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Time scale effects in perception of acoustic signals

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The uncertainty principle (Heisenberg [1] as used in quantum mechanics, or Gabor [2] in signal processing), states that it is impossible to measure the energy (frequency) and duration time simultaneously with the infinite measurement accuracy [1]. In the realm of acoustic pulses as perceived by human hearing it would mean that too short pulses cannot produce a sensation of pitch, the latter being represented by a logarithm of frequency. It is surprising that, despite physical restrictions, humans associate some effective pitch to millisecond pulses up to about 20 ms. The effective pitch has been found to increase with decreasing duration time of the pulse [3,4] and we have shown that the relation between the duration time of the pulse and the effective pitch follows a variant of the Weber-Fechner law [5]. Some differences in the timbre are also noticed by some subjects examined.

Thirty-six musicians and thirty-nine nonmusicians have been examined. The behavioural test was held in controlled conditions; every person used the same software and the same audio tools parameters. The participants marked the just noticeable difference in the pitch and the timbre. Statistical analyses of the results will be presented in the communication.

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