

Applicant:

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Short Term Scientific Mission STSM:

Department of Speech, Music and Hearing (TMH)
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Lindstedsvägen 24
SE-100 44 Stockholm, Sweden

Mission period:

12 June 2005 – 24 June 2005

Scientific Report

A detailed report of the activities and results of the missions included in an accompanying document.

Main goals:

1. Study of emotion expression with one of the most commonly performed gestures during everyday life: walking.
2. Comparison of the acoustical rules for emotion expression in walking with those used in music performance.
3. Study of emotion recognition through walking sounds.
4. Characterization of the acoustical criteria used by listeners to recognize emotions.

Additional goals:

5. Study of auditory recognition of walkers parameters (gender, weight) and of shoes properties (size, sole hardness); study of the acoustical criteria for recognition.
6. Comparison of performance in emotions recognitions with performance in recognition of these additional walking sound source parameters.

Activities performed in order to achieve the above mentioned goals (see accompanying document for further details):

1. Walking performance experiment: several participants were asked to walk as if feeling one of several different emotions. A database of walking sounds was acquired.
2. Design of an analysis package for the acoustical characterization of walking sounds.
3. Listening experiment: several participants were presented a subset of the signals in the walking sounds database. They were asked to judge the emotion of the walker and the above-mentioned additional walkers parameters.
4. Design of a statistical test for the comparison of performance in recognition of the walking sound source attributes – emotion included – judged by participants to the listening experiment.

Results (see accompanying document for further details):

1. Emotions expression in walking – comparison with music performance: strong consistencies were found between musical and walking expression of emotions. Three acoustical properties were found used in the same way both in walking and in music performance: tempo, tempo variability and loudness. Strong differences were however found with respect to timbre, articulation and articulation variability. It was argued that walkers did not control these latter parameters. For this reasons it was concluded for a strong acoustical resemblance of emotions expression in walking and music.
2. Auditory emotion recognition: listeners performed significantly above chance in recognizing the actual emotion of the walker. Sadness was found to be the better recognized emotion, happiness the least well recognized.
3. Acoustical criteria for emotion recognition: auditory recognition of emotions was found to be based mainly on the temporal patterning of footsteps, and on sound level-related properties. However, acoustical-based models that explained listening tests data were found only for anger recognition, found based mainly on the average sound level of the footsteps.
4. Auditory recognition of walker gender, weight and of shoe size and sole hardness: listeners were found performing significantly above chance with recognition of these additional sound source parameters. From the acoustical point of view their recognition was found based mainly on spectral properties of the walking excerpts.
5. Comparison of emotions recognition with recognition of additional parameters of the walking sound source: exception done for walker weight, recognition of emotions in general was found significantly worst than recognition of all these other investigated sound source parameters. However, some emotions were particularly well recognized: sadness as source parameter was the third best recognized one, the first and the second being walker gender and shoe sole hardness, respectively.

Additional results (see accompanying document for further details):

- Females were found significantly better at recognizing emotions than males. Virtually no measure of exposure to music or of musical practice explained differences in recognition performance among listeners.

Applicability of results:

- The data collected during the STSM can be used to control synthesis models of walking sounds that generate walking sounds perceived as being generated by a walker of a given weight, gender, feeling one of four different emotions, and wearing small or large shoes with soft or hard soles. Additionally, the large amount of data collected on the acoustical properties of walking sounds might be used to design synthesis criteria for the perception of natural/realistic (i.e. not synthetic) walking sounds.

Publications written using results from the STSM:

- Bresin, R. and Giordano, B. “Do we play how we walk? An experiment on expressive walking”, submitted to *Sound and Music Computing 2005*, Salerno, Italy

Planned publications written using the results from the STSM:

- At least one paper on emotional expression and emotions recognition in walking sounds, probably accompanied by another paper describing the results concerning recognition of additional walking sound source parameters.