Object recognition 1

Rosch & Gestalt

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Object recognition

We do it effortlessly yet no one knows how. The theories are appealing, but don't explain much.

Definitions

Basic categories (Rosch)

Gestalt (Wertheimer)

Features (Barlow, Treisman, …)

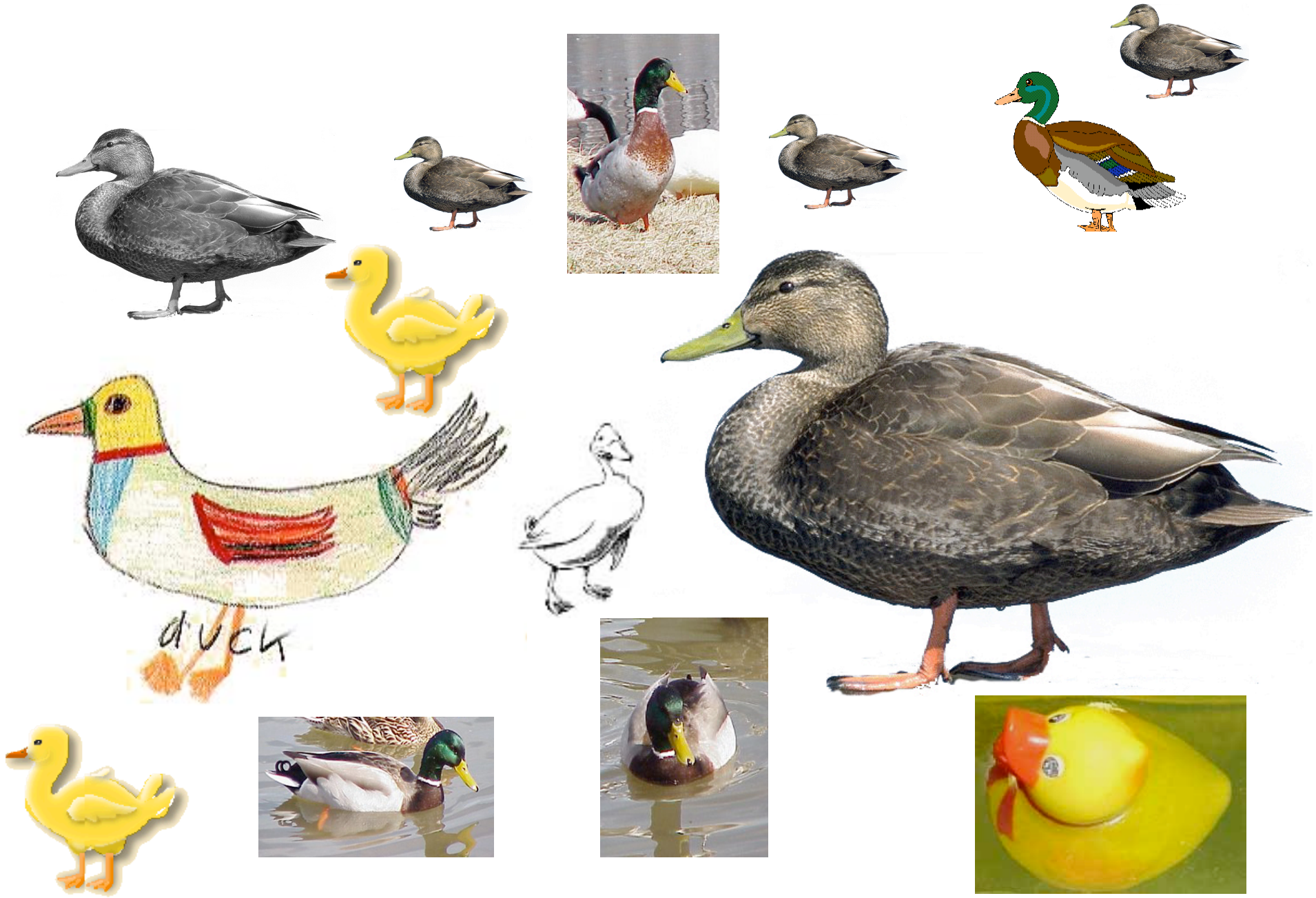
Bayesian (Marr, Poggio, …)

What is recognition?

- Assigning an image of an object to a category. Calling a chair a chair, despite variations in style, viewpoint, rendering, and surrounding clutter.

- This match can serve various purposes:
  - Naming: “moose” “squirrel”.
  - Individual identification: “Bullwinkle” “Rocky”.
  - Recognition memory: I saw that moose before.
  - Matching: this moose and that moose are the same moose.

