How do painters represent motion in garments?
Graphic invariants across centuries

SIMONE GORI *, RICCARDO PEDERSINI and ENRICO GIORA

Department of General Psychology, University of Padua, Italy

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Abstract—Western visual art has radically changed throughout the centuries: different techniques, interest in the representation of reality, and use of graphic signs. Indeed, only a few pictorial cues have retained the same meaning and use. These kinds of graphic invariants may play a key role not only in a comparative study of art history, but also for discovering underlying common perceptual mechanisms. Here the aim is to show that western painters use the same graphic solutions to represent motion in garments, across countries and centuries. A pilot experiment, using 160 paintings representative of all main western European art movements from the thirteenth to the twentieth century, shows that different artists represented the motion of garments with the same orientation, curvature and convergence of lines. Experiment 1 demonstrates, with a smaller sample of paintings (16, i.e. two per century) that the relationship between orientation, curvature and convergence of lines is a good predictor of perceived motion. Experiment 2 shows how the same garments, isolated from the context of the paintings, still give different dynamic impressions according to the same rules. Finally, Experiment 3 confirmed the same results, whilst patterns previously used are simplified to their geometrical structure. These results call for an underlying perceptual mechanism that specifically recognizes orientation, curvature and parallelism levels as cues of motion in a static pattern.

Keywords: Art; depth; graphic invariants; motion perception; static cues of motion.

INTRODUCTION

The history of western visual art is characterised by radical changes in every aspect of the representation of reality, depending on the historical setting of the painters (Gombrich, 1972). Indeed, when thinking about European western paintings, it is easy to find conspicuous differences in the use of graphic signs, especially depending on time and artists’ tastes. Hence, if some graphic solutions employed to represent reality are used constantly, it may be deduced that our perceptual system uses and recognises them unambiguously.
Representation of reality was not the first aim in any given period; moreover, each single artist made very specific choices on how to depict it. Even the so-called ‘mirror of reality’ that some artists tried to achieve in their works, especially before the invention of photography (Cutting, 2002), was not an absolute priority for many others. In other words, sometimes paintings were an impressive attempt to create a realistic representation, but at other times the artist wished to create something far from the reality he was observing. This happened for many different reasons, among which was the symbolic value of some artworks. This premise explains why it is so rare for one graphic solution to stay unchanged through centuries. Finding a few unadulterated graphic solutions could be interesting for both art history and visual perception (Gombrich, 1977). Furthermore, their attestation in works lacking a primary interest for representing reality may mean that it was not only the artist’s taste that determined their choice.

We decided to study motion in paintings. Paintings are static patterns that a priori cannot change over time. Nevertheless everybody has experienced an impression of dynamism observing a painting in a museum or in an art book. It is not an illusory motion like that perceived, for example, in the Enigma figure (Leviant, 1996), but it is still a clear perception of dynamism. In viewing some paintings, observers will report that the scene is dynamic, even if nobody would assert that there is any kind of physical motion in the paintings. The objects of our investigation are garments. This choice was made for several reasons: first, the garments are always recognised as cues of motion in paintings; furthermore, they appear in variously dated centuries. Finally, garments have no specific shape, so that they can convey the impression of motion in many ways, unaffected by the constraints of anatomic masses. In his analysis of the phenomenon of perceived ‘dynamics’ in art, Arnheim (1954) describes how diagonal and convergent lines break the balance of a scene. This suggestion reinforced our intention to test how lines composing garments could be a cue for motion.

Summarising, the aims of this article are: to show the existence of a few specific graphic invariants in paintings tied to the representation of motion in garments; to show how to predict the resulting perceived motion using these graphic invariants; to show how these predictors are effective also when the context surrounding garments is erased; and finally how these graphic invariants alone, in the absence of any other cue, are compelling enough to elicit the perception of motion.

PILOT EXPERIMENT

This experiment was conducted by Simone Gori and Caterina Borghini as part of her Laurea thesis directed by Professor Riccardo Luccio. It was investigated how, in different centuries, painters used the same graphic solution in order to give an impression of motion. The garments’ lines were counted and classified as belonging to three different categories: straight/curved, parallel/convergent and orthogonal/diagonal. Afterwards, the frequencies of specific line patterns were