IDENTIFYING DIFFERENT BIOMECHANICAL 'TECHNIQUES ' – TECHNIQUE TAXONOMY APPLIED TO GOLF PUTTING

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Introduction

Do different golf putting techniques exist?

Players divided into groups based on
Handicap and/or
Putting accuracy

Doesn't help in identifying techniques AND
Likelihood of Type I and II errors

Example of research to date

McLaughlin, Best and Carlson (2008)

➢**Low (0-9), middle (10-18) and high (19-27) handicap players divided into groups**

McCarty (2002)

➢**Group split based on accurate vs less accurate putt results**

Assumes technique differences

Table 1: Mean and SD for COPx parameters by group and by study design.

Method	BS Range COPx (mm)	DS Range COPx (mm)	DS COPx Max. vel. (cm/s)	BC COPx Vel. (cm/s)	Absolute Putt Result (cm from hole)	Handicap
Handicap						
Low (n=30)	4.6±2.9	4.5±4.1*	29.9±24.6*	7.7±24.5*	35.3±34.6	5.9±2.0*
Middle (n=53)	6.5±4.8	5.2±3.6	36.3±26.0	23.0±28.9	34.1±24.1	13.7±2.3
High (n=25)	7.8±6.3	8.7±5.6	55.0±34.3	30.3±36.3	47.5±32.2	22.3±3.4
Cluster						
1 (n= 77)	4.9±2.7*	3.9±2.6*	25.5±15.7*	5.2±16.9*	36.8±28.5	12.4±5.9*
2 (n=31)	9.6±7.0	10.6±4.8	71.8±28.3	58.4±22.9	39.5±32.3	16.4±6.6
Accuracy						
More (n=54)	5.8±3.7	5.5±4.4	37.1±26.9	21.2±27.3	15.8±11.5*	12.0±5.8*
Less (n=54)	6.8±5.7	6.1±4.7	40.5±31.2	19.6±33.8	59.3±25.6	15.0±6.6
Total (n=108)	**6.3±4.8**	**5.8±4.5**	**38.8±29.0**	**20.5±30.6**	**37.6±29.5**	**13.5±6.4**

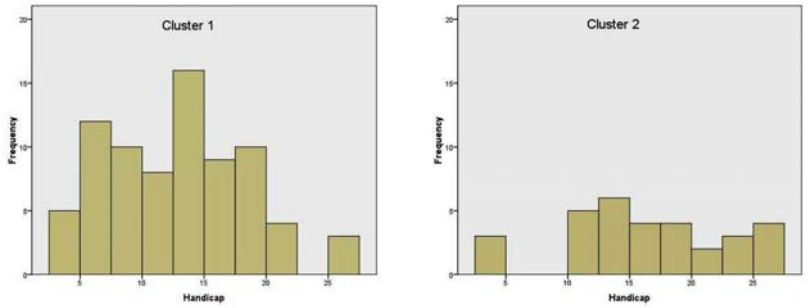
*Significant differences between groups within study design

Cluster analysis?

Like movement patterns combined to form groups

Technique similarities based on movement

Multiple kinematic and COP parameters, multiple players, multiple trials



Method

Private golf course, Melbourne
38 players
Range of handicaps and age
5 x 4m putts
2D video and COP data synchronised 50Hz
62 possible parameters

Results

All putts analysed using three different methods: (a) handicap; (b) putt result; and (c) cluster analysis
Most influential parameters in cluster formation analysed across methods.

Discussion and conclusions

Cluster analysis revealed two distinct technique groupings based on skill execution

Handicap range in clusters is wide
Suggests analysis via handicap or accuracy is invalid
Type I errors committed when significant differences are reported based on handicap

Players can appear in more than one cluster – technique may vary over trials

Choosing the correct method of assessment vital in technique analysis
A priori assumptions should be avoided
Cluster analysis is an appropriate method for technique taxonomy