Invariance of recognition



Novel examples need to be recognized…

Occlusion: recognition when only *part* of an object is visible…

Categorization

A category exists whenever two or more distinguishable objects or events are treated equivalently. This equivalent treatment may take any number of forms, such as labeling distinct objects or events with the same name, or performing the same action on different objects. Stimulus situations are unique, but organisms do not treat them uniquely; they respond on the basis of past learning and categorization. In this sense, categorization may be considered one of the most basic functions of living creatures.

Mervis and Rosch 1981

Classical view of object categories

Definition specifies necessary and sufficient properties.

Problems

It's hard to define most natural categories. (Wittgenstein)

Fails to predict:
typicality (freq. & family resemblance) (Rosch)
unclear membership
intransitivity

Murphy 2002 *The big book of concepts.* Chapter 2.

Furniture	**Fruit**
chair	orange
sofa	apple
table	banana
dresser	peach
desk	pear
bed	apricot
bookcase	plum
footstool	grapes
lamp	strawberry
piano	grapefruit
cushion	pineapple
mirror	blueberry
rug	lemon
radio	watermelon
stove	honeydew
clock	pomegranate
picture	date
closet	coconut
vase	tomato
telephone	olive

Ordered by typicality.

From Rosch and Mervis (1975).

Theories of object categories: prototype vs. exemplars

Prototype. A summary representation. A single unified representation of the entire category.

Feature list.
Features that are usually found in the category members, but some features are more important than others.
Successes:
Borderline cases. Typicality.

Exemplars.
The conceptual category is represented by the set of remembered items.
Successes:
Borderline cases. Typicality.

Murphy 2002 *The big book of concepts.* Chapter 3.

Eleanor Rosch (1976) noted that children learned categories first in terms of concrete cases rather than defining features. Many tests showed that robins were much better "prototypes" of the class bird than were chickens or ostriches. And carrots were a better example of vegetable than were pickles. Rosch defined a hierarchy of categories: superordinate, basic, and subordinate:

- A basic category is the largest class of which we can form a fairly concrete image, like chair or ball. These are the first classifications that children make.

- Superordinate categories are collections of basic categories: furniture includes chairs, lamps, desks, beds, etc. Toys include balls, dolls, furry animals and blocks. No one object clearly represents them.

- Subordinate categories represent divisions of basic classes: such as deck chairs, bar stools, teddy bears or school desks.

Rosch stated that the functional purpose of classes was "to provide maximum information with the least cognitive effort." Although all classes are fuzzy in nature, members of a language group maintain communication by rounding them off to their core, to their most common prototypes. These common prototypes have many features in common, although other members of the same class might share only a few of those features. For example, define a chair. And then think of whether or not a beanbag chair would fit in your definition? And what about a swing? Or a saddle? Or a throne?

http://www.sis.pitt.edu/~mbsclass/hall_of_fame/rosch.htm

Basic category

Preferred, used spontaneously,

Shortest name.

Shortest reaction time.

Learned first by children.

Most inclusive level at which one drawing can represent them all.

Most inclusive level at which category members share many attributes.

Superordinate category - functional (keeps you warm, you wear it)

