Balancing the expected and the surprising in Bridget Riley's disc paintings

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Hypothesis

There is an an æsthetically interesting range where between a quarter and a half of a regular pattern is modified.

Take a regular arrangement of discs. I suggest:

Removal of 50% or more of the discs leaves insufficient of the pattern for the brain to spot any underlying structure to the discs' arrangement.

Removal of less than 25% of the pattern leaves a "pattern with holes": the human brain can easily complete the pattern and we see simply an incomplete version of the whole pattern.
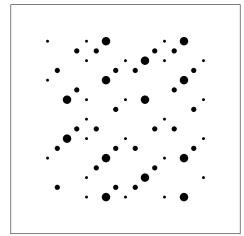
Removal of between 25% and 50% of the discs produces a result which has sufficient structure for the underlying pattern to be discernible and sufficient lack of structure for effort to be required to discern that underlying pattern. The work is thus seen as a work in its own right, rather than an imperfect version of the pattern.

Expected vs surprising

I suggest that the trade-off between the expected and the surprising operates in two opposing, complementary, ways: **we expect a pattern** and are surprised by the deviation from the pattern; and, conversely, **we expect no pattern** and are surprised by the hints of pattern that emerge on prolonged viewing.

More complex adjustment

Fragment 6/9 (1965), screen-print on plexiglass, 625×720 mm, limited edition of 75 prints.

This is not created by simple deletion. Assuming the regular pattern below, we must adjust 43% of the discs, leaving 57% alone. The adjustments are: delete disc (9%), insert disc (12%), move

The disc paintings

Bridget Riley produced three disc paintings. My experimental work was inspired by asking why she chose particular arrangements of discs as being, somehow, the "right" arrangements. This led to my making a range of variations and then to hypotheses about what is going on.

White Discs 2 (1964), emulsion on hardboard, 104×99 mm, the design is a regular pattern from which 30% of the discs have been removed.
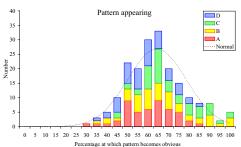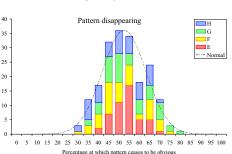
Experiment

The experiment refines the hypothesis to two specific questions: How much of a pattern needs to be present for it to be immediately obvious to a human observer? How much of a pattern can be removed before it ceases to be obvious to a human observer?
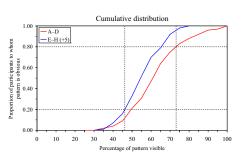
Participants were first shown patterns that gradually appeared over 30 seconds (A–D). They indicated when the pattern became obvious. They were then shown patterns that gradually disappeared over thirty seconds (E–H). They indicated when the pattern ceased to be obvious.

There was a significant difference between the point at which a pattern becomes obvious in the increasing runs and the point at which a pattern ceases to be obvious in the decreasing runs. This indicates that there is a range of values for which the pattern is not obvious but for which a pattern may still be discerned.
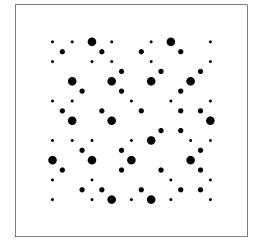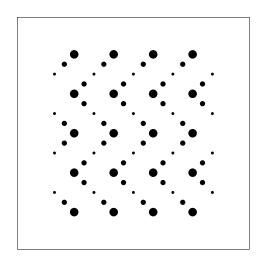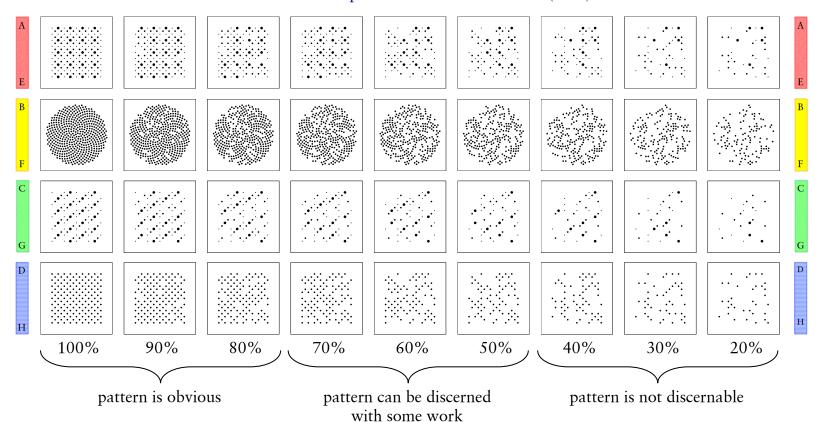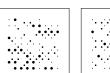
The cumulative distribution shows that, on the increasing stimuli, the pattern is obvious in over 80% of cases where 73% of the pattern is visible, and that, on the decreasing stimuli, the pattern is not obvious in 80% of cases where less than 46% of the pattern is visible. If the pattern is not known, as is the case if the perturbed pattern is presented as an artwork, then we need to consider only the increasing stimuli. This increases the lower value from 46% to 50%. This supports the hypothesis that the æsthetically interesting range is between about 50% and about 75% of the pattern being present.

When does the pattern become obvious? (A–D)

When does the pattern cease to be obvious? (E–H)

100%	90%	80%	70%	60%	50%	40%	30%	20%

pattern is obvious | pattern can be discerned with some work | pattern is not discernable

Is there more going on?

The art is not just in adjusting a certain proportion of discs. Riley has also ensured that her compositions are balanced. The examples at right show the imbalance that results from using just a pseudo-random number generator.