A CASE STUDY OF THE EFFECTS OF INSTRUCTION USING MOBILE PHONE'S ANIMATION FEEDBACK ON THROWING KINEMATICS

Kengo Sasaki, Souishi Shimizu, Ami Ushizu, Kenji Kawabata, Takahiko Sato, *Kazuhiro Matsui, *Yu Nakashima and *Hiroh Yamamoto

Biomechanics Lab., Graduate School of Ed., Kanazawa Univ., Kanazawa, Japan
*** Biomechanics Lab., Fac. of Ed., Kanazawa Univ., Kanazawa, Japan**

KEY WORDS: Animation Feedback, Throwing events, Mobile phone, Motion Analysis

INTRODUCTION: During recent years, the evolution of the mobile phone is highly active. This evolution transcends the framework of telephone. Japanese mobile phones have evolved as unique and Japan is called the Galapagos Islands of mobile phone. These mobile phones have included high quality camera and higher quality digital cameras. In conjunction with these facts, the mobile phone is life multi-tool that has positive possibilities for instruction of sports. The aim of this study was to obtain the data on the effects of instruction using the mobile phone's animation feedback on throwing kinematics during shot put and discus throw events.

METHODS:

Subjects: The two male and one female throwers of Track and Field team in the Kanazawa University were used as subjects in this study. The all subjects were right handed and signed an informed consent. Subject 1 is a female middle grade Discus thrower, Subject 2 is a male beginner Shot-put and Discus thrower and Subject 3 is a male middle grade Shot putter.

Feedback: The feedback test was designed by reference to previous study (James et.al., 2005). The feedback test consists of two sessions. The 1st session, the Base-line test (BT), Feedback and Performance test (PT) of Shot-put and Discus throw were conducted on the same day. The 2nd session, the Retention test (RT) of both events were conducted after 7 days from 1st session. Each test was consisted of 5 trials. The trial intervals were established two minutes. In Shot-Put trial, all subjects used the glide technique. The Base-line test was conducted without any technical instruction for subjects. After 5 BT Shot-put trials, subjects were given 20 minutes of rest. During rest, all subjects were given and watch the expert model animation and self 5 BT trials animation that were recorded by mobile phone data. After complete feedback, the 5 performance test trials were conducted. After complete Shot-put 1st session, the Discus throw 1st session (5 BT trials, Feedback and 5 PT trials) was carried out in a similar manner of Shot- put in same day. Additionally, the 2nd sessions (both Shot-put and Discus throw 5 RT trials) were conducted at 7 days later (Figure1).

As the expert model, both Shot-put and Discus throw animations of an abroad male player who has grate recode was able to download to mobile phones via internet was used in this study. For conform to both shot put and discus throw expert model animations, the BT and PT animations were recorded from Y axis using mobile phone's Cameras.

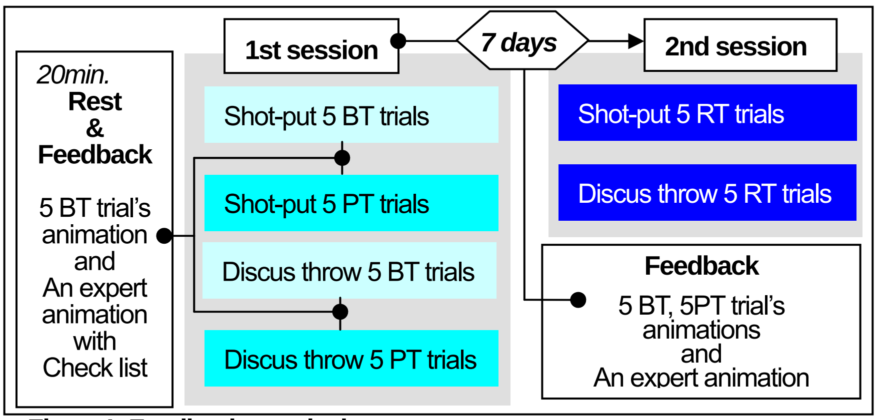

Figure1. Feedback test design

Additionally, the check list was used to provide feedback. The check list include some instruction as follows: (1) increase Trunk Tilt angle at Rear foot touch down, (2) decrease Hip-Shoulder Separation angle at Front Foot Take Off- Rear Foot Touch Down, (3) decrease Hip-Shoulder Separation angle at Front Foot Take Off in discus and (4) decrease Knee-Flexion angle and Hip-shoulder separation angle at Rear foot touch down, (5) decrease trunk-tilt angle and Knee-Flexion angle at Front foot touch down-Release in shot-put throw.