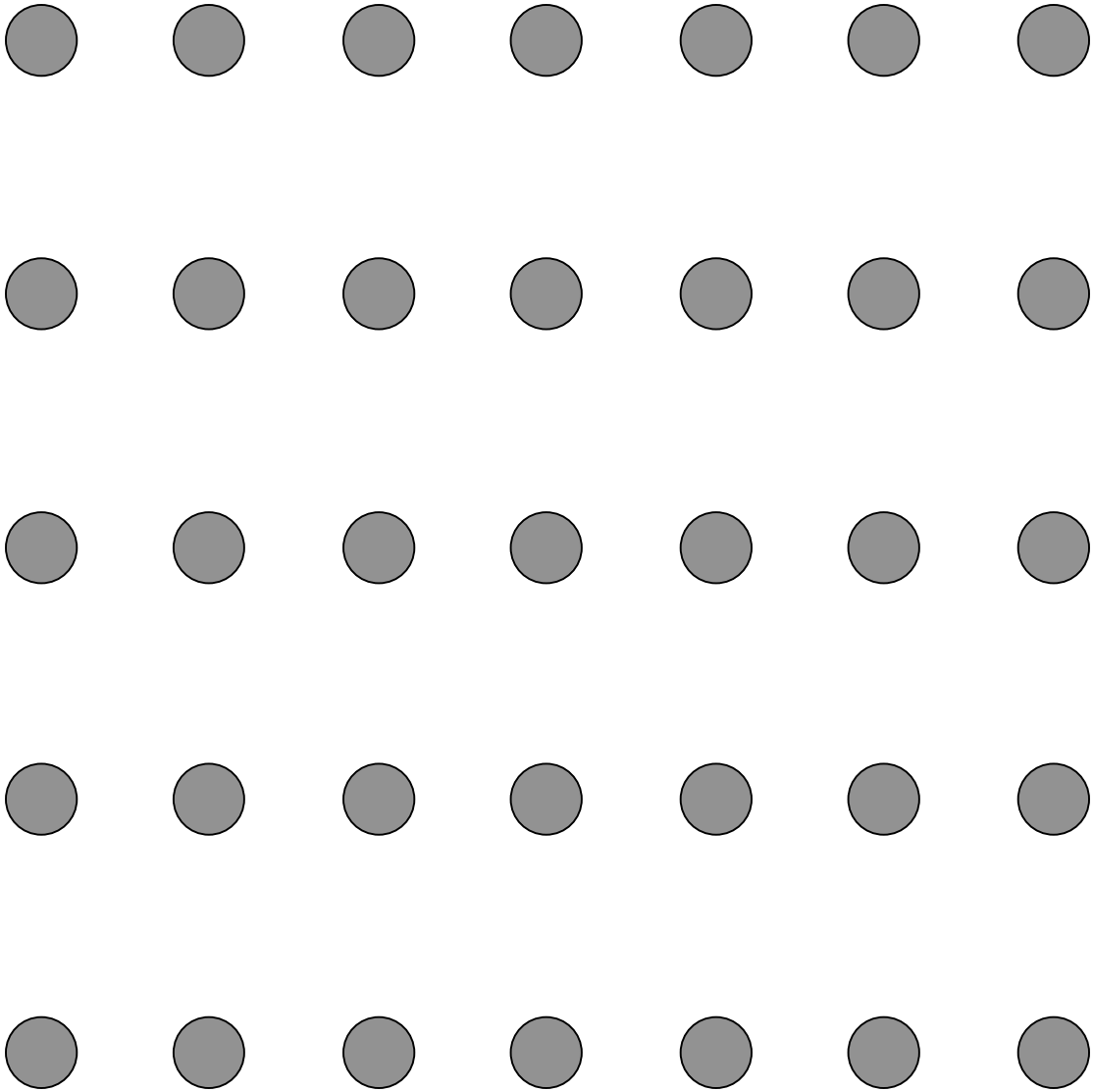
Basic category - noun and adjective properties (legs, buttons, belt loops, cloth)

Subordinate category - adjective (blue)

