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Acquisition a Baseball-Pitch through Observation: What Information Is Extracted?

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Abstract The purpose of the present study was to compare the relative effects of observing video, stick figure and point-light model demonstrations on acquisition a Baseball pitch. Participants (ns = 41) in demonstration and control groups performed 5 trials in pretest, three blocks of 10 trials in acquisition phase, and two retention tests of 5 trials in 10 minutes and one week later. Participants´ performances were assessed by two raters at the level of overall movement and individual movement phases. Results showed similarities between demonstration groups in acquisition phase and early retention test. Participants showed a significant improvement in stride and follow-through phases from pretest to acquisition blocks. The findings are discussed in terms of theoretical and methodological backgrounds.

Keywords: *skill acquisition, observation, baseball-pitch, relative motion information, movement phases*

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1. Introduction

Athletic coaches and teachers often apply skill demonstrations as an educational tool to facilitate the process of learning a new motor skill. It is well known that observation of an action performed by other individual results in motor skill acquisition (Ashford, Bennett, & Davids, 2006). An interesting issue in observational learning is to identify the nature of information picked-up by observer while watching a demonstration. "Visual Perception Perspective" (VVP) proposed by Scully and Newell (1985) suggested that relative motion information, i.e., movement of the segments of body in relation to each other, is perceived by the observer and later used to reproduce the modeled action. According to this hypothesis, making salience the relative motion information within a display by generating point-light or stick-figure demonstrations can be more effective than presenting the observers with a classic video display.

Several researchers examined this hypothesis during the last decade. Al-Abood, Davids, Bennett, Ashoford, and Martinez-Marin (2001) compared the relative effects of observing video vs. point-light display on learning a dart aiming motor task. They found that demonstration groups showed a closer approximation of modeled action, but point-light display was not superior to video display. Using a whole-body cricket bowling task, Breslin, Hodges, Williams, Kremer, and Curran, (2005) found no significant differences between point-light and video groups in movement outcome and coordination. Rodrigues, Ferracioli, and Denardi (2010) replicated those results in a pirouette task in ballet dance and found no superiority for point-light display over video display in movement time and coordination.

In general, the above mentioned studies do not support the assumption of extraction of relative motion information within a display. In the present study we aimed to extend the existence literature and further examine this hypothesis by comparing the relative effects of observing video, point-light and stick-figure demonstrations on performance and learning a highly complex sport skill. We hypothesized that point-light and stick-figure groups would perform better than video group and also demonstration groups would perform better than control group.

2. Method

This research has been performed in accordance with the Ethical Standards laid down in the Deceleration of Helsinki (1964).

2.1. Participants

Forty one female and male volunteers (Mean = 24.2, SD = 3.3 years) were randomly allocated to video, stick-figure, point-light and control groups. They were right-side dominant and naive to the motor task used in this study. All participants gave written consent.

2.2. Task, model, and Production of Videos

The motor task was a very complex throwing action, Baseball pitch. Baseball-pitch has a clear phase structure including wind-up, stride, arm cocking, arm acceleration, arm deceleration, and follow-through (Dillman, Fleisig, & Andrews, 1993). We performed analysis of the participants´ performances at the level of overall movement and individual movement phases (Figure 1).

The model was a semi-professional right-handed male pitcher (age = 32) with eight years of experience in second league in northern Germany. While the model performed a pitch, four digital cameras filmed spatiotemporal positions of reflected markers placed on the forehead, shoulder, elbow, wrist, hip, knee, ankle, and toe joints on the left and right side of the model. Simi Motion software 5.0™ was used for generating stick-figure and point-light model displays. A digital video camera was applied to produce a normal video demonstration from a sagittal plane. All model demonstrations were edited such that each one had identical start and end point and had an exact duration of four seconds.

