

CLARIFICATION OF ATTACKING ASPECTS IN OFFENSE SET-PLAY USING SEQUENCE ANALYSIS IN HANDBALL

**Shiro Ichimura¹, Tetsushi Moriguchi², Jun Fukuda³,
Kenta Yokote⁴ and Norio Shimizu⁵**

1. Tokyo University of Science
2. Fukuoka University
3. University of Miyazaki
4. Takamatsu University
5. International Budo University



About notational analysis

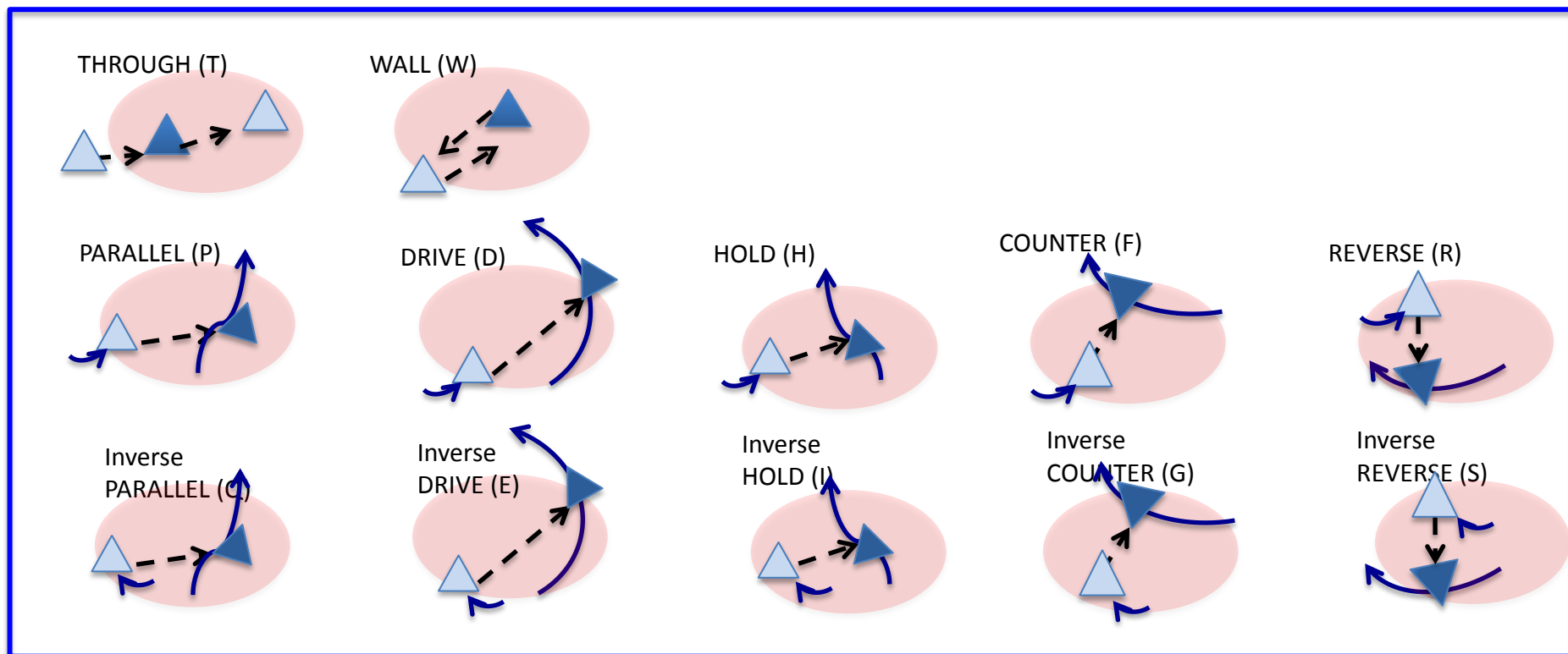
Notational analysis quantifies for tactical actions as “When”, “Where”, “Who”, “What” and “How” can be used for evaluation of game performance.

In previous study,
There are also studied the relationship between sequences of actions during beach volleyball (Koch and Tilp 2009) and handball (Lopes et al 2010, Schrapf and Tilp 2013).