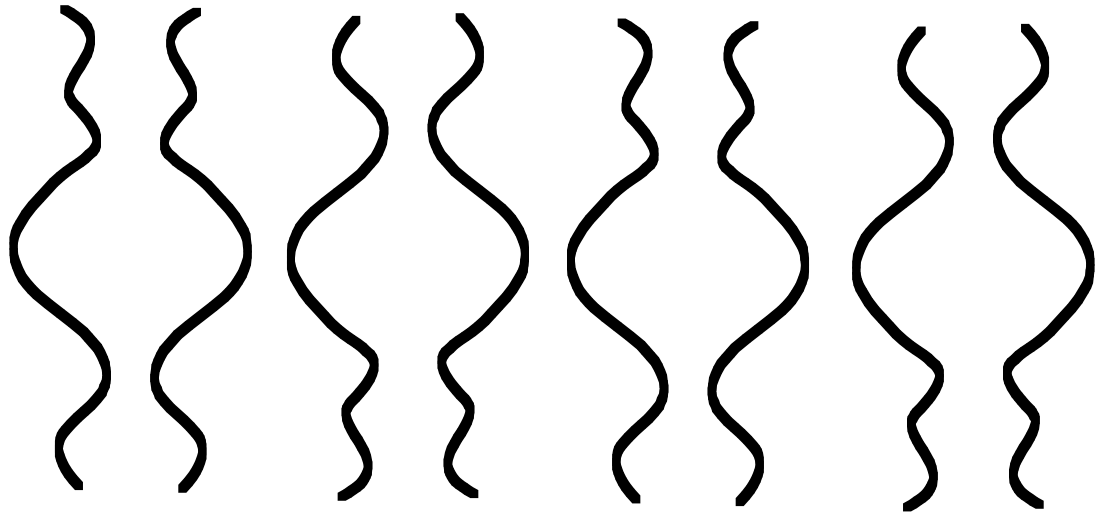
Gestalt: perceptual grouping

- Similarity
- Proximity
- Good continuation
- Symmetry

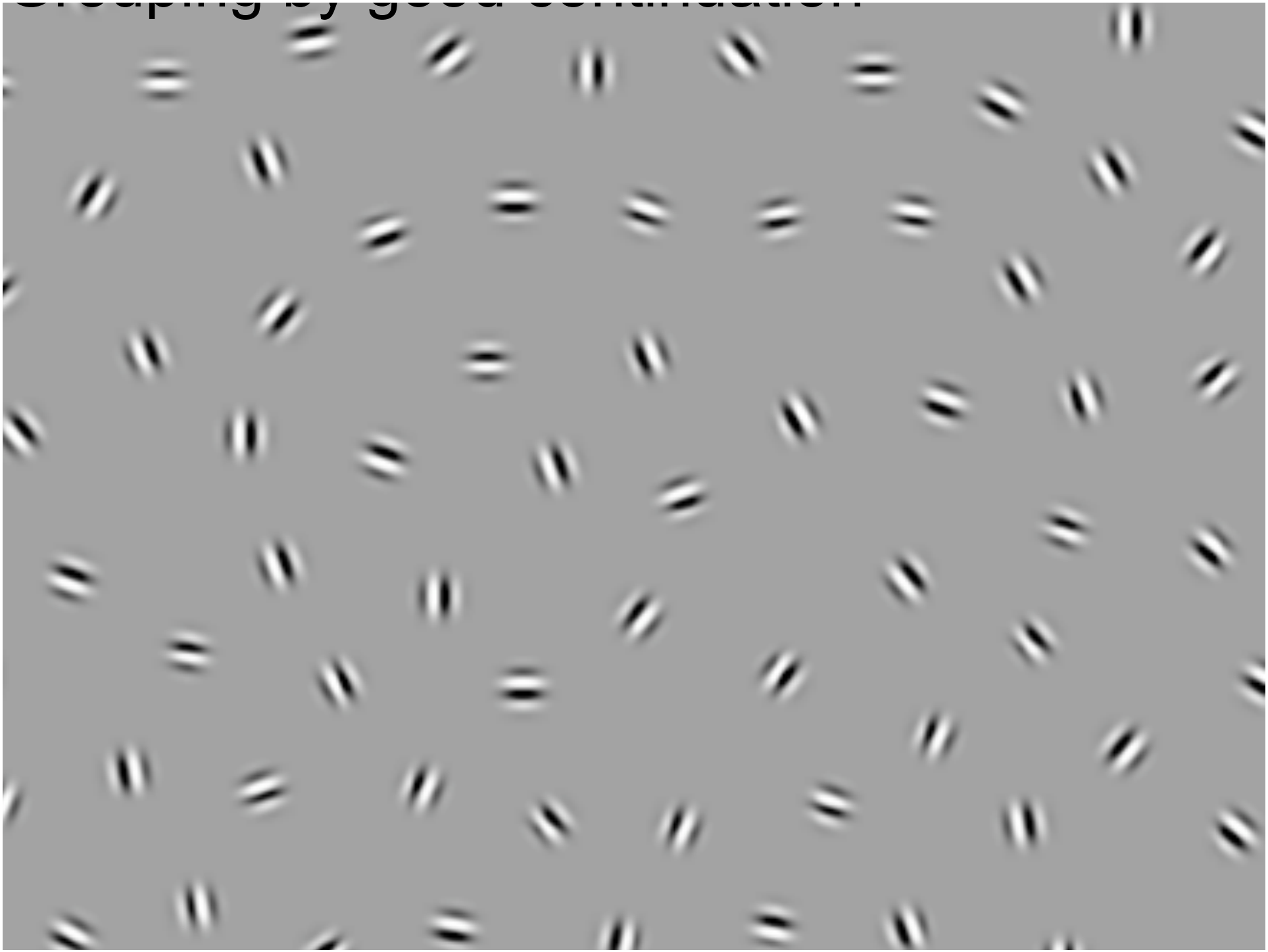
