INFLUENCE OF BRAIN TYPES ON MOTOR SKILL COORDINATION

Alfred Finch[1], Jon Niednagel[2], Laura Finch[1] and Gideon Ariel[3]

[1]Indiana State University, Terre Haute, Indiana, USA
[2]Brain Type Institute, Thornfield, Missouri, USA
[3]Ariel Dynamics, San Diego, California, USA

The influence of a person's brain type and the segmental coordination used in free throw basketball shooting was evaluated by video analysis. Fifteen subjects were classified using a brain typing inventory with 16 categories. Markers were placed on selected joints of the participants who performed 5 free throws, videotaped in the sagittal plane at 60 Hz. Three participants having a brain type on each end of the personality spectrum were selected for film analysis. The shooting coordinate data was analyzed using an Ariel APAS. The time and maximal angular velocities were calculated for selected joints. The order of joint sequencing was determined for the brain types. Subjects who were brain type (BCIL/INTJ) tended to use multiple joint sequencing and those of brain type (FEAR/ESFP) used primarily large segments.

KEY WORDS: brain types, motor skill coordination, fine and gross motor control.

INTRODUCTION: Brain typing has shown to be an effective method of identifying personality characteristics to identify individuals who may be effective as managers in business or in sports in a variety of leadership roles. The Brain Type Institute founded by Jon Niednagel has been successfully involved in the brain typing of professional athletes over the past 20 years. The brain typing process involves the administration of, a Brain Typing Inventory personality questionnaire developed at the Brain Type Institute and based on Jung-Myers topologies (Briggs & Myers, 2001), and the responses on the 20 question brain type identifies the individual's personality characteristics and the brain type out of the 16 possible brain types on a continuum. Subsequent research on brain typing and brain activity (EEG) by J. Niednagel has lead to the association of brain types and the neural control or wiring demonstrated by an individual. The purpose of this study was to examine the influence of participants' brain types associated with the polar ends of the brain type continuum on motor coordination used in selected fundamental sport skills. Good motor coordination, is defined by Espenschades and Eckert (1967) as when one moves efficiently and the sequence and timing of his motions are well controlled. Putnam (1991) in a study examined an analysis of the segmental interaction of proximal-to-distal sequential segment motion patterns.

METHODS: Fifteen college students volunteered to participate in this study. After providing informed consent each participant was evaluated by an expert in personality/brain typing using a modified Jung-Myers personality questionnaire (Niednagel, 2010). All the participants' brain types were stratified into one of the available 16 personality types. Ten body data point markers were affixed unilaterally to each participant's ankle, knee, hip, shoulder, elbow, wrist, hand, chin and forehead. After a brief 5 minute warm-up period of light jogging and stretching, participants were recorded performing 5 free throws. Video images were collected at 60 Hz in the sagittal plane and kinematic timing and coordination variables were be determined. The free throws of 6 subjects were selected for video temporal analysis and following analysis, their brain types (3 group A, 1 group B, 2 group C) were identified. The x, y data point coordinates were transformed using a 2D DLT into real distances using a calibration cube, and the coordinates were smoothed using a Butterworth 2nd order digital filter with a 10 Hz frequency cut-off. Then the maximal angular velocities about the z axis for the knee, hip, shoulder, elbow, and wrist joints and the corresponding times were identified using the Ariel APASview module for the analysis of the joint coordination. Ball release velocity and corresponding times were also determined.

RESULTS: A data table of the maximal joint velocities and time of occurrence was created and then the order of the time sequence of maximal velocity prior to ball release was determined. To effectively integrate a free throw shooter's whole body into the shot, the kinetic link or summation of velocity principle must be utilized (Kreighbaum & Barthels, 1990). This required the initiation of the shooting action from the legs and then the individual sequentially moves the joints going up the body and concluding with the wrist/hand action on the ball at release. Presented in Table 1 are the maximal joint velocities, time of occurrence, with the order of the maximal joint velocity sequencing are shown. The beginning of the shooting movement was initiated with maximal shoulder velocities exhibited in 5 of the 6 participants. Also, 3 of the 5 shoulder initiating participants demonstrated simultaneous contraction of the hip and shoulder joints. Participants (C), (A1), and (A2) utilized the wrist as the last joint that provided impetus to the final ball release velocity. However, participant (B) utilized a simultaneous extension of the elbow and wrist flexion to provide final ball propulsion. No participant commenced the propulsive movement using knee extension to generate ball projection velocity. It was found that 3 of the 6 participants commenced the shooting movement with hip extension. Given that most participants initiated the shooting movement from the shoulder action, it may be that the 4.6 m shooting distance was not distant enough to illicit significant lower extremity involvement for the ball speed contribution. This would result in the participants needing to sequentially coordinate fewer segments in the shooting movement and essentially simplifying the coordination of the shooting skill. Hudson and Hill (1991) indicated that coordination research typically focused on qualitative analysis of inter-segmental sequencing and timing parameters. However, they reported that there was a need for objective measurement of the segmental sequencing and timing and this pilot study developed an objective procedure to quantify and classify coordination.