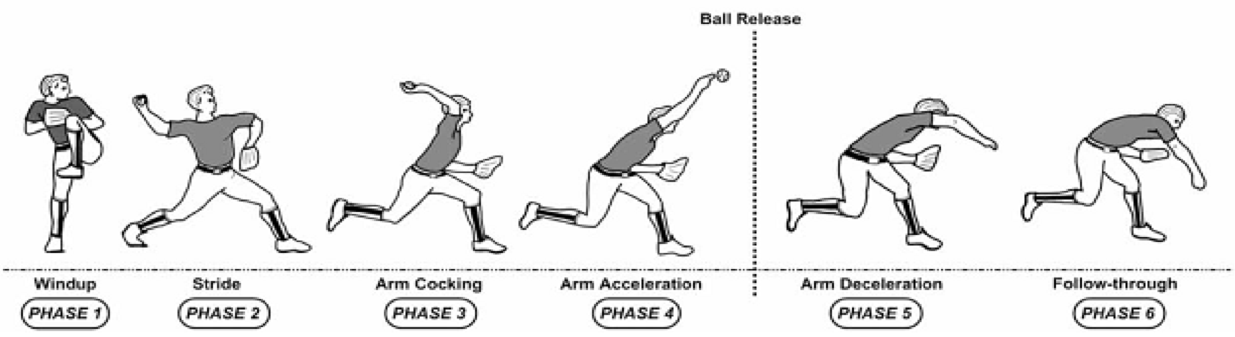

Figure 1. Movement phases of a Baseball pitch (Adopted with permission from Rojas et al. 2009, p. 560)

2.3. Procedure

Participants took part in two experimental sessions. During the first session, they were informed about the experimental process and completed a questionnaire designed in order to collect information about age, gender, side-dominant and previous experiences in Baseball. Participants were then given an instruction of the motor task consists of a series of images of the pitch phases (Figure 1) as well as additional notes of main features of each phase. Participants were told that only aim is to reproduce technique of the pitch correctly, not achieving a specific outcome or throwing the ball very fast. After two practical trials, participants performed 5 trials in pretest followed with three blocks of 10 trials in acquisition phase. Participants in demonstration groups observed the respective demonstration three times before each acquisition block on a 17.3 inch laptop. Participants in control group followed same protocol without observation of the model. The participants performed early and late retention tests with 5 trials were performed 10 minutes and a week later after last acquisition block. The performances of the participants were filmed by using a digital camera for subsequent analysis.

2.4. Movement form evaluation

Two male experienced baseball coaches evaluated the performances of the participants. The evaluation was performed by using an evaluation form which designed especially for this research in collaboration with two raters. The evaluation form contains seven items, including six items for six movement phases and one item for overall evaluation. Two to four criteria were considered for each item on a four-point scale from 0 (not completed) to 3 (fully completed). Totally, twenty one criteria were considered for the evaluation form and, therefore, the score of a pitch performance varied between 0 to 63 points.

Because of the large number of trials during experiment, we chose a selection of trials for later evaluation. For each participant, a total of 24 trials including all trials on the pretest and retention tests and first 3 trials of each acquisition block were selected for later analysis. Thus, a total of 984 trials (24 trials x 41 participants) were evaluated by the raters. Both raters evaluated all trials of participants. Correlation between two raters for overall movement, movement phases, and overall evaluation were good to very good (mostly over 0.8). Evaluative scores of the first rater were used for statistical analysis.

2.5. Statistical analysis

The performances of participants in the pretest and retention tests were analyzed by separate one-way analysis of variance (ANOVA). Post hoc comparisons were made here, as in all other analysis, using Scheffé test. The performance development during the acquisition phase was assessed by 4 (experimental groups) x 3 (acquisition blocks) ANOVAs with repeated measures on the last factor. Moreover, the pretest was also included in an additional 4 (experimental groups) x 4 (pretest, acquisition blocks) ANOVAs, in order to assess the performance development from pretest to acquisition phase. Significance level was set at $p <. 05$.

3. Results

The mean scores of movement form evaluation for overall movement are shown in Figure 2. The results of statistical analysis revealed that in the pretest there was a significant difference between experimental groups, F = 3.85, $p <. 05$, $\varepsilon par^2 =. 27$. Participants in stick-figure group performed significantly worse than participants in control group in pretest. In the acquisition phase, there was no significant main effect for group, F = 2.24, $p >. 1$, blocks, $F = 1.58$, $p >. 1$, or group x block interaction, $F = 0.19$, $p >. 1$. From pretest to acquisition blocks, a significant main effect was observed for time, $F = 5.54$, $p <. 01$, $\varepsilon par^2 =. 17$, but not for group, $F = 2.80$, $p =. 06$, or group x time interaction, $F = 0.42$, $p >. 1$. In early retention test, no significant main effect was observed for group, $F = 1.61$, $p >. 1$. However, a significant difference was observed between experimental groups, $F = 3.43$, $p <. 05$, $\varepsilon par^2 =. 25$, in late retention test. Participants in stick-figure group performed significantly worse than participants in video group in late retention test.