Grouping by proximity



Grouping by symmetry



Grouping by good continuation



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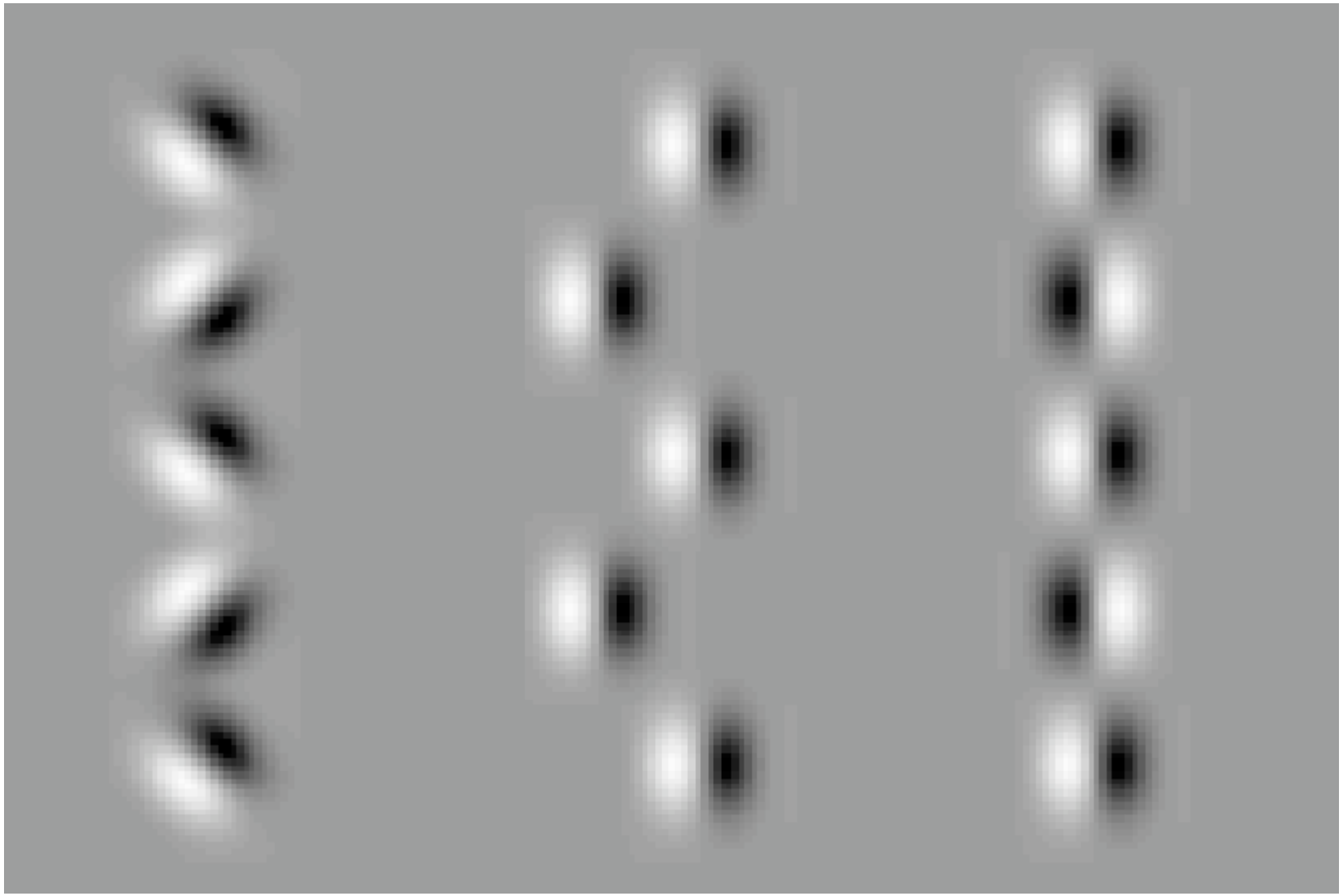

