

Influence of duration of tone stationary part on perception of starting transient

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ABSTRACT

Sounds of different types of organ pipes were used for the study of an influence of duration of the tone stationary part on starting transient perception. Long sounding tone recordings were truncated from the end in successive steps from original duration about 2 s to the length of 80 ms. Attack transients of tones remains unchanged, truncated tone ends were equally modified with level decrease to silence (fade out). Sets of tones derived from the same original tone were judged on dissimilarity in pairs, focusing on perception of only initial transient part. Results are discussed for tones with various types of transient and stationary part.

1. INTRODUCTION

When getting the stimuli for psycho-acoustic listening tests ready for musical acoustic purposes, it is often necessary to manipulate the recordings of the real musical instrument sounds. One kind of the manipulation can be the shortening of the time duration of the sounds, the other changing of the initial and final transient parts. Using the manipulation not suitable for the case, the results of those tests might be affected by a systematic error. For example when the sound is too short, then the timbre perception mostly defines the transient part of a sound and can even totally reduce the perception of stationary part.

While creating the project with an aim of organ pipe voicing, it was required to compare tones having various transient parts and also judge the stationary part. The question was how long could be those tones for such listening test.

The aim of this work is the subjective evaluation of the effect of the tone shortening on the perception of the initial transient of the tone.

2. METHOD

The recordings of the concert organs in Martinu hall were used for this experiment. The recordings were made for stops of the 1st manual (Spitzgambe 8', Trompete 8', Superoctave 2') and the selected types of transients (see Figure 1 to 4). The recordings were made using two omnidirectional microphones BK 4005 with a base of 175 mm. The microphone was situated inside the organ in the position where the organmaker stays during the pipes voicing. The sounds were digitalized and saved into a PC in a format of 44.1 kHz / 24 bits.

The duration of the recorded tones was about 4 seconds. For experiment they were shortened to 2.0, 1.6, 1.3, 1.0, 0.7, 0.5, 0.4, 0.3, 0.25, 0.2, 0.18, 0.16, 0.15, 0.14, 0.13, 0.12, 0.11, 0.10, 0.09, 0.08 s (see Figure 5).