Sequence analysis for sports analysis

(Ichimura et al. 2013)

1. Attacking play actions were classified based on the players movement and pass direction.

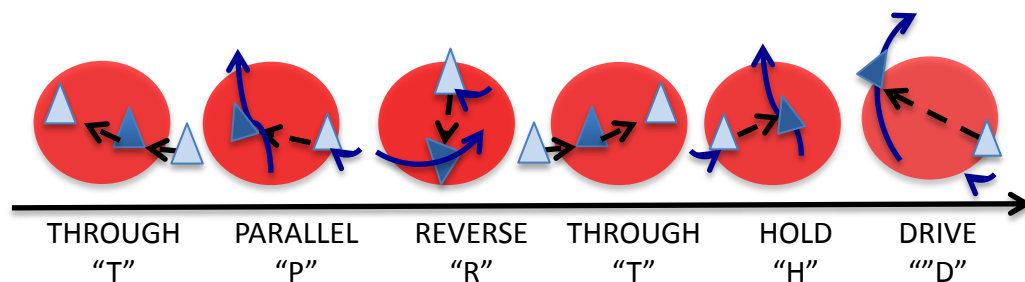
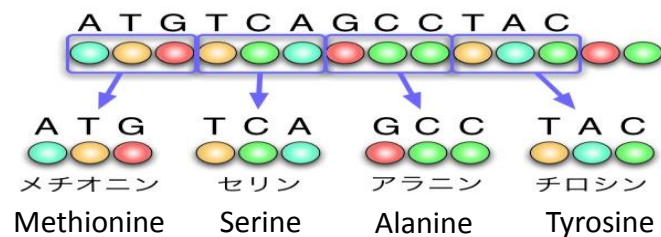
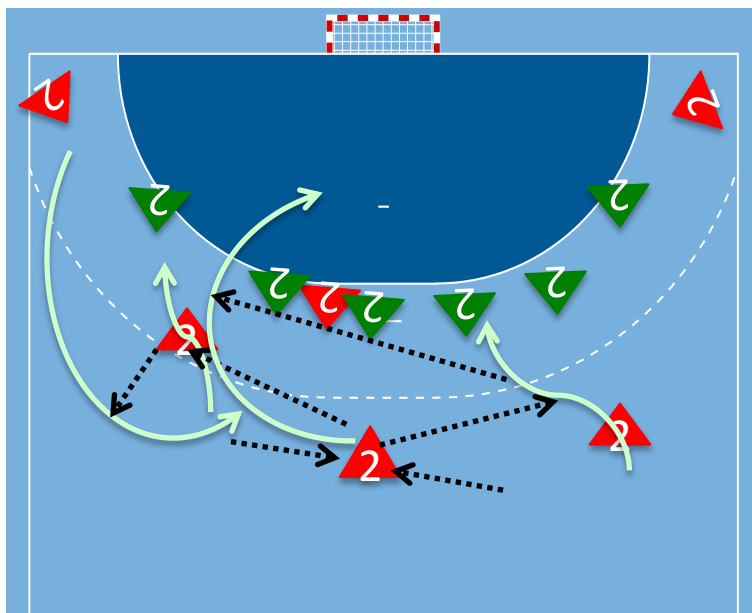


Sequence analysis for sports analysis

(Ichimura et al. 2013)

- The classified attacking actions are encoded to the character, respectively.
- Encoded characters are array in chronological order.

Continuous attacking action was represent like a sequence data of nucleotide of DNA.

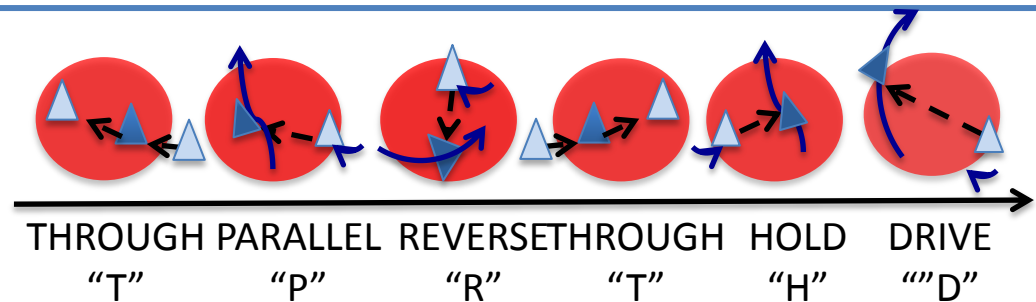


Purpose

The characteristic of single attacking action and the structure of attacking action sequence are not clarified.