Data collection: The three VHS video cameras (DCR-TRV50: Sony) were used to record the throwing motion for analysis at a rate of 30 Hz (Figure2). And the three mobile phones (W31S, W42S: Sony, W51T: Toshiba / au by KDDI) were used to record the subject's throwing motion of BT and PT for feedback at a rate of 15 Hz. To investigate the relationship between quality of feedback and parameter displacement, the amount and type of feedback in one day was observed in one week from 1st session to Retention Test. The successfully 3 trials were extracted from every 5 trials of each test, the 27 Shot-put trials, and 27 Discus throw trials were used to digitize. The critical instants of Rear (right) Foot Take Off /RFTO, Front (left) Foot Take Off /FFTO: discus only, Rear Foot Touch Down /RFTD, Front Foot Touch Down /FFTD, and Release /Re of the Discus throw and Shot -put were identified from each video camera for every trial to calculated critical parameters (Young and Li, 2005, Leigh and YU, 2007).

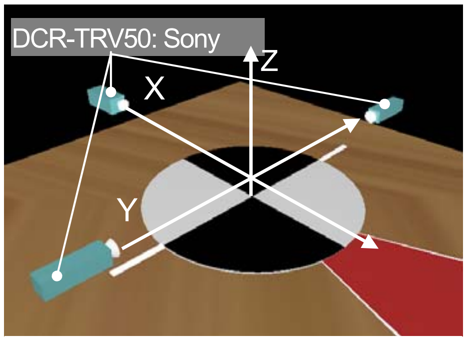

Figure 2.The Location and Axis

The three parameters (Figure 3) were calculated and investigate it's displacement through 3 tests (BT, PT and RT) in this study. The recorded animations by three VHS video cameras were into a personal computer (Versa VY12: NEC). And the 3-D motion analysis system (Frame DIAS□ Ver.3 for Windows: DKH) was used to calculate parameters. Ten (right and left shoulder, hip, knee and foot) body landmark were manually digitized in each instant.

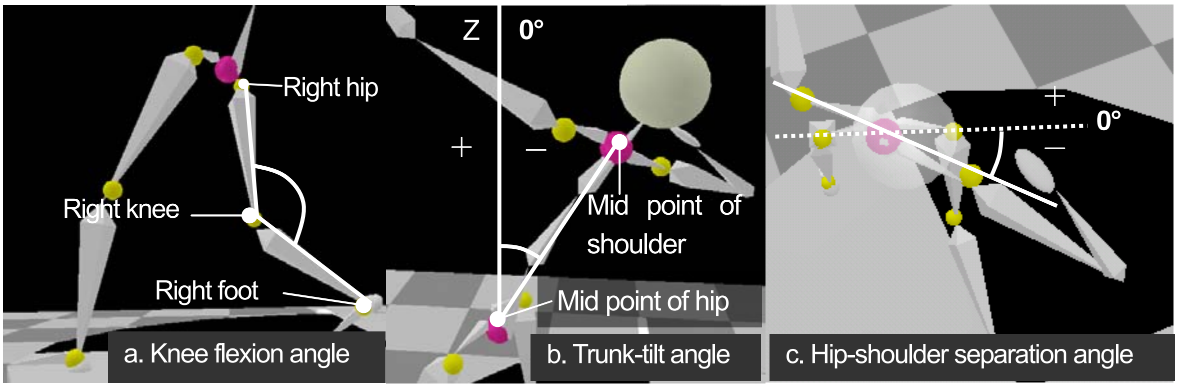

Figure 3.Paramaters

RESULTS: The average amounts of feedback in a day were shown table1. The subject 1 and subject 3 were watched more expert animation than self animation. In addition, the Subject 3 was less watched self animations (BT and RT) than other subjects. On the other hand, the subject2 was no difference between animation types.

Table 1. Amount of Feedback/ a day

Type of animation	Shot-put			Discus throw		
	Subj. 1	Sbuj. 2	Subj. 3	Subj. 1	Subj. 2	Subj.3
Before Feedback (BT)	**5.0**	**2.0**	**0.4**	**4.7**	**2.0**	**0.4**
After Feedback (PT)	**3.0**	**2.3**	**1.0**	**3.7**	**2.6**	**0.4**
Expert	**7.7**	**3.4**	**4.9**	**15.7**	**3.4**	**1.1**

The kinematics parameters and distances on Discus throw were shown Figure 4. On RT, the distance of subject 2 was increased concurrently with angular displacement of HSS from RFTD to Release was larger than other tests. The suject1 and subject 3 were not increase distance. On RT of subject 1, the angular displacement of HSS from RFTD to Release was larger than BT and PT. At the same time, angular displacement of TT on RT from FFTD to Release was smaller than other tests. Additionally, on RT of subject 3, the angular displacement of TT from RFTD to Release was larger than other tests. Concurrently with angular displacement of HSS on RT was small than other tests.

