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The Influences of perceptual grouping on the temporal dimension of auditory events

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Abstract

In this research, it was hypothesized the influence of the vertical segregation of an event on the global duration of the auditory sequences. Two experiments were carried out in which the method of adjustment was used. The result of the first experiment shows that the stimulus onset asynchrony-within decreases when an “empty” interval is placed between two sounds. The result of second experiment shows a reduction of perceptual duration in sequences with vertical segregation of the white noise. These results suggest that temporal dimension of the auditory sequences is related to the perceptual grouping.

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1. Introduction

Many experimental investigations on the perceptual time organization (Fraisse, 1957) represents evidence that a series of events, which are therefore in succession on a physical time gradient, does not correspond to the succession of events that inhabit phenomenal time. As an example, the notes of a very quick melody are heard simultaneously because they fall within a single phenomenal event. In fact, the judgement of simultaneity depends on the perceptual structure, which is the outcome of the qualitative relationship between perceptual properties of the temporal objects. In this sense, a phenomenological approach to perceptual time is relevant.

Benussi used the experimental phenomenology approach to perception of time in *Psychologie der Zeitauffassung* (1913). According to him if the stimuli fall within a short interval of time, they are not perceived individually, each in its own physical position, but rather as a structural whole (a Gestalt) which is directly given to perceptual

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experience. He considers the articulation of elements rather than the analysis of these considered in isolation and he is directed towards the description of temporal events and the definition of those laws that govern the organization in time of such events considered as unity. In this respect, there are a lot of investigations regarding the temporal organising of a short succession of auditory events (see Bregman, 1990). Remarkable literature on the perceptual factors regarding tonal or timbre properties in temporal organisation of auditory events regards investigation on auditory stream (Singh & Bregman, 1997; Cusack & Roberts, 1999; Christison-Lagay, Gifford & Cohen, 2014) and temporal displacement (Rubin, 1949; Vicario, 1963). Investigations concerning temporal proximity and tonal proximity were studied by Bozzi and Vicario (1960) and by Bregman (1990).

An opposite approach to the perceptual organization of temporal events concerned cognitively the *psychological moment*. According to Stroud (1955) psychological time has a discontinuous structure: the central system would produce a scanning every “moment” (it is about 100 msec). When two events fall at the same “moment” they could interact and not correspond to the physical succession. This theoretical explanation derived with observation that subjects experience simultaneity if a very short interval separates two brief stimuli (Block, 1990). The psychological momentum was considered also as a travelling-moment by Allport (1968), as a persistence of vision by Efron & Lee (1971), as a time quantum by Geissler (1987). In any case, many theorist assert that perceptual moment models are cognitively insufficient (Patterson, 1990) because they however assume as a premise a mental “calculator” based on cycles of the physical organism.

Reconsidering the experimental phenomenological approach, it is also well-known that intervals having the same physical duration are not necessarily judged as equal in perceived duration. In many cases, the judgment depends on the non-temporal characteristics of the stimuli (Allan, 1979). For example: a filled auditory interval is perceived as longer than an empty interval of identical physical duration (Craig, 1973); several auditory filled intervals alternating between two intensities and frequencies are judged as longer than constant filled intervals (Brown and Hitchcock, 1965). In the present research, it was hypothesized the influence of the vertical segregation of an auditory event on the global duration of the sequences. I have considered the following auditory sequence studied by Vicario (1963): sound (440 Hz, 100 msec), white noise (35 msec), sound (392 Hz, 100 msec). The experimental subjects claimed the white noise is temporally displaced. In this sequence, according to Vicario (1999), there is a vertical segregation of the white noise because the sounds tend to be grouped by the law of similarity (Werheimer 1923; in auditory field see Bozzi and Vicario, 1960; Bregman, 1990) (see Figure 1).

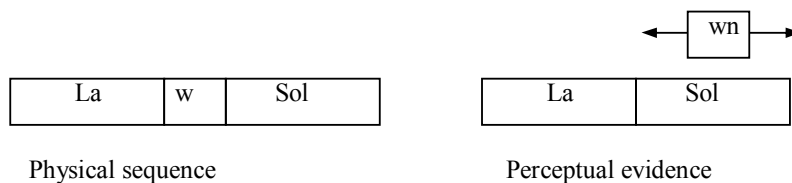


Fig. 1. The physical sequence La (100 msec), white noise (35 msec) and Sol (100 msec) is perceived as two sounds grouped together and the white noise positively dislocated on a different tonal plane.

Two experiments were carried out in order to establish whether the temporal dislocation, on a different tonal plane, influences the perceptual duration of the global sequence.

2. Experiment I

Stimuli. The participants were 10 students (6 men and 4 women) from the University of Padua, ranging in age from 18 to 30 years, with declared normal hearing. The participants were not musicians (professionals or students at the conservatoire). The signals were synthesized by the Sound Edit 16 for Macintosh software. Stimuli were generated by an Apple Power Macintosh 9600/350, amplified by a Technics SU-V560 power amplifier and presented through headphones (Sennheiser HD 570). Participants responded by using a computer keyboard. The experiment took place in an isolated room. The stimuli were three sequences: (A) La 440 Hz, 100 msec; Lab 415.3

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