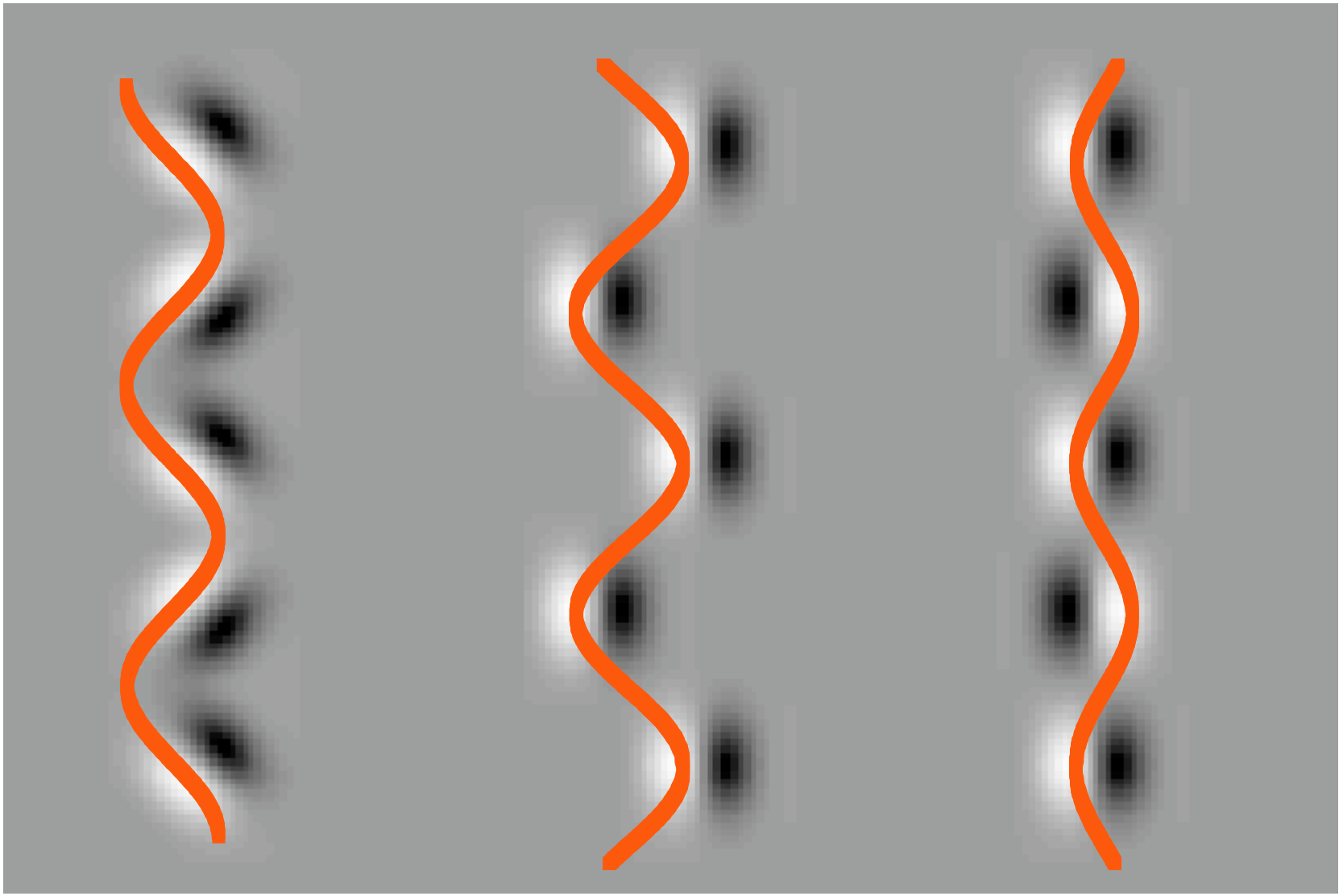

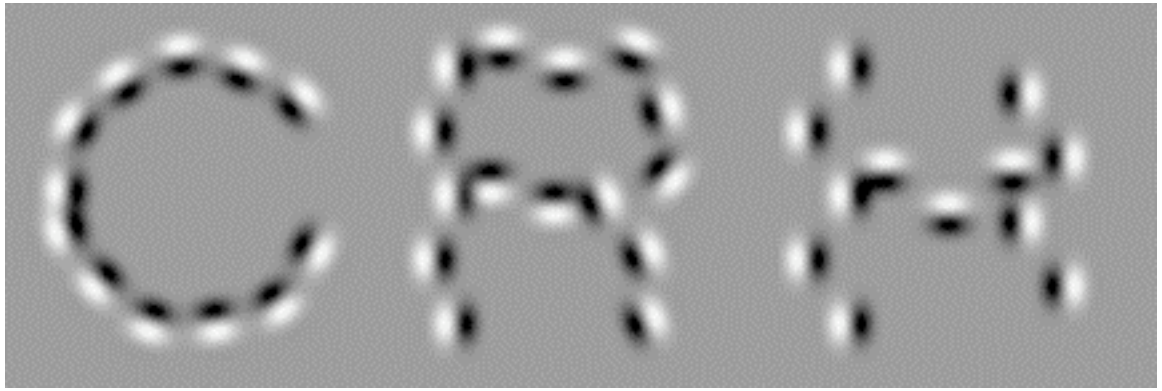

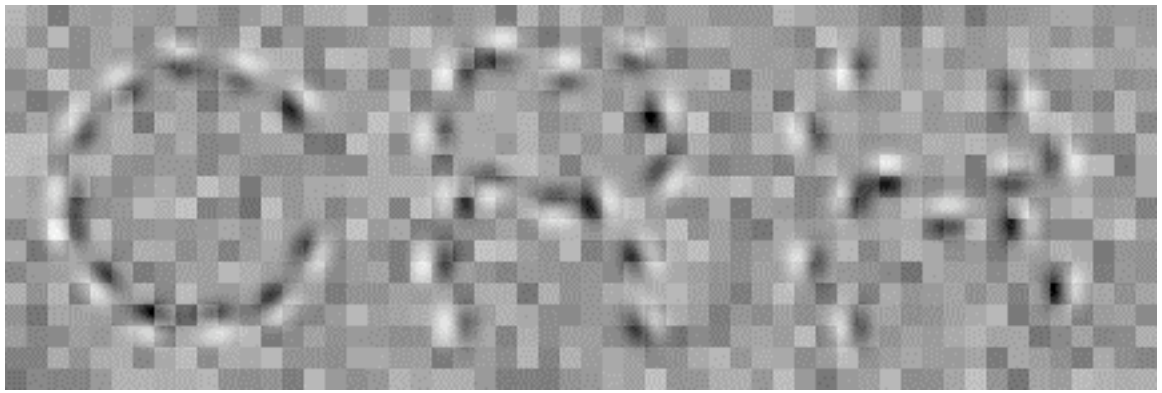

