Studying Movement Coarticulation in Drumset Performance

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1. BACKGROUND AND OBJECTIVE

So far, studies of drumming movements have primarily focused on isolated tasks, typically played on single instruments or force plates [1]. Outside the laboratory settings, however, any typical setup of instruments in the drum set would require the drummer to move feet, hands, arms, shoulders, as well as often torso and even the whole body, in order to play the musically interesting textural patterns so often found in both various grooves and in particular in various fills. Coarticulation [2] then comes to play with both the preparatory motion of the effectors prior to any beater-instrument impact, as well as following such an impact on the way to the next point of impact. 'Coarticulation' may be defined as the fusion of otherwise distinct motion and sound events into more superordinate sound-motion events, e.g. to various patterns, grooves, or gestalts. As instantaneous body motion is not possible, and because of a need to move effectors (e.g. beater/hands, arms, shoulders, and even torso) ahead of the actual impact with a drum or cymbal, this results in what we call a contextual smearing of otherwise discrete excitatory motion.

We present our method of approach to study coarticulation in drumset performance with the objective of finding relationships between the singular stick-instrument impact points (i.e. the sound onsets) and the coarticulatory context of the entire effector apparatus (from fingers to whole body) of the drummer. This necessitates plotting the motion trajectories at different points of this effector apparatus, as well as the velocities and acceleration profiles of these points, all in relation to the singular mallet-instrument impact points. From these figures and associated calculations of derivatives, we believe it is possible to get a better image of the salient sound-motion features that we may experience as the hallmarks of great drum set performances.

2. METHOD

For our studies of full drumset performance we have opted for a combination of measuring methods: high precision marker-based motion capture in combination with midi and video data. Future data collection will also include electromyography (EMG) and accelerometer data to accurately capture feet and pedal actions.

Obtaining motion capture data from all effectors in a full performance is a challenging task for several reasons. For instance, the many instruments obstruct and limit camera view of all the player's effectors while shiny surfaces create unwanted reflections. Any markers or sensors attached to the drumstick should not to obstruct the playing or fall off.

A primary concern is that the high movement velocities during playing require high frame rates in optical tracking systems. Song and Godøy [3] showed that a higher frame rate than Nyquist-Shannon sampling rate is required to avoid identity confusion between passive markers. They proposed a criterion to precisely estimate the necessary frame rate needed for a particular type of movement.

3. CONCLUSIONS

Studies of drum set performances (and of their crucial contribution to the music that we perceive) will need to focus on both the body motion features of the drummer and on the resultant sound output, as well as the interaction of these two domains in what we could call sound-motion features. From drummers' point of view, control over the full striking movement is important, as the actual time interval during which the beater is in contact with the instrument is so brief [1]. However, direct observation of the playing movement is difficult so measurement and recording of movements can provide feedback for the individual player on how the movement is *actually* done. Hence, a full-body approach to the analysis of drumset performance can be provide important insights for players and help them to develop efficient and sound movement patterns for a sustainable career.

4. REFERENCES

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