The clarification of the characteristic of attacking action and the structure of attacking action sequence were helpful in improving the tactical behavior and in preventing injury.

The purpose of this study is to clarify the characteristic of attacking action and the structure of attacking action sequence.



Sample

The offense set-plays of 42 games in the 2012 European Women's Handball Championship in Serbia

In total, 21,381 single actions were recorded.
The offense set-plays were 4,310 times.



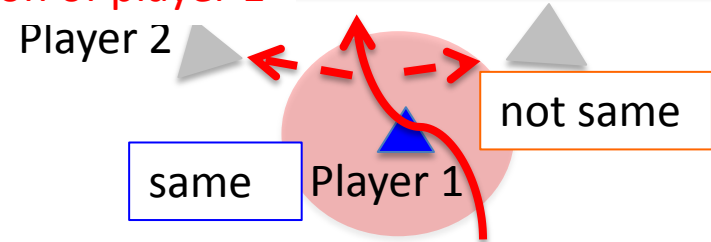
Analysis

1. The attacking actions during the offense set-play were classified into the 15 kinds.
2. The sequence analysis of combined attacking actions in a chronological order.

The classifying criteria of attacking action

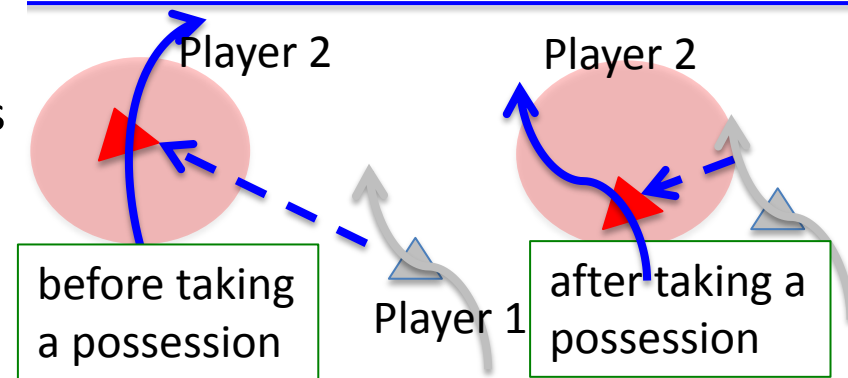
1. The direction of passing the ball and attacking action of player 1

Whether the directions of passing the ball and attacking action of player 1 is same or not.



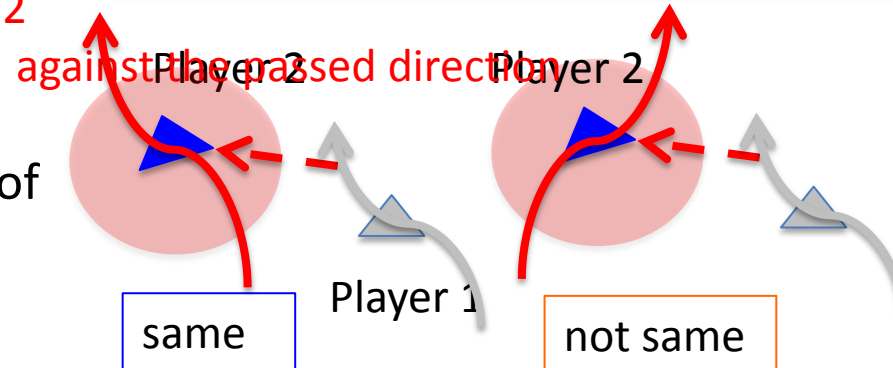
2. The timing which starting movement of player 2

Whether the starting movement of player 2 is before or after taking a possession.