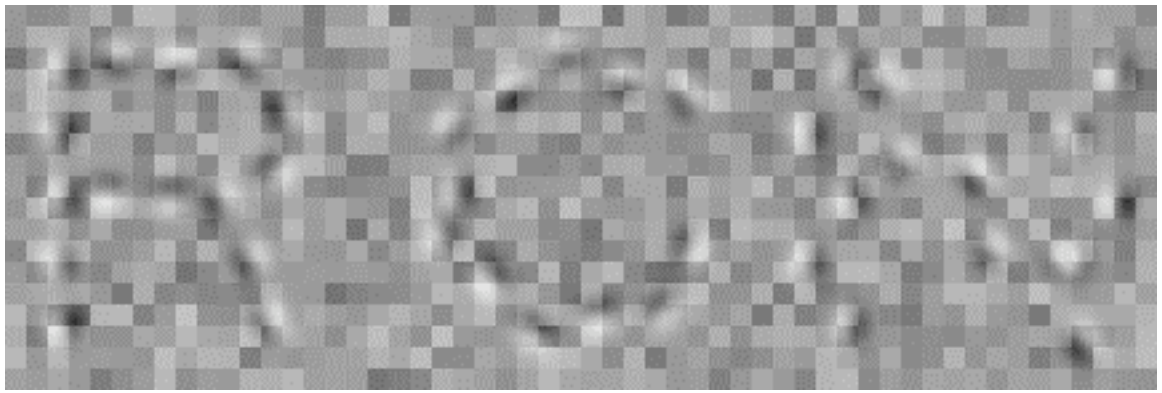

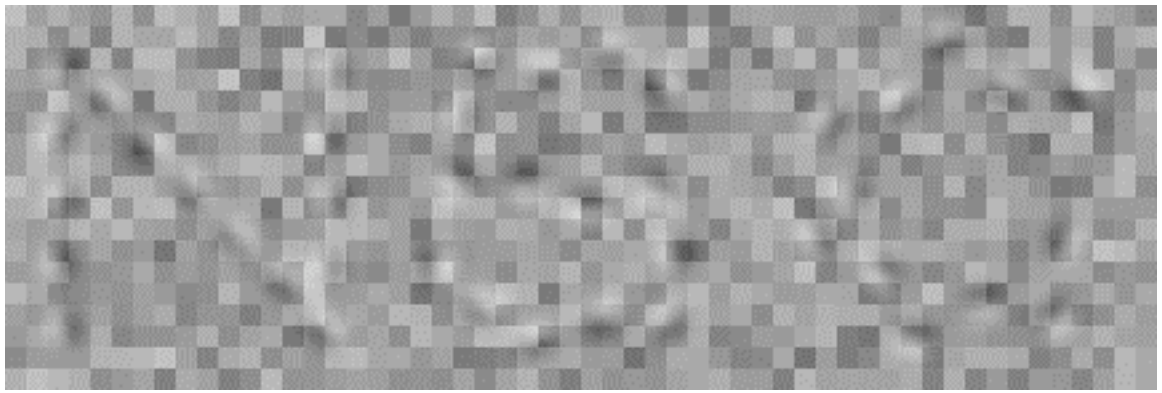

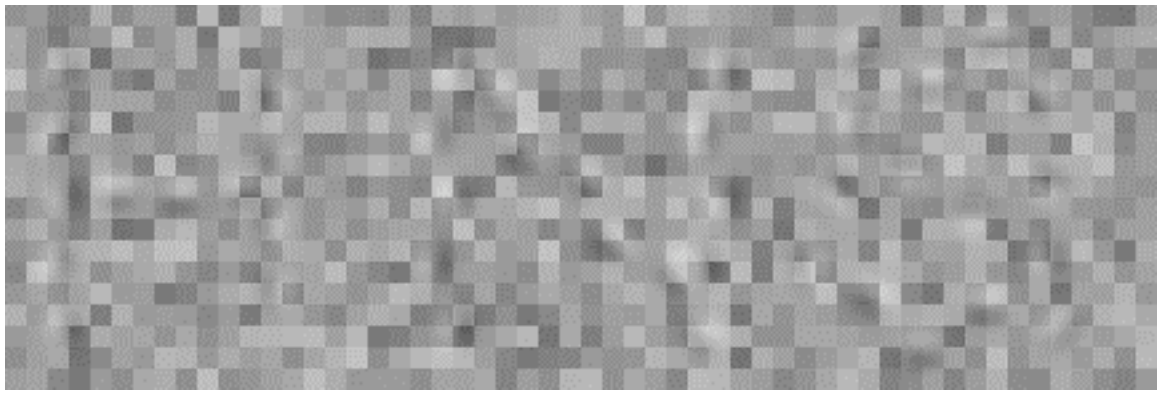