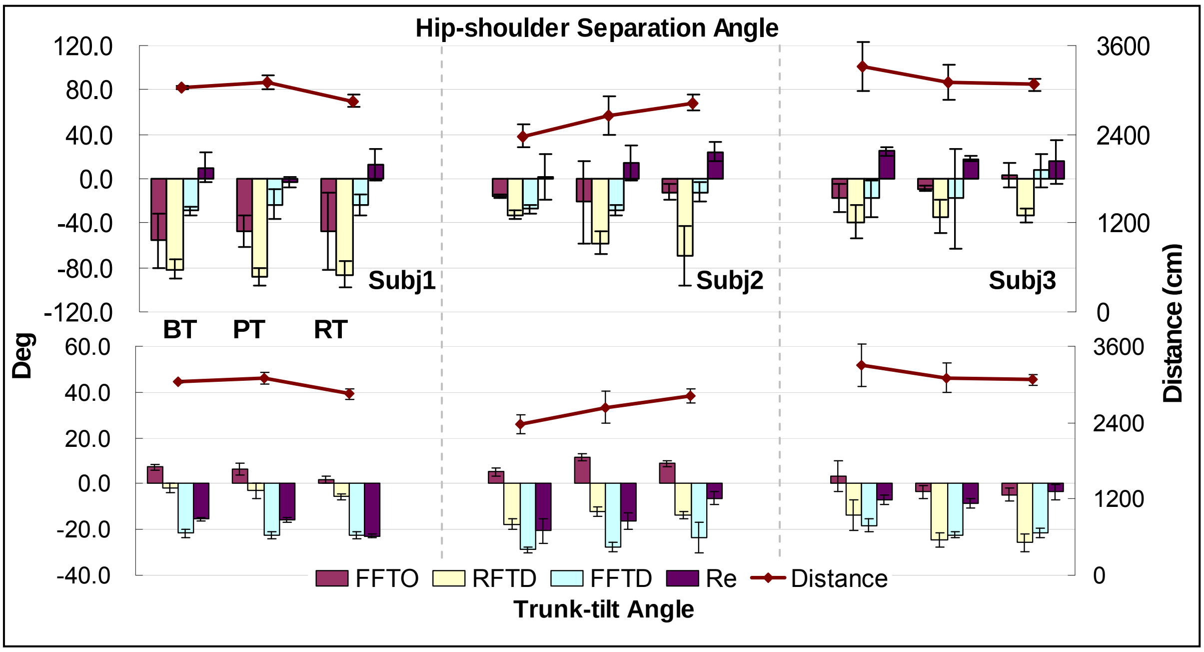

Figure 4. **Results of Discus Throw**

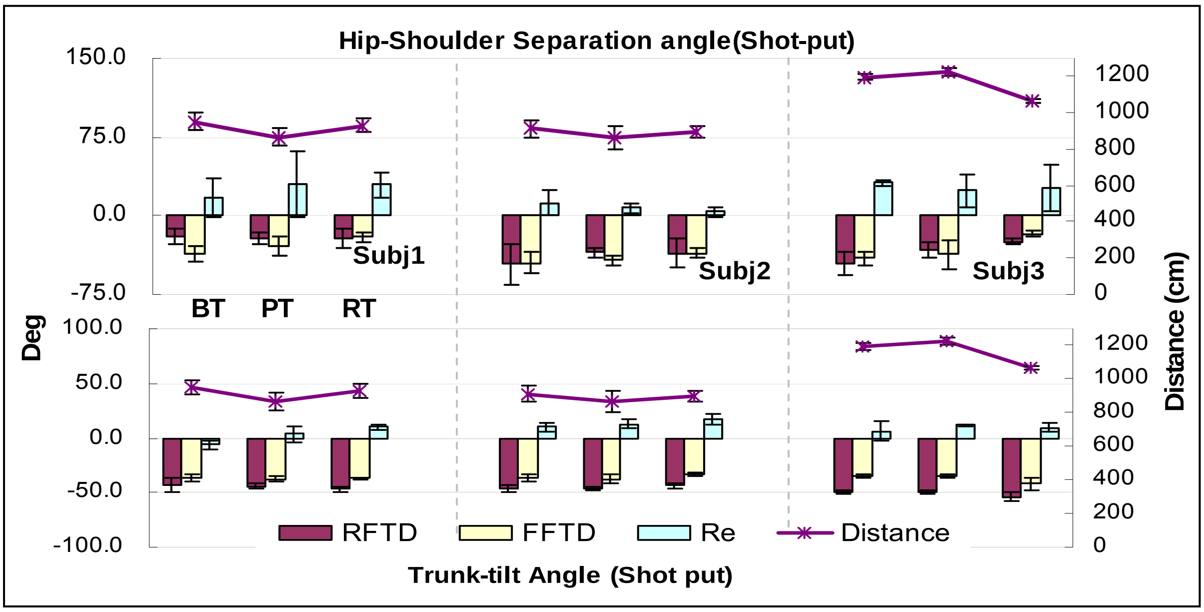

Figure 5. **Results of Shot-Put**

The distances and kinematics parameters of Shot-put were shown Figure 5. The distance and angular displacement of HSS from RFTD to Release on RT of subject3 (middle grade shot put player) were smallest in three tests. The distances on RT of subject1 and subject2 were lowest each other test, and distances of RT were higher than performance test. In all subjects, the angular displacement of TT on RT from FFTD to Release was larger than other tests.

The knee flexion angle at any instants of all subjects has negligible displacement during test sessions in each event.

DISCUSSION：In both Discus throw and Shot-put, the increased distance of subjects on RT may be due to improved angular kinetics by increased angular displacement of TT and HSS. The cases of without increase distance, angular displacement indicated increase. Despite these case, distance on RT was not increased may be cause of other angular displacements that are different from increased were became smaller than BT or RT. In Discus throw, The HSS at RFTD-FFTD and TT at release were determined parameters that indicated inverse correlation with distance (Leigh and YU, 2007). For this reason, the changes of angular displacement on RT of this study were appearing to improvement of parameter including without increase distance.

In the Shot-put, the increased angular displacement of TT from RFTD to Release on RT was appearing to cause of increasing distance. However, in previous study of Shot-put kinematics (Young and Li, 2005) was not indicate correlated distance with Trunk-Tilt angle. For this reason, the increasing TT appeared to not directly but indirectly effect of increasing distance such as improve angular kinetics on Shot-put in this study. Additionally, decreased subject 3's distances on RT may be due to the angular displacement of HSS from RFTD to Release on RT was smallest in three tests. At the same time, the subject 3 had a fewer self animation (BT and PT animations) feedback. This study was not intended to obtain statistic analysis. However the amounts of feedback may be correlated with parameter displacement. The feedback test of previous study (James et.al., 2005) found that the use of self or combination (self and expert animation augmented) videotape feedback was most useful for increasing kinematics and reducing kinetics during landing. For that founding, a few amount of self animation feedback in subject 3 was not enough to affect improve motion kinematics similar Discus throw. This means that the most cause of decreased subject3's distance on RT was appear to be another factor different from feedback effect.