Mean and standard deviation of movement form evaluation of pitch phases are presented in Table 1. Statistical analysis of movement phases showed a significant main effect for time from pretest to acquisition blocks in stride, $F = 5.12$, $p <. 01$, $\varepsilon par^2 =. 16$, and in follow-through phases, $F = 4.41$, $p <. 01$, $\varepsilon par^2 =. 14$, and also in overall evaluation, $F = 6.93$, $p <. 01$, $\varepsilon par^2 =. 20$. In late retention test, a significant difference was observed between experimental groups in arm cocking, $F = 5.47$, $p <. 01$, $\varepsilon_{par}^2 =. 35$, and arm deceleration phases, $F = 3.08$, $p <. 05$, $\varepsilon_{par}^2 =. 23$. Participants in stick-figure group performed significantly worse than participants in video and point-light groups in late retention test.

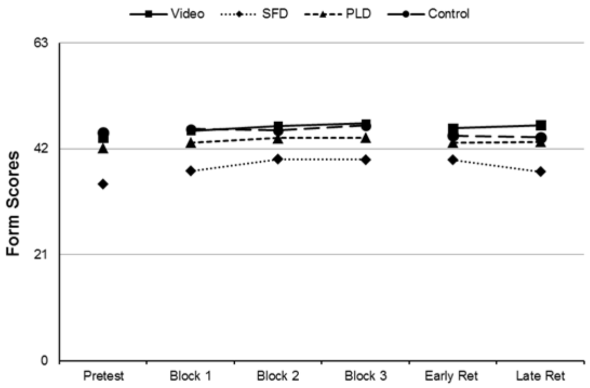

Figure 2. Mean scores of movement form evaluation for the experimental groups

Table 1. Descriptive data of movement form scores

Phase	Group	Pretest	Block 1	Block 2	Block 3	Early Ret	Late Ret
Overall movement (21 items)	VI	44.21 (4.05)	45.61 (5.35)	46.55 (7.05)	47.03 (4.90)	46.09 (4.86)	46.71 (5.01)
	SF	35.03 (11.34)	37.62 (8.29)	39.98 (8.27)	39.85 (9.59)	39.83 (7.86)	37.05 (8.46)
	PL	42.14 (7.08)	43.27 (6.22)	44.16 (6.28)	44.24 (7.76)	43.23 (5.32)	43.41 (4.15)
	CO	45.20 (5.60)	45.91 (7.21)	45.66 (5.51)	46.62 (6.79)	44.64 (9.91)	44.30 (8.33)
Wind-up (4 items)	VI	10.48 (1.15)	10.00 (1.70)	10.05 (1.78)	10.14 (1.41)	9.96 (1.80)	10.39 (1.37)
	SF	9.56 (2.07)	9.37 (2.09)	9.87 (1.69)	10.07 (1.47)	9.99 (1.48)	10.07 (1.41)
	PL	9.67 (1.45)	9.53 (1.31)	10.22 (1.35)	10.07 (1.22)	9.90 (0.97)	9.80 (1.18)
	CO	10.51 (1.43)	10.45 (1.37)	10.66 (1.27)	10.33 (1.49)	9.90 (2.10)	9.95 (1.38)
Stride (3 items)	VI	6.42 (0.60)	6.42 (0.96)	6.33 (1.29)	6.90 (0.99)	6.31 (0.97)	6.73 (0.65)
	SF	4.89 (1.40)	5.55 (1.39)	5.72 (1.63)	5.75 (1.44)	5.85 (1.33)	5.51 (1.32)
	PL	6.03 (0.96)	6.14 (1.17)	6.50 (0.80)	6.55 (0.89)	6.50 (0.63)	6.52 (0.65)
	CO	6.54 (0.97)	7.10 (1.23)	7.20 (0.83)	7.25 (0.90)	6.40 (1.82)	6.89 (1.05)
Arm cocking (3 items)	VI	7.38 (1.12)	7.42 (0.96)	7.57 (1.04)	8.11 (0.84)	7.23 (0.80)	7.84 (0.96)
	SF	5.60 (1.91)	6.33 (1.24)	6.50 (1.41)	6.33 (1.28)	6.31 (1.65)	5.76 (1.53)
	PL	7.54 (1.24)	7.90 (0.90)	7.59 (1.12)	7.61 (1.08)	7.52 (0.82)	7.75 (0.60)
	CO	7.91 (0.96)	7.79 (1.05)	7.95 (0.84)	7.58 (1.31)	7.34 (1.54)	7.16 (1.51)
Arm acceleration (4 items)	VI	9.32 (1.37)	9.16 (0.54)	9.48 (1.19)	9.50 (0.97)	9.00 (0.97)	8.80 (1.15)