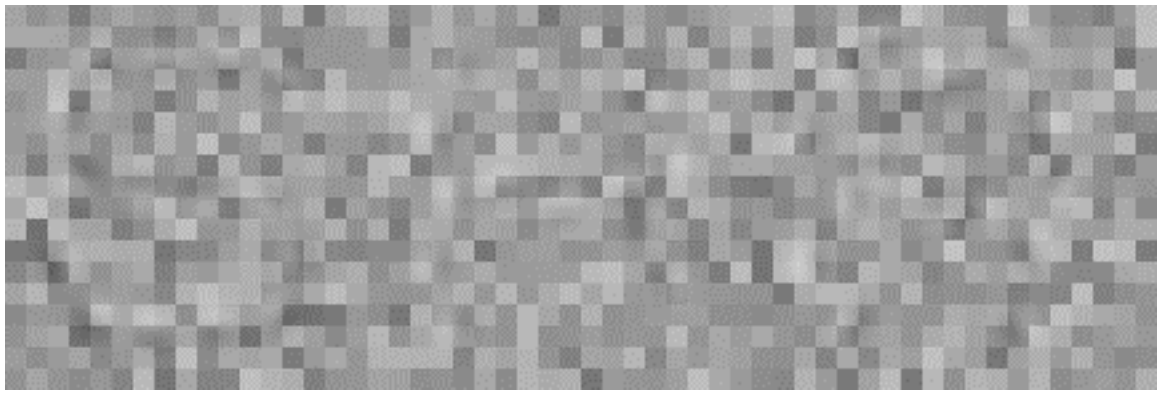

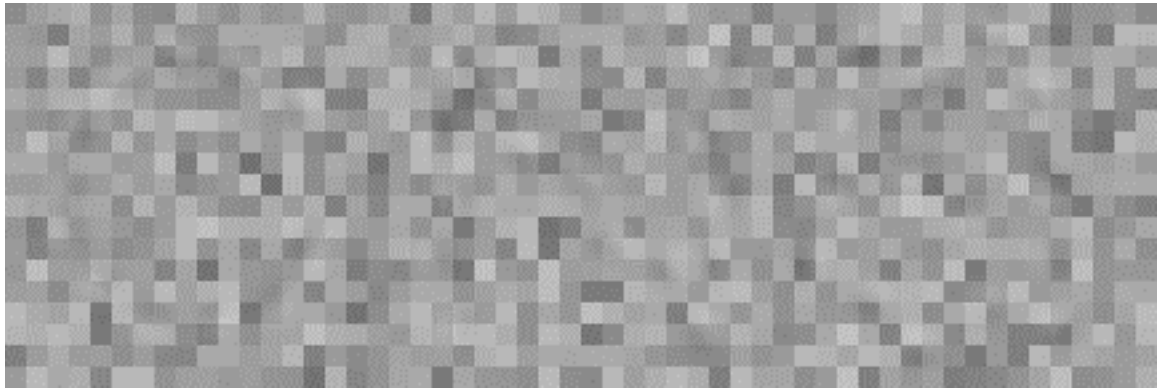

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The end