In this study, the distance and parameters in some of subjects were indicated bit improve trend on RT. This result appears to suggest that animation augmented feedback is effective as a training tool. Additionally, the mobile phones were used to video feedback in this study. That appears to suggest the mobile phone such as life multi tool has positive possibility to use for instruction of sports. In addition, all subjects were inexperienced jump-landing test in previous study. And jump-landing test was more simply motion than throwing event's motion (James et.al., 2005). For these factors different from this study, the feedback effect may be difference by difference level of athletes and complexity of motion.

CONCLUSION: The feedback using mobile phone's animation for throwing event may allow kinematics to improve but we can not determine clearly the effect of feedback. In future studies, more subjects are needed. Investigating the difference of feedback effect from skill level of athletes and complexity of motion are needed. Multiple analyses of kinetics and kinematics were needed.

REFERENCES:

James A. Oñate, Kevin M. Guskiewicz, Stephen W. Marshall, Carol Giuliani, Bing Yu and William E. Garrett (2005).Instruction of Jump-Landing Technique Using Videotape Feedback, *Am J Sports* Med ,33, 831-842

Leigh, Steve and YU, Bing (2007).The associations of selected technical parameters with discus throwing performance: A cross-sectional study. *Sports Biomechanics*, 6, 269-284

Leigh, Steve, Gross, Michael T., Li, Li and Yu, Bing (2008).The relationship between discus throwing performance and combinations of selected technical parameters. *Sports Biomechanics*, 7, 173 -193

Mont Hubbard, Neville J. de Mestre, John Scott (2001). Dependence of release variables in the shot put. *Journal of Biomechanics*, 34, 449–456

Young, Michael and Li, Li (2005).Athletics', Determination of Critical Parameters among Elite Female Shot Putters. *Sports Biomechanics*, 4, 131-148

Yu, B., Broker, J., and Silvester, J. L. (2002). A kinetic analysis of discus throwing techniques. *Sports Biomechanics*, 1-46