Association of Sound movements in space to Takete and Maluma

Amalia de Götzen

Aalborg University Copenhagen
Department of Architecture, Design and Media Technology
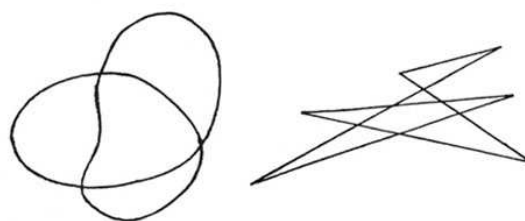Sound and Music Computing
`ago@create.aau.dk`

ABSTRACT

This paper describes an experiment that has been performed to verify if the well known association between the words "takete" and "maluma" and the images of two shapes (one jagged and one rounded) could be replicated using two sound movements in space instead of the visual shapes. In this case the association is not cross-modal since both the stimuli are in the auditory domain, but the connection between words and sound movements is not trivial. A significant preference (twelve out of thirteen subjects) associated "takete" with the jagged sound movement and "maluma" with the round one. Colored noise was used as stimulus. The qualitative answers of the subjects suggest also a possible common expressive intention that could be conveyed by the two words/sound movements: an aggressive attitude to "takete" and a more calm and feminine one to "maluma".

1. INTRODUCTION

Several experiments have been performed since 1929, when Wolfgang Köler found out that there is a general tendency to associate rounded shapes with words containing the vowel "o" and "u" while more jagged shapes with words containing the vowels "e" or "i" [1, 2]. Köler showed for the first time that there is a privileged association between shapes attributes and auditory dimensions. While he was mostly looking into the "angular" dimension of this correspondence, other studies proved it with respect, for instance, to size [3] or aspect ratio [4]. This cross-modal association is present across cultures, and from an early age [5]. The above mentioned effect can be included in the so called *arbitrary-looking cross-modal matchings* [6] that includes cross-modal associations between words and tastes [7], shapes and flavours [8], shapes and smells[9] and also words and kinaesthetic feedback [10]. In this paper we investigate the association between words and sound movement in space. Both the stimuli are auditory one, but the association is not trivial at all. Sound movement into space is a sound parameter that can not easily be associated with words. The idea of this investigation is that sound move-

ment per se can convey expressive intentions as many other sound parameters [11] and that at the same time the same expressive intentions can be conveyed by the sounds of the words Takete and Maluma. So the association is highly correlated to the conveyed expressive content.

Figure 1. Takete and Maluma as used in Köler's experiment.

2. METHOD

The experiment has been carried out in the Multisensory Experience Lab of the Sound and Music Computing group of Aalborg University in Copenhagen, see fig. 2.


Figure 2. The Multisensory Experience lab at Aalborg University in Copenhagen

2.1 Participants

A total of 13 subjects performed both tests. The subjects' average age was 24.4, the youngest subject being 19 years old while the oldest was 34. There were a total of 11 male and 2 female participants, and 5 among them had some musical background and/or were studying an instrument. Each test lasted around 3 minutes. Participants were rewarded with a movie ticket.

2.2 Apparatus and Stimuli

The 2 stimuli were performed through a 16 channels surround sound system (Dynaudio BM5A). Colored noise was used as a test sound. The auditory stimuli as well as the two pre-defined sound movement patterns were generated and scripted using a patch made with Max/Msp 5.1.5. A high order ambisonics technique has been used to synthesise the sound spatialisation. See fig. 3 The two movement lasted 4 seconds each and replicated a graphical representation of the stimuli used in the original Köler experiment, shown in fig. 1. A segmented trajectory was used to synthesize "Takete" and a rounded trajectory was used to synthesize "Maluma".
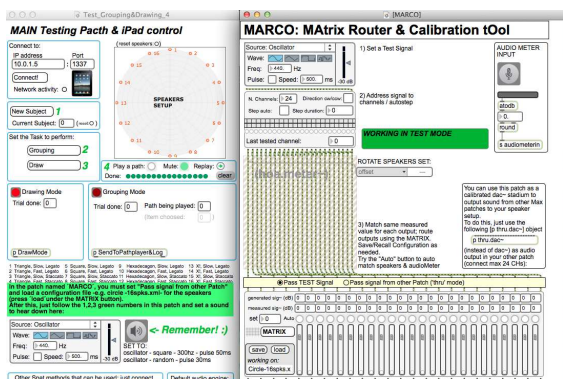
Figure 3. The Max/MSP patch used for the sound rendering. Credits for this patch go to Francesco Grani

2.3 Procedure

Subjects were asked to stand in the middle of a room with a surround audio system made of 16 loudspeakers. The radius of the circle was about 3.5 m. They familiarised with the surround sound system, listening to different sound trajectory for a couple of minutes, just to give them the idea of what a spatialised sound is. Then they were asked to listen to two sound trajectories and to answer the following question: "Who do you think is Maluma and who do you think is Takete?". Very often subjects were asking for the meaning of the two words, saying that they could not understand the question. If such question arised they were instructed not to care about the meaning of the words. Subjects could listen to the two trajectories as many instances as they wished, until they came up with the final association. The time to perform the test (training plus evaluation) amounted to about 3 minutes.

2.4 Results

The results are reported in table 1: 92.3% of the subjects associated the rounded trajectory with Maluma, and the jagged trajectory with Takete; just 2 out of 13 subjects new something about the Köler experiment, but both of them remembered just vaguely about the Kiki and Bouba version of it [4].

