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Effect of the similarity on the judgment of simultaneity for visual objects

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The effect of similarity in shape and colour on perceptual simultaneity was studied. The length of each stimulus was 170 msec. The stimuli were presented with different degrees of asynchronization: 40, 60 and 80 msec. Experimental subjects judged the simultaneity of two stimuli.

Results show that objects that are more similar are easier to perceive as siumultaneous. Moreover, the similarity effect on the judgement of simultaneity is not significantly greater when the asynchronization of the pairs were 80 msec than when the asynchronization of the pairs were 40 msec. The data suggest that if the stimuli fall in a brief interval of time (the time of presentness) experimental subjects perceive a whole, regardles of the duration that these stimuli may bear at a physical level.

The results are consistent with the Benussi hypothesis on the influence of structural properties of events on perceptual time.

Some classic studies on the perceptual simultaneity (Fraisse, 1957) represent experimental evidence that a series of events, which are therefore in sequence on a physical time gradient, does not necessarily correspond to the succession of events that inhabit phenomenal time. As an example, the short notes of a very quick melody are heard simultaneously because they fall within a single perceptive event. In fact, in the perceptual world, the judgement of simultaneity depends on the perceptual structure, which is the result of the qualitative relationship between perceptual properties of the objects. In this sense, a phenomenological approach to perceptual time is relevant (Vicario, 1973, 1998).

Vittorio Benussi adopted the experimental phenomenology approach to perception of time in *Psychologie der Zeitauffassung* (1913). He argued that if the stimuli fall within a brief interval of time, they are not perceived individually, each in its own specific position, but rather as a structural whole (a *Gestalt*) which is immediately given to phenomenal experience. In this definition, the phenomenological position of the Graz School appears evident. It favours the study of the articulation of elements rather than the analysis of these considered in isolation. This position is, in fact, directed towards the description of perceptual events and the definition of those laws that govern the formation and the stability in time of such events considered in their unity (Sinico, 1999).

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Differently, a large number of experimental studies have investigated perceptual simultaneity as a temporal resolution of perceptual systems. Exner (1875) reported that if two binocularly presented stimuli appear with a stimulus-onset asynchrony less than about 44 msec, subjects experience them as a single stimulus (see Hirsh & Sherrick, 1961).Numerous other studies investigated the interval between the physical offset of the test stimulus and the physical offset of the probe stimulus for which these two events are judged to be simultaneous. This interval is a measure of the duration of the visible persistence (see Coltheart, 1980).

Another approach to perceptual simultaneity studied the *psychological moment*. Psychological time, for Stroud (1955), is to have a discontinuous structure. The central (cortical) system would produce a scanning, every "moment" of which would last approximately 100 msec. If two events occurred at the same "moment" they could interact and not correspond to the sequence given in the physical gradient. This hypothesis originated with observation that experimental subjects experience perceptual simultaneity if a very short interval separates two or more brief visual stimuli (Block, 1990). Yet, if there were no synchronisation between the central scanning and the physical events, then the two above mentioned stimuli could sometimes fall within a single "moment" while, on the other hand, from time to time they would appear in two adjacent "moments", thus giving rise to a perceptive result which is different every time (Vicario 1973).More recently, other models and explanations were proposed (Fraisse, 1984). The psychological momentum was considered as a travelling-moment

by Allport (1968), in terms of persistence of vision by Efron (1970) and Efron & Lee (1971), as a time quantum by Geissler (1987) and Kristofferson (1980). However, most current theorist (Coltheart, 1980; Long, 1980) believe that perceptual moment models are no longer tenable (Patterson, 1990). Besides, in general these models assume as a basic premise the existence of a mental "calculator" based on cycles of the physical organism. Therefore, the problem simply shifts to the reading of the calculator.In conclusion, Benussi (1913) hypothesised that the perception of simultaneity would be more probable whenever the stimuli show such similarity as to be able to be unified in a visual structure. According to the phenomenological approach to the study of time perception, I investigated the effect of perceptual similarity on perceptual simultaneity. Two events are simultaneous if neither of them is earlier or later than the other. Therefore, I used instantaneous stimuli (see Servire, Miceli & Galifred, 1977; Vicario & Zambianchi, 1998).

METHOD

The present study was designed to test directly the hypothesis that perceptual similarity between different objects can influence the judgment of simultaneity. Specifically, it was proposed that the perceptual simultaneity of two kinds of objects – a red square and a green disk - might be subject to perceptual similarity influence. Besides, the hypothesis was undertaken to examine whether a similarity effect occurs in a different range of duration of the comprehensive stimulation (210, 230 or 250 msec).

Participants

Twelve students (6 males and 6 females) from University of Padua with declared normal or corrected-to-normal vision participated.

Stimuli

The experiment took place in a dark room. Stimuli were generated by an Apple Power Macintosh 9600/350 computer and presented on an Apple ColorSync Display monitor 17'. The monitor has a refresh rate of 75 Hz and the system clock can be read from software with an error lower than 2 msec. The subject observed the display binocularly from a distance of 500 mm. The display monitor was set to maximum overall luminance. The light emitted by the screen was the only source of illumination in the room.