Table 1: Maximal joint angular velocities, times, and order of sequencing during basketball free throw shooting.

Subject	Knee Vel	Hip Vel	Should Vel	Elbow Vel	Wrist Vel	Ball Rel Vel
Subj B Order	**2**	**1**	**1**	**3**	**3**	
Time	-0.083 s	-0.100 s	-0.100 s	0.000 s	0.000 s	0.000 s
Variable	8.9 rad*s^{-1}	5.2 rad*s^{-1}	1.5 rad*s^{-1}	12.3 rad*s^{-1}	-14.2 rad*s^{-1}	6.1 m/s
Subj C1 Order	**3**	**3**	**1**	**2**	**4**	
Time	-0.033 s	-0.033 s	-0.117 s	-0.050 s	0.000 s	0.000 s
Variable	-8.7 rad*s^{-1}	7.6 rad*s^{-1}	2.5 rad*s^{-1}	12.6 rad*s^{-1}	-21.4 rad*s^{-1}	7.3 m/s
Subj C2 Order	**2**	**3**	**1**	**4**	**5**	
Time	-0.167 s	-0.150 s	-0.334 s	-0.100 s	0.000 s	0.000 s
Variable	-6.9 rad*s^{-1}	7.8 rad*s^{-1}	2.2 rad*s^{-1}	14.9 rad*s^{-1}	17.2 rad*s^{-1}	7.3 m/s
Subj A1 Order	**2**	**1**	**1**	**3**	**2**	
Time	-0.067 s	-0.167 s	-0.167 s	-0.050 s	-0.067s	0.000 s
Variable	-11.8 rad*s^{-1}	9.4 rad*s^{-1}	3.2 rad*s^{-1}	19.2 rad*s^{-1}	-12.4 rad*s^{-1}	8.0 m/s
Subj A2 Order	**2**	**1**	**3**	**4**	**5**	
Time	-0.150 s	-0.167 s	-0.067 s	-0.050 s	-0.017 s	0.000 s
Variable	-6.5 rad*s^{-1}	4.9 rad*s^{-1}	-13.1 rad*s^{-1}	15.8 rad*s^{-1}	28.9 rad*s^{-1}	7.5 m/s
Subj A3 Order	**3**	**2**	**1**	**4**	**5**	
Time	-0.117 s	-0.134 s	-0.267 s	-0.033 s	-0.017 s	0.000 s
Variable	-10.7 rad*s^{-1}	5.6 rad*s^{-1}	3.0 rad*s^{-1}	21.8 rad*s^{-1}	-32.1 rad*s^{-1}	8.0 m/s

DISCUSSION: In that most of the participants with brain type C, (FEAR/ESFP) categorization can be viewed as easy going, gross motor skilled individuals sequencing of the free throw shooting mechanics illustrates that the participants who initiate the free throw movement from the shoulder joint and complete the movement with a gross, ballistic wrist / hand action. Conversely participants with brain type A (BCIL/INTJ) can be viewed as analytical and fine skilled individuals who initiate the free throw movement from the hips and lower extremity sequentially coordinating through the rest of the body linkage. The temporal sequencing plots for individuals with a brain type of C (FEAR/ESFP), who employ gross motor skill coordination strategies, are visually illustrated in Figure 1. An illustration of a brain type A (BCIL/INTJ) individual who adopts the fine motor control strategy of multiple sequencing is shown in Figure 2.

