Configural Processing Consortium (CPC), 2014

Long Beach, California

Wednesday, November 19, 2014

WHEN:	Wed., November 19th, starting at 9am.
WHERE:	Hyatt Regency hotel, Long Beach, CA. Room TBA
WHO:	Phil Kellman

WHAT:

Schedule to be advertised soon

Website: **http://configural.org/**

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Holism, Unitization and Familiarity in Face Recognition

James C. Bartlett

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Findings suggest that face recognition is special in the sense that it is based on configural or holistic processing. Yet, few would doubt that general memory processes support face recognition, at least to a degree. A question, then, is how best to integrate general theories of memory with holistic/configural processing of faces. A possible answer is based on studies of "associative recognition" with non-facial stimuli (e.g., words). Participants study pairs of stimuli (A-B, C-D . . .) and then attempt to distinguish "intact" (A-B) from "conjunction" (A-C) pairs. In theory, performance is based on conscious recollection of the relevant associations (e.g., A-C might be rejected based on recollection of A-B or C-D). However, under conditions of "unitized" encoding, associative recognition is based on a uni-dimensional, strength-like signal referred to as familiarity (i.e., conjunction pairs feel on average less familiar than intact pairs). From the perspective of this general memory theory, can configural/holistic processing of faces be viewed as a form of unitized encoding of the various face parts? If so, familiarity should support associative recognition of faces in conditions that allow configural/holistic processing, but not in conditions (e.g., inversion) that disrupt such processing, even if performance is matched. I will discuss a method and some data that speak to this idea.

Why Faces but not Objects Exhibit Configural Effects

Irving Biederman, Xiaokun Xu, Manan P. Shah, & Sarah B. Herald

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A striking phenomenon in face perception is the configural effect in which a difference in a single face part appears more distinct in the context of a face than it does by itself. Remarkably, there has never been a plausible explanation of this fundamental signature of face recognition. We show that the configural effect can be simply derived from a model of overlapping receptive fields (r.f.s) characteristic of early cortical simple-cell tuning but also present without the linking of spatial frequency (s.f.) to r.f. size in face-selective areas. Because of the overlap in r.f.s, the difference in a single part (between target and foil) is not only represented in the r.f.s centered on it, but also propagated to larger r.f.s centered on distant parts of the face. The retention of a spatial (Gabor-like) representation in which parts are not distinguished from relations (vs. object structural descriptions) may be unique to the representation of faces and explains why distinguishing similar faces (unlike distinguishing objects of equivalent physical similarity) is ineffable (because we do not have cognitive access to the r.f. activation values) and so adversely affected by inversion and contrast reversal.

Automatic Extraction of Center-of-Mass Information from Spatial Configurations

Aysecan Boduroglu & Irem Yildirim

Bogazici University, Istanbul-Turkey

It is known that location of an item can either be represented in an absolute fashion as coordinates in a space, as relative to another item, or as part of a broader spatial configuration. Previously we had shown that when participants were asked to retrieve briefly studied target locations, availability of configural cues at retrieval facilitated retrieval by increasing the resolution of individual location representations. We also empirically established that configural representations could not be reduced to relative location representations. In a related series of experiments, we focused on what is actually represented when viewers are presented a spatial configuration. Specifically, we investigated whether configural information may in part be represented as a statistical summary, in the form of the center-of-mass (centroid) of a configuration. We demonstrated that the unlike individual target locations, centroid information was extracted more accurately, and people were always pulled towards the centroid when they tried to retrieve target locations. This pull was strongest when there were insufficient cues to scaffold retrieval and when participants reported being unsure of the target location. Masking the study set and reducing encoding time did not change the general pattern of results suggesting that configural centroids may be automatically extracted.

Differentiating Processes in Amodal Completion using a Dot Localization Method

Susan Carrigan[1], Evan Palmer[2], & Philip J. Kellman[1]

1. University of California, Los Angeles;
2. Wichita State University

Competing theories of perception of partly occluded objects (amodal completion) have emphasized local contour interactions or influences of symmetry and/or familiarity. These theories may reflect two different processes: a contour completion process and a more global recognition process. The two could be distinguished experimentally if only the former gives rise to precise boundary representations. Using a dot localization paradigm, we assigned participants to either a local or global condition, which determined how the participant was instructed to complete objects with divergent local and global interpretations. On each trial, a small dot was flashed on top of an occluder. Subjects reported whether the dot fell inside or outside the occluded object. Adaptive staircases were used to estimate the point at which the probability was .707 and .293 that the dot would be seen as outside the boundary. The results indicate that local contour interpolation produces precise and accurate representations of occluded contours, whereas symmetry or familiarity cues do not.

The Global-first Topological Definition of Perceptual Objects

Lin Chen

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What is a perceptual object? We propose that the core intuitive notion of an object is its holistic identity preserved over shape-changing transformations, and this identity can be characterized precisely as topological invariants, such as holes. Behavioral experiments demonstrated that changes in topological properties disturbed object continuity, leading to the perception of an emergence of a new object; and fMRI experiments showed that the topological changes activated the anterior temporal lobe and amygdale.