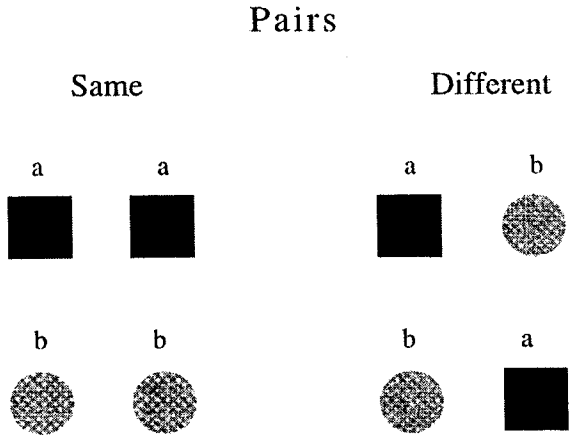

Figure 1. Schematic representation of the pairs of stimuli (same or different) used in the experiment.

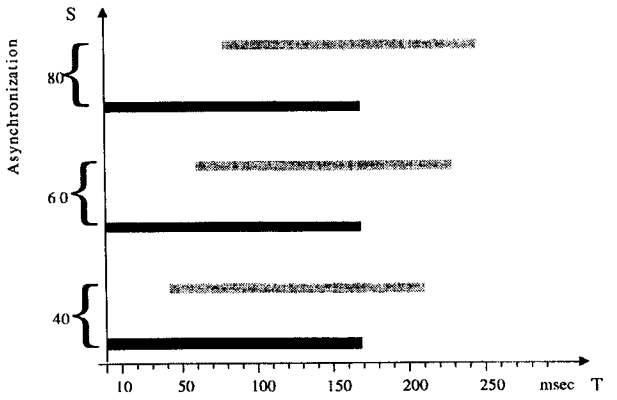

Figure 2. The stimuli of the pairs presented with different degrees of asynchronization: 40, 60, 80 msec.

The stimuli consisted of a red square (A) which measured 10 x 10 mm and a green disk (B) which diameter was 10 mm. They were presented in pairs. All combinations of two stimuli (AA-AB-BA-BB) were displayed (see Figure 1). The distance between stimuli was 165 mm (measured between adjacent edges). Consequently, apparent motion was not experienced. For fixation, a white cross was placed in the middle of the screen. The length of each stimulus was 170 msec, and the stimuli pairs of were presented with different degrees of asynchronization: 40, 60, 80 msec (see figure 2).

Procedure

The task was to judge whether the stimuli within the pairs were simultaneous. Thus, the subjects had to choose among two possible responses: (1) simultaneous; (2) in

succession. The subject entered the response by means of two keys of the keyboard.

There were eight blocks made of 12 trials each. The resulting 96 trials were presented in an individually randomized order to each subject. The experiment took approximately 25 min.

RESULTS

Experimental data were submitted to a 2 x 3 repeated measures analysis of variance (ANOVA). The factors were Similarity (same or different) and Asynchronization (40, 60, 80 msec). The analysis showed that the main effect due to similarity was significant ($F(1,12)= 11.70$, $p<.01$; see Figure 3).

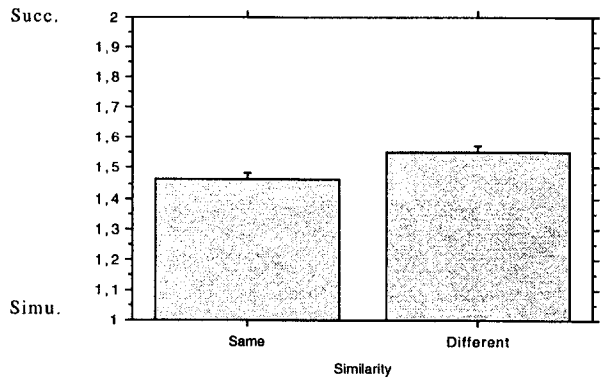

Figure 3. Means of the judgment of simultaneity for same and different pairs of stimuli.

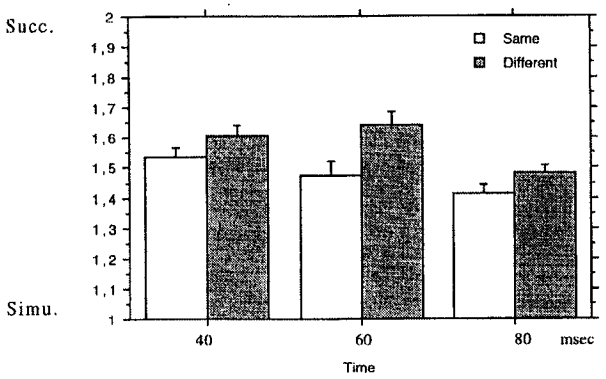

Figure 4. Perceptual simultaneity as a function of the different degrees of asynchronization.

