points to their rightmost points), but the continuous entity appears longer.

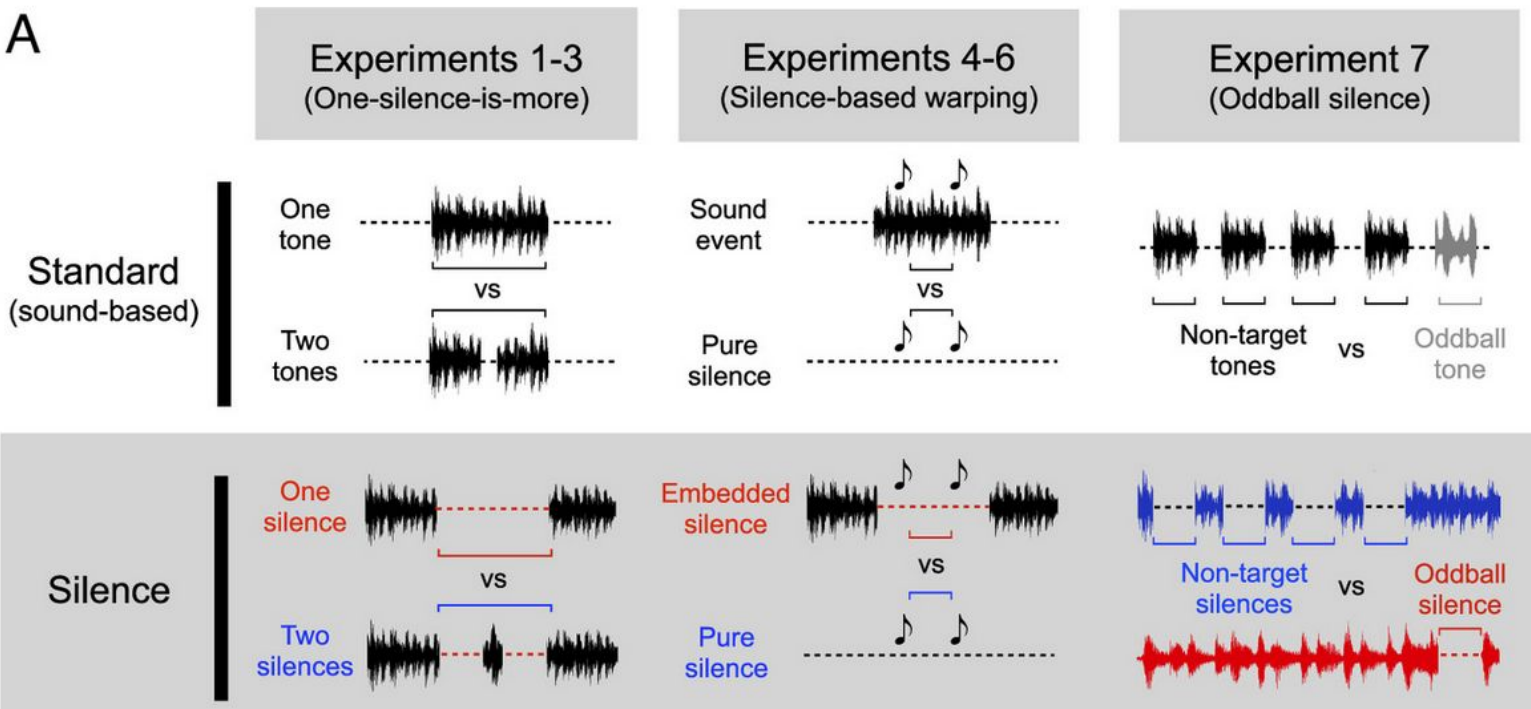
Cont.

- ❖ “Silences can “substitute” for sounds in event-based auditory illusions – adapted from perceptual illusions previously thought to arise only with sounds. In all cases, **silences elicited temporal distortions perfectly analogous to their sound-based counterparts, suggesting that auditory processing treats moments of silence the way it treats sounds. Silence is truly perceived, not merely inferred.**’ (Goh 2023:1)
- ❖ Interesting corollaries of their view:
 - Silences can be ‘frames’ – like parts of the space in vision (embedded silences)
 - There are ‘types’ of silences – partial or relative (‘oddball’ silences)
- ❖ **Case where clever empirical experiments can help solve deep philosophical problems**

Experimental setup

Fig. 1.

A



P/C in the bigger picture

CPP as a Kant-Sellars (KS) Thesis (Mamak 2016)



- ❖ Following **conceptualism** in philosophy of perception (concepts are necessary for perception). Both Kant and Sellars (1956; with his **Myth of the Given**) subscribed to the view. **Inferentialist theory** (*see: R.Brandom*) in my reading meets modern (structural) representationalism (Ramsey 2007).
- ❖ **The view states that there can be no 'raw' experience that is non-mediated (not caused at least partly, non-mediated) by the powers of intellect, i.e. higher-order *cognitive* faculties (operating on concepts).**
- ❖ It's a generalization of CPP onto a normative, overarching epistemic statement about the nature of experience. Empirical research is fodder for that, **but cannot exhaust the entire explanatory picture. That's what big philosophical theory is for.**
- ❖ Hugely shortcutting here. We interpret Kantianism (especially Sellarsian) as an *inferentialist theory* and aim to rephrase it in for philosophy of mind for cognitive science.
modern terms as a normative theory
 - **KS-full: For any cognitive system S (or part thereof) to operate as a representational mechanism, there needs to be a higher level system (S') that governs, structures and regiments its contents. S is then necessarily structured via inference from information derived from S'. (Mamak 2016:5)**

Conclusions



- ❖ There is very little difference between theoretical psychology and philosophy of perception (Block 2015 on seeing-as)
- ❖ Even though some debates are uninteresting or even flat-out dumb to practitioners (neuroscientists or more lab-ish psychologists) it's **no reason to discard them, provided they are not *merely* verbal.**
- ❖ To dispel this charge: there are examples of excellent & progressive conceptual work done and to be done) by philosophers that contributes to understanding the mind (**Beck on C/P divide**)
- ❖ Philosophical import can also inspire and motivate empirical studies forming a serious explanatory powerhouse (**see: silence research**).
- ❖ And I argue that there is still both fun and merit in big-picture grand theorizing (**Kant-Sellars Thesis**), as long as it's empirically-informed and accommodates naturalistic debates.

Warszawa. Pomnik Kopernika
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Thank you for coming and for your attention.

Any questions welcome! If any of the references
grabbed your interest, please do ask or pop an
e-mail, I'll be glad to provide the bibliography!

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