	SF	7.13 (2.86)	7.62 (2.51)	7.77 (2.50)	7.50 (2.18)	7.67 (1.89)	7.53 (2.22)
	PL	8.90 (1.97)	8.70 (1.77)	8.50 (1.74)	8.25 (2.01)	8.16 (1.55)	8.78 (0.85)
	CO	8.95 (1.13)	9.45 (1.34)	8.83 (1.30)	9.33 (1.39)	9.18 (2.00)	8.51 (1.52)
Arm deceleration (2 items)	VI	3.76 (0.70)	4.12 (1.09)	4.25 (1.30)	4.18 (0.74)	4.24 (0.74)	4.31 (0.46)
	SF	2.33 (1.70)	2.77 (1.66)	3.20 (1.20)	2.92 (1.72)	3.08 (1.50)	2.63 (1.39)
	PL	3.30 (1.12)	3.70 (1.26)	3.62 (1.28)	3.42 (1.92)	3.61 (1.35)	3.46 (0.95)
	CO	3.60 (1.16)	3.27 (1.58)	3.37 (1.54)	3.75 (1.41)	3.64 (1.52)	3.63 (1.62)
Follow-through (3 items)	VI	3.82 (1.53)	5.20 (1.72)	5.51 (1.55)	4.75 (1.46)	5.88 (1.23)	5.26 (1.48)
	SF	3.37 (1.93)	3.55 (1.61)	4.09 (1.63)	4.24 (2.11)	4.02 (1.84)	3.56 (1.74)
	PL	3.62 (1.50)	4.01 (1.56)	4.31 (1.36)	4.70 (2.20)	4.16 (1.84)	3.91 (1.63)
	CO	4.38 (1.67)	4.68 (1.89)	4.45 (1.87)	5.29 (1.79)	4.96 (1.90)	4.97 (2.25)
Overall evaluation (2 items)	VI	3.01 (0.69)	3.25 (0.95)	3.33 (0.72)	3.42 (0.78)	3.47 (0.85)	3.37 (0.69)
	SF	2.13 (1.01)	2.40 (0.96)	2.81 (1.06)	3.01 (1.21)	2.90 (0.96)	2.41 (1.14)
	PL	3.08 (0.71)	3.25 (0.55)	3.40 (0.85)	3.61 (0.93)	3.35 (0.60)	3.16 (0.84)
	CO	3.29 (0.95)	3.14 (0.87)	3.16 (0.79)	3.08 (0.95)	3.22 (0.85)	3.17 (1.10)

4. Discussion

The aim of the present study was to investigate the proposition of the VPP regard to the extraction of relative motion information within a display for later replication. It was hypothesized that point-light and stick-figure groups would perform better than video group in acquisition phase and retention tests and also demonstration groups would show superiority in motor learning than no-demonstration control group. The results did not confirm our hypothesis because there was no superiority of observing point-light or stick-figure demonstrations over classic video demonstration and also no superiority of model observation itself over no-observation in acquisition phase or retention tests. Moreover, stick-figure group performed worse than video or point-light groups in overall movement, arm cocking and arm deceleration phases of pitch in late retention test.

Our results are partly consistent with some reports in the literature, e.g., Al-Abood et al. (2001) and Breslin et al. (2005), which found that observing a point-light demonstration does not necessarily result in any superiority in motor performance and learning over classic video demonstration. Those findings may debate the importance of making salience the relative motion information within a display.