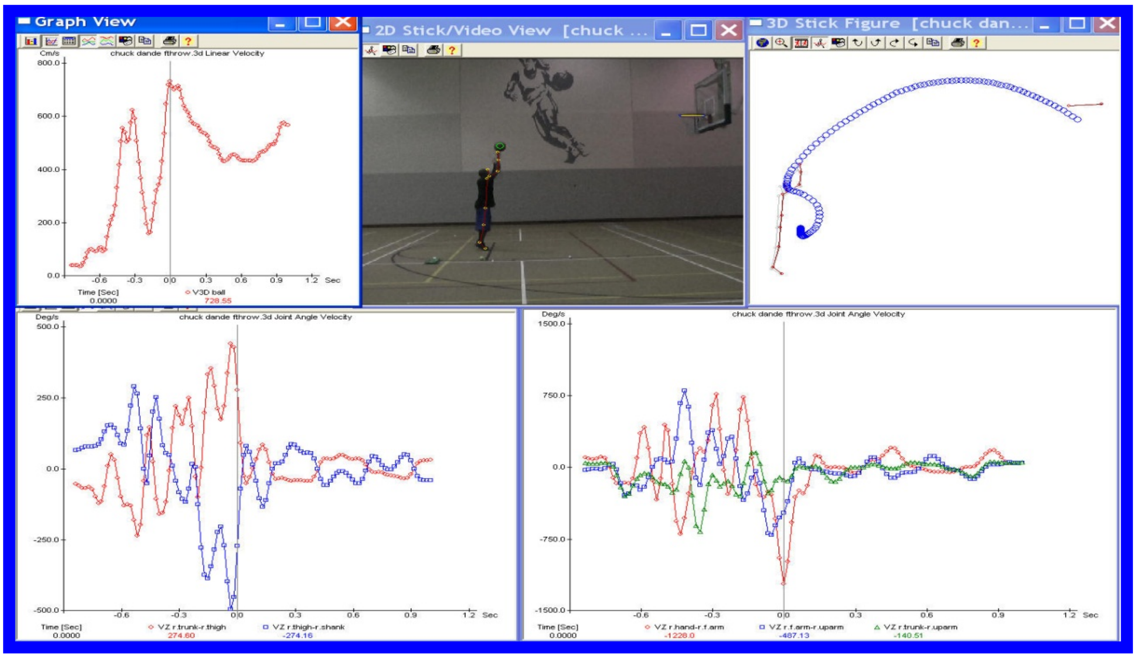

Figure 1: Angular kinematic sequencing for brain type (FEAR/ESFP), gross motor control.

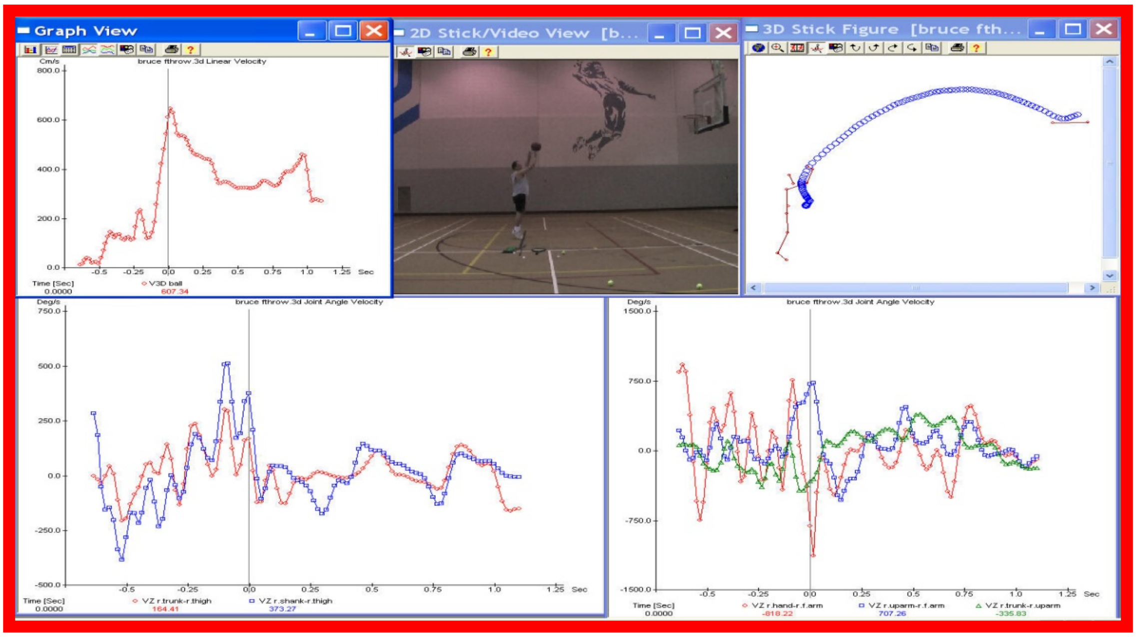

Figure 2: Angular kinematic sequencing for brain type (BCIL/INTJ), fine motor control.

CONCLUSION: Results of this pilot study using temporal sequencing of a free throw suggests that this evaluative process is a viable means to objectively identify fine and gross motor control related to brain type. A larger overall sample with increased numbers across brain types, who perform a variety of gross and fine motor based sport skills are still required to arrive at statistically significant conclusions the assessment of athletic motor ability and the influence of brain type on body coordination. The influence of brain type/control and motor ability has the potential to provide objective evaluative tools that could be used in athletic scouting combines for athletic motor ability assessment.

REFERENCES:

Briggs, K.C. & Myers, I.B. (2001). *Myers-Briggs type indicator form Q (Step II)*. Palo Alto, CA: Consulting Psychologists Press.

Espenschade, A.S. & Eckert, H.M. (1967). *Motor development*. Columbus, OH: Merrill Publishers.

Hudson, J.L. & Hills, L. (1991). Conceptions of coordination. *Proceedings of Biomechanics in Sports IX*, (pp. 215-219), Ames, Iowa.

Kreighbaum, E. & Barthels, K.M. (1990). *Biomechanics: A Qualitative approach for studying human movement*. (3rd ed.), New York: Macmillan.

Nidenagel, J. (2010). Brain types questionnaire. Retrieved from http://www.braintypes.com /questionnaire.asp

Putnam, C.A. (1991). A segmental interaction analysis of proximal-to-distal sequential segment motion patterns. *Medicine and Science in Sports and Exercise*, 23, 130-144.