Thus, the hypothesis that perceptual similarity between different events can influence the judgment of simultaneity was supported. Precisely, objects that are more similar are easier to perceive as simultaneous. A comparison among means exhibited only small differences between the asynchronous pairs of 60 msec ($F(1,22)= 8,21$, $p<.01$; see Figure 4). There is no interaction ($F(1,22)= 9,41$, $p= .39$).

The analysis also show that the effect of the variable Asynchronization was significant ($F(2,22)= 9,47$, $p<.01$; see Figure 4), indicating that the judgement of simultaneity depended on the degrees of asynchronization of the objects.

DISCUSSION

In the first place, the present experiment demonstrates that for short time two physical objects seen in sequence do not necessarily correspond to two successive perceptual objects. This result is important as a starting point of the history of the experimental phenomenology because it has established research on the interaction between the phenomenological qualities of objects presented, regardless of the correspondence that these structural relations may bear to physical variable.

Moreover, the aim of the present paper was to test the validity of the Benussi (1913) hypothesis on the influence of visual similarity on perceptual simultaneity. The results show a significant effect of similarity on the judgement of simultaneity: objects that are more similar are easier to perceive as simultaneous.

An additional finding that arises from the present experiment is that the similarity effect on the judgement of simultaneity is not significantly greater when the asynchronization was 80 msec than when the asynchronization was 40 msec. Although these conditions implied (1) a different interval between the physical offset of the first stimulus and the physical onset of the second stimuli and (2) a different global duration on the stimulus (see Figure 2). This result suggests that if the stimuli fell in a brief interval of time (210-250 msec) - the time of presentness (Stern, 1897) - experimental subjects perceived a whole, regardless of the duration that these stimuli may bear at the physical level. Therefore, perceptual simultaneity cannot be accounted for in terms of temporal relationships at the physical level since the time of presentness involves perception of a qualitative relationship between events at a phenomenological level.

REFERENCES

ALLPORT, D.A., (1968). Phenomenal simultaneity and the perceptual moment hypothesis. *British Journal of Psychology, 59*, 395-406.

BENUSSI, V., (1913). *Psychologie der Zeitauffassung* The perception of time. Heidelberg: Carl Winter's,

BLOCK, R.A. (1990). *Cognitive models of psychological time.* Hillsdale: Lawrence Erlbaum Associates.

CATTARUZZA, S. (1999). *Vittorio Benussi: Perception, art, experiment.* Estrella de Oriente, Trento, monographic number of *Axiomates*, 1-3.

COLHEART, M., (1980). Iconic memory and visible persistence. *Perception & Psychophysics , 27*, 183-228.

EXNER, S. (1875). Experimentelle Untersuchung der einfachsten psychischen Processe [Experimental investigation on the physical processes]. *Plügers Archiv für die Gesammte Physiologie.*

EFRON, R., (1970). Effect of stimulus duration on perceptual onset and offset latencies. *Perception & Psychophysics, 8*, 231-234.

EFRON, R., & LEE, D.N. (1971). The visual persistence of a moving stroboscopically illuminated object. *American Journal of Psychology, 84*, 365-375.

FRAISSE, P. (1957). *Psychologie du temps* [The psychology of time]. Paris: Presses Universitaires de France.

FRAISSE, P. (1984). Perception and estimation of time. *Annual review of Psychology, 35*, 1-36.

GEISSLER, G.G. (1987). The temporal architecture of central information processing: Evidence for a tentative time-quantum model. *Psychological Reasearch, 49*, 99-106.

HIRSH, I.J., & SHERRICK, C.E. (1961). Perceived order in different sense modalities. *Journal of Experimental Psychology, 62*, 423-432.

KRISTOFFERSON, A.B. (1980). A quantal step function in duration discrimination. *Perception & Psychophysics, 27*, 300-306.

LONG, G.M. (1980). Iconic memory: A review and critique of the study of short-term visual storage. *Psychological Bulletin, 88*, 785-820.

PATTERSON, R., (1990). Perceptual Moment Models Revisited. In Block, R.A., (1990) *Cognitive models of psychological time.* Hillsdale: Lawrence Erlbaum Associates.

SERVIRE J., MICELI D., & GALIFRED Y. (1977). A psychophysical study of the visual perception of "instantaneous" and "durable". *Vision Research, 17*, 65-69.

SINICO, M. (1999). Benussi and the history of temporal displacement, *Axiomathes, 1-3*, 75-93.

STERN, L.W. (1897). Psychische Präsenzzeit [The psychological time of presentness]. *Zeitschrift für Psychologie und Physiologie der Sinnesorgane, 13*, 325-349.

STROUD, J.M. (1955). The fine structure of psychological time. In Quaster, H. (Ed.), *Information theory in Psychology*, (pp. 174-205). Glencoe: Free Press.

VICARIO, G. (1973). *Tempo psicologico ed eventi* [Psycological time and events]. Florence: Giunti Barbera.

VICARIO, G.B., & ZAMBIANCHI, E. (1998). *La percezione degli eventi* [Events perception]. Milan: Guerini.

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