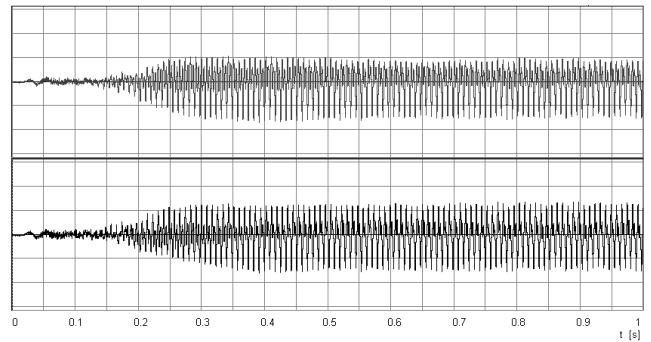


Figure 1: *Spitzgambe 8', tone B2.*

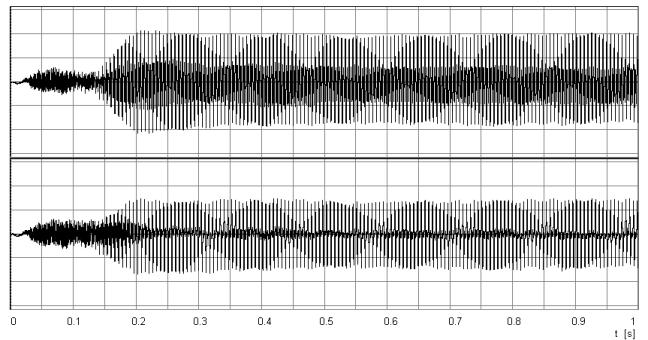


Figure 2: *Spitzgambe 8', tone E3.*

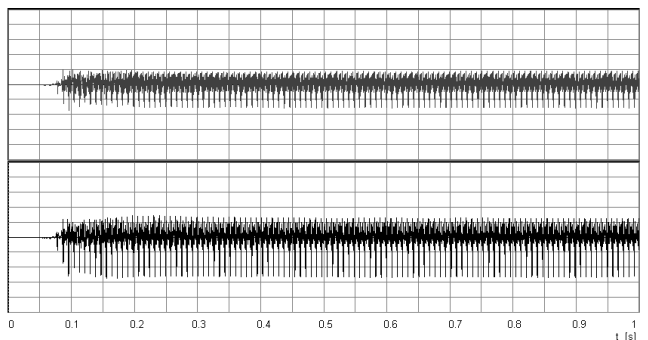


Figure 3: *Trompete 8', tone B2.*

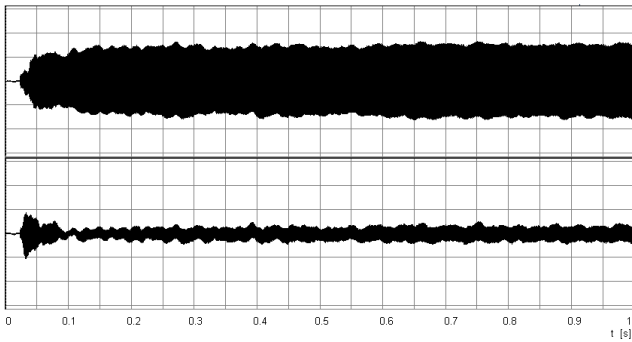


Figure 4: *Superoctave 2', tone B5.*

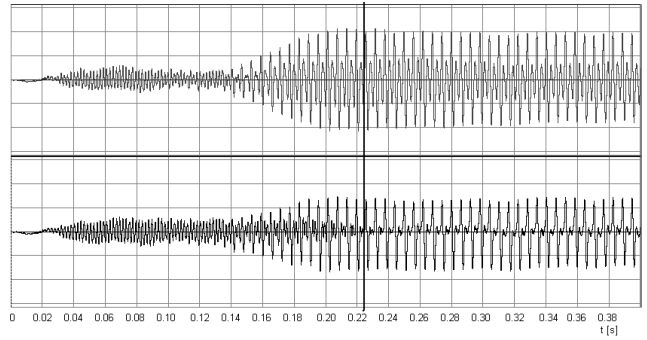


Figure 7: *An example of physical transient duration estimation (220 ms), Spitzgambe 8', tone E3.*

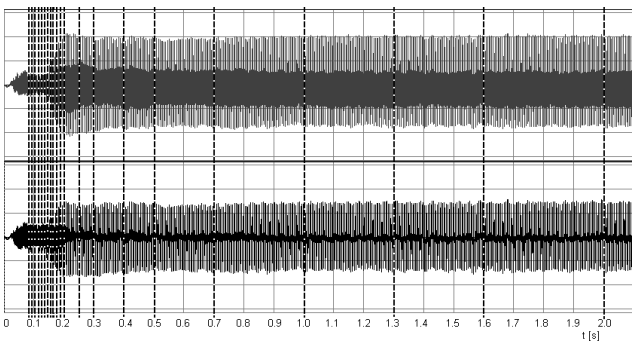


Figure 5: *Positions where the shortening of the tone was made.*

The final part of all tones was treated with a 30 ms fade out (see Figure 6).

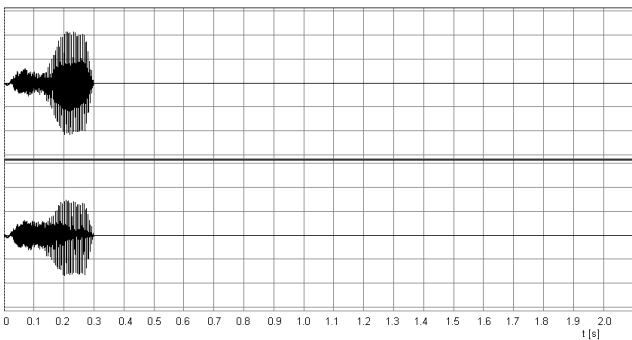


Figure 6: *An example of the 30 ms fade out, Spitzgambe 8', tone E3, duration 0.3 s.*

The estimation of physical transient duration was made from time course of each tone (see Figure 7).

	physical transient duration
Spitzgambe 8', tone B2	0.45 s
Spitzgambe 8', tone E3	0.22 s
Trompete 8', tone B2	0.19 s
Superoctave 2', tone B5	0.11 s

The listening test was done with Sennheiser headphones HE 60 and headphone amplifier HEV 70. The loudness was the same as during the recording. All pairs of the shortening modifications of each tone were listened. The dissimilarities in the initial transient were judged on scale from 0 (no dissimilarity) to 5 (maximum dissimilarity).

3. RESULTS

For the identification of an appropriate tone length, to be used in future listening tests of the comparison of the initial transient, such criterion was established that the tone elongation above this appropriate length does not influence the value of the judgement. On a graph of results in Figures 8 to 11 this length is a start of an area with the same shade of gray.