It should be noted that the lack of other choices (only 2) in the evaluation by subjects decreases the validity of the experiment: different pairs of sound movements could be

Subject no.	Sex	Prev. knowl-edge	Decision on round traj.
1	female	no	maluma
2	male	no	maluma
3	male	no	takete
4	male	no	maluma
5	male	no	maluma
6	male	no	maluma
7	female	yes	maluma
8	male	yes	maluma
9	male	no	maluma
10	male	no	maluma
11	male	no	maluma
12	male	no	maluma
13	male	no	maluma

Table 1. Subjects' decisions.

associated to the two words. So even if the experiment was ment to replicate the original Köler experiment, the results should be coutiously used.

Beside the quantitative data, the subjects had also to answer two questions. The first question was on their knowledge about Takete and Maluma, while the second one was a kind of open question, looking for comments about the experiment. The last question ("Do you have any comments about the experiment?") provided several interesting observations on the nature of the two sound movements:

- 1 subject categorized them as hard vs soft

- 2 subjects categorized them as agressive/masculine vs calm/feminine

- 1 subject categorized takete as more agressive

- 2 subject cathgorized maluma as smoother

- 1 subject categorized takete as stressed out and maluma as calm

- 2 subjects defined the task "kind of weird"

4 subjects did not provide any answer.

3. DISCUSSION

An interesting element which stems from this experiment lies in the fact that sound location is usually considered a "signalling" information related to the relative position of the source compared to the receiver. While this information may be sometimes relevant and even critical, its importance is highly dependent on – perhaps even secondary to – situation and source evaluation (i.e. timbre). So much so that it is a well known fact that ears discard relative phase information when performing sound object fusion and in the act of listening in general. Position is generally detected with sufficient precision, it is true, but this is interpreted as a variable property of specific sound objects

which does not impact significantly on the perception of the source itself.

Thus, it may come as a surprise to find that when the position of the source is dynamic, that is when the sound source moves with respect to the listener, the quality of the movement is easily associated to the quality of words, replicating quite closely the results of a famous gestalt experiment such as the "takete/maluma" one.

On the other hand, one could say that music composers have understood, albeit intuitively perhaps, the potential expressivity of sound moving through space since many years now. If we do not want to trace back the expressive potential of sound localisation to the "cori battenti" of the Gabrieli brothers in XVI century, we are well aware that in the most important contemporary music compositions of the past fifty years movement of sound in space has constituted a major expressive element. Boulez' *Répons*, the *Prometeo* by Nono, Stockhausen's *Kontakte* and *Oktophonie* and Berio's *Ofanìm* are but a few of the most prominent examples of musical works which feature sound movement in space as an essential expressive element. These (and other) compositions led to early investigation on the expressive potential of sound movement in space [11, 12].

This experiment consolidates the idea that indeed, there is a connection between sound movement in space and expression, and that this connection is quite reliable and robust (at least for clearly defined patterns such as those used for "takete" and "maluma").

4. CONCLUSION

An exploration of the association between sound movement in space and the words "takete" and "maluma" was carried out through a specific experiment involving two contrasting sound movement trajectories. The results confirm the pattern presented in the original experiment by Köler: "takete" is associated with the jagged trajectory, while "maluma" is associated with the rounded one. The use of sound movement instead of the visual feedback opens the investigation to further questions: do subjects associate the sound movement trajectory to the corresponding image? is it the spatial or the temporal analogy guiding the performance of the subject? Further research should be conducted on the same topic, providing for instance the two words in print instead of verbal utterances and/or testing with different trajectory pairs.

Acknowledgments

5. REFERENCES

[1] W. Köler, *Gestalt Psychology*. New York: Liveright, 1929.

[2] ——, *Gestalt Psychology: An introduction to new concepts in modern psychology*. New York: Liveright, 1947.

[3] T. D. Sweeny, E. Guzman Martinez, L. Ortega, M. Grabowecky, and S. Suzuki, "Sounds exaggerate visual shape," *Cognition*, pp. 194–200, 2013.

[4] V. Ramachandran and E. Hubbard, "Synaesthesia: A window into perception, thought and language," *Journal of Consciousness Studies*, vol. 8, no. 12, pp. 3–34, 2001.

[5] D. Maurer, T. Pathman, and C. Mondloch, "The shape of boubas: sound-shape correspondences in toddlers and adults," *Journal of Consciousness Studies*, vol. 9, pp. 316–322, 2006.

[6] O. Spence, C. Deroy, "Crossmodal correspondences: Innate or learned?" *I-Perception*, pp. 316–318, 2012.

[7] A.-S. Crisinel, S. Jones, and C. Spence, "the sweet taste of maluma: Crossmodal associations between tastes and words," *Chemosensory Perception*, vol. 5, no. 3-4, pp. 266–273, 2012. [Online]. Available: http://dx.doi.org/10.1007/s12078-012-9133-9

[8] O. Deroy and D. Valentin, "Tasting shapes: Investigating the sensory basis of cross-modal correspondences." *Chemosensory Perception*, pp. 80–90, 2011.

[9] H.-S. Seo, A. Arshamian, K. Schemmer, I. Scheer, T. Sander, G. Ritter, and T. Hummel, "Cross-modal integration between odors and abstract symbols," *Neuroscience Letters*, vol. 478, pp. 175–178, 2012.

[10] F. Fontana, "Association of haptic trajectories to takete and maluma," *HAID 2013*, vol. 7989, pp. 60–68, 2012.

[11] A. de Götzen, "Enhancing engagement in multimodality environments by sound movements in a virtual space," *IEEE Multimedia*, vol. 11, no. 2, pp. 4–8, 2004.

[12] A. de Götzen, E. Sikström, D. Korsgaard, S. Serafin, and F. Grani, *The grouping of sound movements as expressive gestures*. Springer, 2013.