Demonstration of an Aftereffect Occurring in the Tactile-Kinesthetic Domain

The Gravimetric Aftereffect

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Summary. The aim of this work is the demonstration of a tactile-kinesthetic aftereffect. A sequence of stimuli was offered to adult subjects whose task was to compare two weights presented simultaneously to both hands by means of a Piéron gravimeter. In Experiment 1 the inspection stimuli consisted of two successive presentations of unequal weights for a period of 2 x 10 s. The test stimuli consisted of two equal weights rapidly following an inspection stimulus. Control stimuli consisting of two equal weights not preceded by an inspection stimulus were interspersed in the sequence. The results obtained confirm the existence of a contrast effect after presentation of an inspection stimulus. In Experiment 2 the inspection stimuli consisted of a single presentation of two unequal weights for a period of 20 s. The results confirm those of the first experiment and provide data enabling the contrast effect obtained to be interpreted as a Köhler-type aftereffect. In order to avoid confusion with the kinesthetic-figural aftereffect, we propose to call the effect demonstrated here the “Gravimetric Aftereffect”.

Introduction

Although the phenomena grouped under the general heading “aftereffects” have been the object of relatively numerous and varied investigations in the visual domain, this is not true for other sensory modalities. Partly for this reason, we have chosen to take a closer look at a phenomenon occurring in the kinesthetic modality, originally described by Müller and Schumann in 1899, then by Steffens (1900) and Myers (1911) and called the “Weight Expectancy Illusion”: lifting a relatively heavy weight several times consecutively with one hand causes an underestimation of a lighter weight, and vice versa.

Though this effect has been used in previous studies, particularly in probability learning (Brunswik and Herma, 1951; Levin, 1952), it does not appear to have been systematically studied as an aftereffect. In fact, it is still open to what extent the phenomenon can be considered as a perceptual aftereffect. For instance, Mac Nicol and Pennington (1973) and Dinnerstein (1965) interpret the weight expectancy illusion in terms of an “anchor effect”. 

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On this point we find a fundamental and well-established opposition between two conceptions of perceptual processes: the former underlines the role of judgmental factors on the subject's part and tends to explain the modification of judgment in the presence of an anchor by psychophysical phenomena (Parducci et al., 1959; Ross and Di Lollo, 1968); the latter underlines the phenomena which intervene at the level of sensory processes, and tends to emphasize the physiological basis of these phenomena (Köhler and Wallach, 1944; Over, 1971).

However, a careful analysis of the arguments invoked to support one or the other conception shows that there are no operational criteria for distinguishing between the two types of hypothesis.

We have confined ourselves to the definition proposed by Bonnet (1963), eliminating the reference to the figural aspect of the phenomenon: "We speak of an after-effect when the prolonged inspection of a stimulus (inspection stimulus) causes modifications in the perception of a second stimulus (test stimulus) which is rapidly substituted for it within the same perceptual field." Bearing in mind certain experimental conditions which we will describe later, this definition can be applied to the weight expectancy illusion and it is for this reason that we choose to study it in this work.

Experiment 1

Apparatus

The apparatus consisted essentially of a Pieron gravimeter modified to be compatible with certain requirements of the proposed experiment. The modifications were principally concerned with two points: (1) the arms supporting the weights were lengthened to 40 cm to improve the sensitivity of the apparatus; (2) the protective cover was removed to facilitate the rapid handling of the weights by the experimenter.

Experimental Procedure

The subject was seated exactly in line with the axis of the gravimeter, his forearms on the table, his two index fingers placed on the levers, and his eyes masked with opaque glasses. His task consisted of exerting pressure simultaneously on the two levers with his two index fingers, and verbally indicating by "right" or "left", as quickly as possible, which weight he perceived to be heavier. The instructions requested the subject to avoid, if possible, the response "equal" or "I don't know," but were not imperative on this point. Following an auditory signal, the subject had to press the levers, give his response, and was not allowed to release his pressure until he heard a second signal. These auditory signals consisted of clicks previously recorded and delivered by a tape recorder.

A series of four practice trials was run. Each subject undertook a series of 90 weight comparisons composed of five different items A, B, C, D, and E following each other in an order which, although not random, did not present an easily discernible regularity, to minimise the effects of probability learning and anticipation. After the thirtieth and sixtieth trials, the subject was allowed a five-minute rest period.

Table 1 shows the stimulus pairs corresponding to the items A, B, C, D, and E. A preliminary test had shown that item A always evoked the response "right" and B the