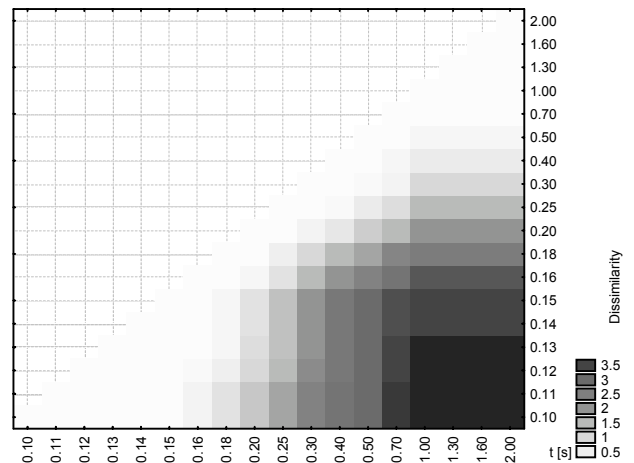


Figure 8: *Resulting dissimilarity pair test judgment for Spitzgambe 8', tone B2.*

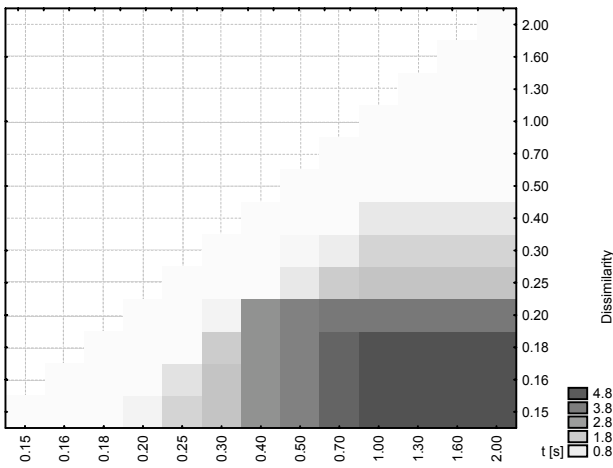


Figure 9: Resulting dissimilarity pair test judgment for Spitzgambe 8', tone E3.

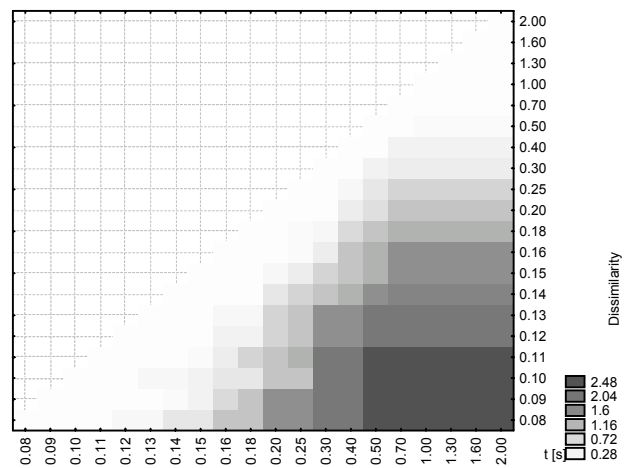


Figure 11: Resulting dissimilarity pair test judgment for Superoctave 2', tone B5.

4. DISCUSSION

Even though none of the physical transients exceeded length of 0.45 s (typically 0.2 s), the stabilization of judgement began mostly at a tone with the length of 0.7 s, even for the length of the transient 0.45 s the dissimilarity judgement is stabilized at 1.0 s. The respondent justifies his judgement by explaining that only by a longer tone he was sure with the end of the transient.

At a tone length comparable with the length of the duration of the physical transient, the dissimilarity of the perception is smaller with the shorter tones, because in both compared tones the expectation remains that the tone transient may continue after its end.

Psychologically the perception of the transient is longer about such duration of the stationary part at which the listener finds out that the initial transient was finished. "About how much longer" and "how dependent and on what" would be possible to state on the basis of another, more complex experiment. For the preparation of a tone for listening tests, this has to be taken into account.

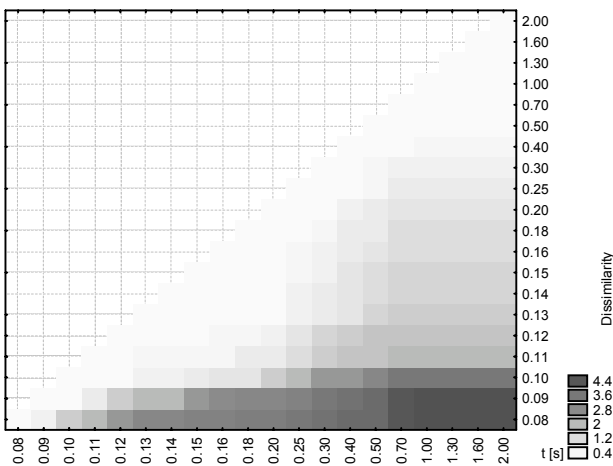


Figure 10: Resulting dissimilarity pair test judgment for Trompete 8', tone B2.

5. ACKNOWLEDGEMENTS

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