Neural Correlates of Dynamic Global Form in Spatiotemporal Boundary Formation

Gennady Erlikhman[1], Philip Kellman[2], Gideon Caplovitz[1]

1. *University of Nevada, Reno;*
2. *University of California, Los Angeles*

Spatiotemporal boundary formation (SBF) is the perception of boundaries, global form, and global motion from discrete changes of sparse elements (Shipley & Kellman, 1993, 1994). SBF affords an interesting opportunity to study dynamic form perception because shapes are perceived only after information is integrated across multiple frames. Using fMRI, we measured activation in early visual, intermediate, dorsal, and ventral areas in response to SBF-defined shapes. The stimuli consisted of a field of randomly oriented Gabor elements. A virtual (invisible) shape (square or circle) centered on the screen expanded and contracted. Whenever the boundary of the virtual shape passed over the center of a Gabor element, the element changed its orientation or was displaced by a small amount in a random direction. The perception was of an expanding and contracting circular or square illusory boundary of the same color as the background. Shape identity could be decoded in early visual areas (V1, V2v, V2d) and ventral regions (VO1, VO2), but also in intermediate areas (V3A, V3B) involved in form-motion interaction, and in dorsal areas (V7/IPS0). These findings support a growing body of work indicating a role of feedback from dorsal areas in the perception of dynamic, global form.

Positional priming of pop-out is nested in visuospatial context

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In visual pop-out search, reaction time performance is influenced by cross-trial repetitions vs. changes of target-defining attributes. Positional priming of pop-out allows investigating target processing as a function of target's current location compared to previous trial(s). The target on trial *n* could be located at trial *n-1* target/distractor/neutral location. Such transitions permit to disentangle positional priming effects, namely target facilitation and distractor inhibition (Maljkovic & Nakayama, 1996). Positional priming effects were investigated under conditions of repeated/changed configurations and categories. The search items were arranged in Z- or T-configurations (Garner & Clement, 1963) and varied across trials. A category was defined as set of unique geometrical elements sharing features perceptually distinct from the elements of other categories (Z/T category). A configuration was defined by a particular element in a given category ("_|¯" in Z-category or "_|_" in T-category). Positional priming effects were assessed on consecutive trials of repetitions vs. changes of configurations and changes of categories. Target facilitation was dependent on repetition of the exact item configuration, whereas distractor inhibition was influenced by the changes of the visuospatial category. The results indicate that single item locations are stored by means of configural rather than absolute/location-based representations.

Keywords: visual search, positional priming, configural representations ; Q1

Anti-configurality: How do information processing systems deal with conflicting information?

Daniel R. Little

The University of Melbourne

In this presentation, I will discuss how different information processing architectures deal with incongruent or conflicting information. This refers to a situation in which two sources of evidence point to different response outcomes and, consequently, can be considered a type of “anti-configurality” in which the whole maybe sometimes worse than each of the individual parts. I will argue that the effect of conflicting information depends on the processing architectures and derive a new measure of information processing called the conflict contrast function by drawing an analogy to the capacity of an information processing system. I will show results from several experiments and show that this novel measure provides convergent evidence to other measures based on the Systems Factorial Technology (Townsend & Nozawa, 1995; e.g., the Mean Interaction Contrast and the Survivor Interaction Contrast) about the underlying processing architecture. This measure may prove useful to the study of configurality as it lends itself naturally to certain types of configural tasks.

Toward a Field Theoretic Model of Aesthetic Preference in Spatial Composition

Steve Palmer

University of California Berkeley

I will present data on contextual effects in people's aesthetic preferences for spatial composition within rectangular frames. I will argue that a field theoretical framework may be appropriate for modeling them, in which repelling and attracting "forces" operate on objects to determine their best position, depending on the object's spatial relations to various elements of the frame (e.g., its center, edges, lines of local and global symmetry) and other elements contained within the frame.

Figural Cues (not Figures) Reduce Uncertainty Regarding Target Location

Mary A. Peterson[1], Andrew Mojica[1], Elizabeth Salvagio[1], and Ruth Kimchi[2]

1. University of Arizona; 2. Haifa University

Do figures automatically attract attention? Target discrimination studies by Nelson and Palmer (2007) suggested that they do. They used elongated rectangular displays divided in half by a central border that suggested a familiar configuration on one side but not the other. Previous studies had shown that familiar configuration is a figural cue (e.g., Peterson & Gibson, 1994). Participants identified targets faster and more accurately when they appeared on the familiar configuration side of the border. Nelson and Palmer concluded that figures *automatically* attract attention, because targets appeared equally often on both sides of the border, and there seemed to be no reason to attend more often to the familiar side. Nelson and Palmer could not distinguish whether figures or figural properties underlay these effects because familiar configurations are perceived as figures on a large percentage of trials. We examined whether similar results are obtained for convexity, a less reliable figural cue. Targets appeared equally often on the convex and the concave side of the central border of bipartite displays. Participants discriminated target identity (x, y) and then reported whether the target was shown on the region they perceived as the figure or the ground. Discrimination responses were faster for targets that appeared on the convex rather than the concave side of the border, *but this pattern of results was found only when the target location was highly variable; w*hen target locations were more predictable, discrimination latencies did not differ as a function of the side on which the target appeared. Thus, attention is not automatically drawn to figures; uncertainty regarding target location is critical. Finally, our results indicated that figural properties rather than perceived figures were instrumental: discrimination latencies did not differ for targets shown on figures versus grounds. In a second experiment, we showed that, like convexity, targets on the familiar configuration side of the border are privileged only under conditions of uncertainty regarding target location. Our results show that figural properties can reduce uncertainty regarding target location. The finding that figural properties rather than figures are instrumental suggests that these effects operate before or during figure assignment.