Our findings regard to comparison of demonstration groups with control group are not in consistency with the results of Al-Abood et al. (2001) and Horn, Williams, Scott, and Hodges (2005) who found that participants who observed model demonstration showed superior performances over control group in acquisition phase and retention tests. This inconsistency is surprising because demonstration groups experienced totally nine times respective demonstrations, but they showed no significant enhancement in skill acquisition during acquisition blocks.

This inconsistency might be interpreted by the experimental procedure used in this study. One possibility might be that participants in demonstration groups needed more amount of model observation to improve the performance in acquisition phase. Another possibility might be because of the instruction participants were given in the beginning of the experiment including a series of static pictures representing Baseball-pitch phases. Participants´ scores in the pretest, which are relatively high scores (> 42) with exception of stick-figure group, indicate that the participants were able to imitate the to-be-learnt action rather completely by only observing a series of static images of movement phases. Although we used this instruction to introduce the to-be-learnt action, it might be possible that the instruction prevented the influence of observing dynamic model demonstrations during the acquisition phase because the action has been already acquired by observers.

However, those results raise a question of whether participants picked-up relative motion information from static images or there is another kind of information available within these images. In our opinion it is hardly plausible that relative motion information could be extracted from those images. According to Lappe (2012), people extract body form/posture information over time to perceive human biological motions. Hence, it might be possible that information of body form/posture was perceived from static images of movement phases and used by observers for later action reproduction. However, we do not conclude that it is body form/posture information that is extracted for later reproduction, but we do suggest that future studies may focus on this issue.

Analysis of pitch phases revealed significant improvements in stride and follow-through phases from pretest to acquisition phase. These results might indicate that these phases require more amount of practice than other phases of the pitch.

To conclude, the results of the present study do not confirm the proposition of Scully and Newell (1985) about the extraction of relative motion information within a demonstration. We, however, suggested that the future research may investigate the proposition of Lappe (2012) regard to perception of body form/posture information from a display. We also observed significant improvements in stride and follow-through phases from pretest to acquisition blocks, which may indicate that these phases are most practice demanded phases of pitch.

References

[1] Al-Abood, S. A., Davids, K., Bennett, S. J., Ashford, D., & Martinez-Marin, M. Effects of manipulating relative and absolute motion information during observational learning of an aiming ask. *Journal of Sports Sciences*, 19, 507-520, 2001.

[2] Ashford, D., Bennett, S. J., & Davids, K. Observational modeling effects for movement dynamics and movement outcome measures across differing task constraints: A meta-analysis. *Journal of Motor Behavior*, 38 (3), 185-205, 2006.

[3] Breslin, G., Hodges, N. J., Williams, A. M., Kremer, J., & Curran, W. Modeling relative motion to facilitate intra-limb coordination. *Human Movement Science*, 24, 446-463, 2005.

[4] Dillman, C. J., Fleisig, G. S., & Andrews, J. R. Biomechanics of pitching with emphasis upon shoulder kinematics. *Journal of Orthopaedic & Sports Physical Therapy*, 18(2), 402-408, 1993.

[5] Horn, R. R., Williams, A. M., Scott, M. A., & Hodges, N. J. Visual search and coordination changes in response to video and point-light demonstrations without KR. *Journal of motor Behavior*, 37 (4), 265-274, 2005.

[6] Lappe, M. Perception of biological motion as motion-from-form. *e-Neuroforum*, 2012, 3, 67-73.

[7] Rodrigues, S. T., Ferracioli, M DE. C., & Denardi, R. A. Learning a complex motor skill form video and point-light demonstrations. *Perceptual and Motor Skills*, 111 (1), 1-17, 2010.

[8] Rojas, I. L., Provencher, M. T., Bhatia, S., Foucher, K. C., Bach, B. R Jr., Romeo, A.A., Wimmer, M. A., Verma, N. N. Biceps activity during windmill softball pitching: injury implications and comparison with overhand throwing. *American Journal of Sport Medicine*, 37 (3), 558-565, 2009.

[9] Scully, D. M., & Newell, K. M. The acquisition of motor skills: toward a visual perception perspective. *Journal of Human Movement Studies*, 12, 169-187, 1985.