A new performance measure of perceptual grouping

James Pomerantz, Bethany Qiang, Kimberley Orsten

Rice University, Houston, Texas, USA

One of the major advances since Gestalt psychology began has been the development of performance measures of perceptual organization, including Garner interference, configural superiority, and many others. Here I present a new measure that is applicable to search displays, especially those where observers search for a singleton target in a field of identical (homogenous) distractors. Such fields often yield pop out, although sometimes they yield false pop out wherein one of the homogeneous distracters pops out. When asked to locate the odd item out, observers pointing responses usually center on the actual target (the singleton), but when the grouping structure of the search field shifts from single items toward pairs of items, pointing responses systematically move away from the singleton and toward the distractor with which it groups. Basically, observers now point at the odd pair, not at the single odd element. Bonus: an update on pure false pop out.

Connecting the dots: Configuring humans from sparse and uncertain visual information

Steven Thurman & Hongjing Lu

Department of Psychology, UCLA

Johansson (1973) developed the first point-light biological motion display over 40 years ago, which launched an extremely active field of research that now spans many topics and domains. Point-light displays typify many principles of gestalt perception – a sparse set of dots representing human joint movements leads irrevocably and irresistibly to a phenomenal impression of human activity. Much of the early research helped to establish that configural processing, much like faces, plays a central role in biological motion perception. Inverting the figure or scrambling the elements in space or time will classically demolish the global gestalt. The intimate connection between point-light biological motion and gestalt psychology is palpable, if not explicit in current theories. The phenomenology of seeing a point-light display in action is certainly more than the sum of the individual dot trajectories. Or is it? Here, we will examine recent research exploring the complex relationship between configural and motion cues and their contribution to biological motion perception. We further examine the impact of sensory uncertainty on these processes, highlighting the exquisite nature of cue integration in dynamic shape perception more generally. Last, we consider computational approaches to biological motion that might accommodate these latest findings.

Proposed Definitions for Configural Terms

James T. Townsend

Indiana University

From earlier sallies into this treacherous mine field, the author proffers some definitions for terms like “feature”, “dimension”, “featural order”, “holism”, “matching” and “emergent feature”. The definitions rest on rigorous mathematical underpinnings but can be expressed in ordinary language, which will be emphasized here.

Local advantage or global disadvantage in ASD?

Peter A. van der Helm

KU Leuven – University of Leuven, Laboratory of Experimental Psychology

A cognitive architecture is a neurally plausible model that unifies mental representations and cognitive processes. I apply such a model to re-evaluate the local advantage phenomenon in autism spectrum disorders (ASD), that is, the better than typical performance on visual tasks in which local stimulus features are to be discerned. The model takes perceptual organization as a stimulus-driven process yielding hierarchical stimulus organizations, and attention as scrutinizing the hierarchical structure of established percepts in a task-driven top-down fashion. This combined action of perception and attention accounts for the dominance of wholes over parts, and implies that perceived global structures mask incompatible local features. Building on this model and on empirical (both behavioral and neurophysiological) and theoretical (both logical and computational) evidence, I argue that the local advantage phenomenon in ASD is a side effect of a global disadvantage caused by impaired neuronal synchronization.

Not all Gestalts are equal: The encoding of parts and wholes in the visual cortical hierarchy

Johan Wagemans

KU Leuven – University of Leuven

Gestalt psychology argued that the whole is different from the sum of the parts. Wholes were considered primary in perceptual experience, even determining what the parts are. How to reconcile this position with what we now know about the visual brain, in terms of a hierarchy of processing layers from low-level features to integrated object representations at the higher level? What exactly are the relationships between parts and wholes then? I will argue that there are different types of “Gestalts” with their own relationships between parts and wholes, both in visual experience and in their neural encoding. Some Gestalts seem to be encoded in low-level areas based on feedback from higher-order regions. Other Gestalts seem to be encoded in higher-level areas, while the parts are encoded in lower-level areas. In some cases, this happens without suppression of the parts (“preservative Gestalts”); in others, with suppression of the parts (“eliminative Gestalts”). I will briefly sketch a few studies from our own lab to illustrate these different types of Gestalts and to provide empirical support for the general conclusion that not all Gestalts are equal. I hope that the specific conceptual refinements made may help to motivate further research to better understand the mechanisms of how parts and wholes are encoded in the visual cortical hierarchy.

Qs. 1 and 3