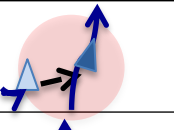
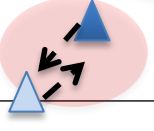
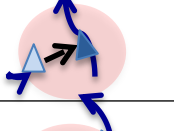

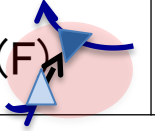
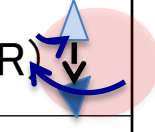
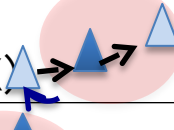
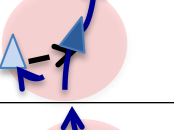
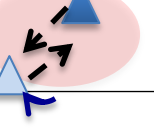
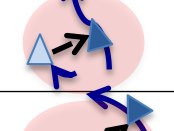
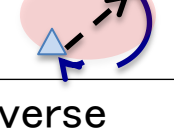
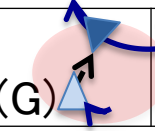
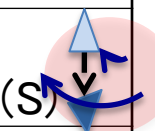
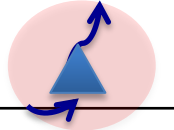


3. The direction of attacking action of the player 2

Whether the directions of attacking action of player 2 after taking possession is same or not against the passed direction from player 1.



Expalanation of criteria to classify the attacking play actions

	Criteria 1	Criteria 2	Criteria 3	Not intention to attack	Intention to attack
1	Same	After	Same	THROUGH (T) 	PARALLEL (P) 
2	Same	After	Not same	WALL (W) 	HOLD (H) 
3	Same	Before	Same		DRIVE (D) 
4	Same	Before	Not same		COUNTER (F)  REVERSE (R) 
5	Not same	After	Same	Inverse THROUGH (X) 	Inverse PARALLEL (Q) 
6	Not same	After	Not same	Inverse WALL (Y) 	Inverse HOLD (I) 
7	Not same	Before	Same		Inverse DRIVE (E) 
8	Not same	Before	Not same		Inverse COUNTER (G)  Inverse REVERSE (S) 
9	After dribble				CUTTING (C) 

Tree diagram of sequence attacking action

1	f	h			p	
2	fp	hh	hi	hp	ph	pp

1	t																					
2	td	tf										th										
3		tfd	tff	tf _g	tf _h	t _f i	t _f p	t _f r				t _h f	t _h g	t _h h	t _h i	t _h p			t _h r	t _h t		
4							t _f p _f	t _f r _d	t _f r _f	t _f r _h	t _f r _p	t _f r _r					t _h p _f	t _h p _p	t _h p _r	t _h r _f	t _h t _h	t _h t _p
5																						
6																						
7																						

1	t																				
2	tp			tr		tt															
3	tpf	tpp	tpr	trf	trp	ttf		tth		ttp	ttr	ttw									
4				trhf		ttft	ttfw	tthd	tthp		ttrh	ttwd	ttwh	ttwp		ttwt					
5						ttfth	ttfwf							ttwpd	ttwpp	ttwtd	ttwtf	ttwth	ttwtp	ttwt	
6																ttwtdr			ttwtp	ttwtpr	ttwt
7																					

1	t																
2	tw																
3	twd		twf		twh				twp								
4	twdp	twdr	twfp	twfr	twhf	twhh	twhi	twhr	twpd	twpf	twph	twpi	twpp	twpr			
5													twppf	twprf	twprh	twprp	twprr
6																	
7																	

1	t																															
2	tw																															
3	twf																twth				twtp	twtr				twtt	twtw				tww	
4	twff				twfh	twfi	twfp	twfr		twthd	twthh	twthp	twtpf	twtrf	twtrh	twtrp	twtrr	twttf	twtwd	twtwf	twtwh	twtwp	twtwt		twwf	twwh	twwp					
5									twfrf	twfrh															twtwpr	twtwtf	twtwtr	twtwtw				
6																																
7																																

1	f	h			p	
2	fp	hh	hi	hp	ph	pp

1	t																	
2	td	tf							th									
3		tfd	tff	tfg	tfh	tfi	tfp	tfr			thf	thg	thh	thi	thp		thr	tht
4														thpp	thpr	thrf	thth	thtp
5	<div>Up to 3 continuous attacking actions</div> <div>and</div>																	
6																		
7																		

1				
2	tp			
3	tpf	tpp	tpr	tr
4				trh
5				
6				
7				

and

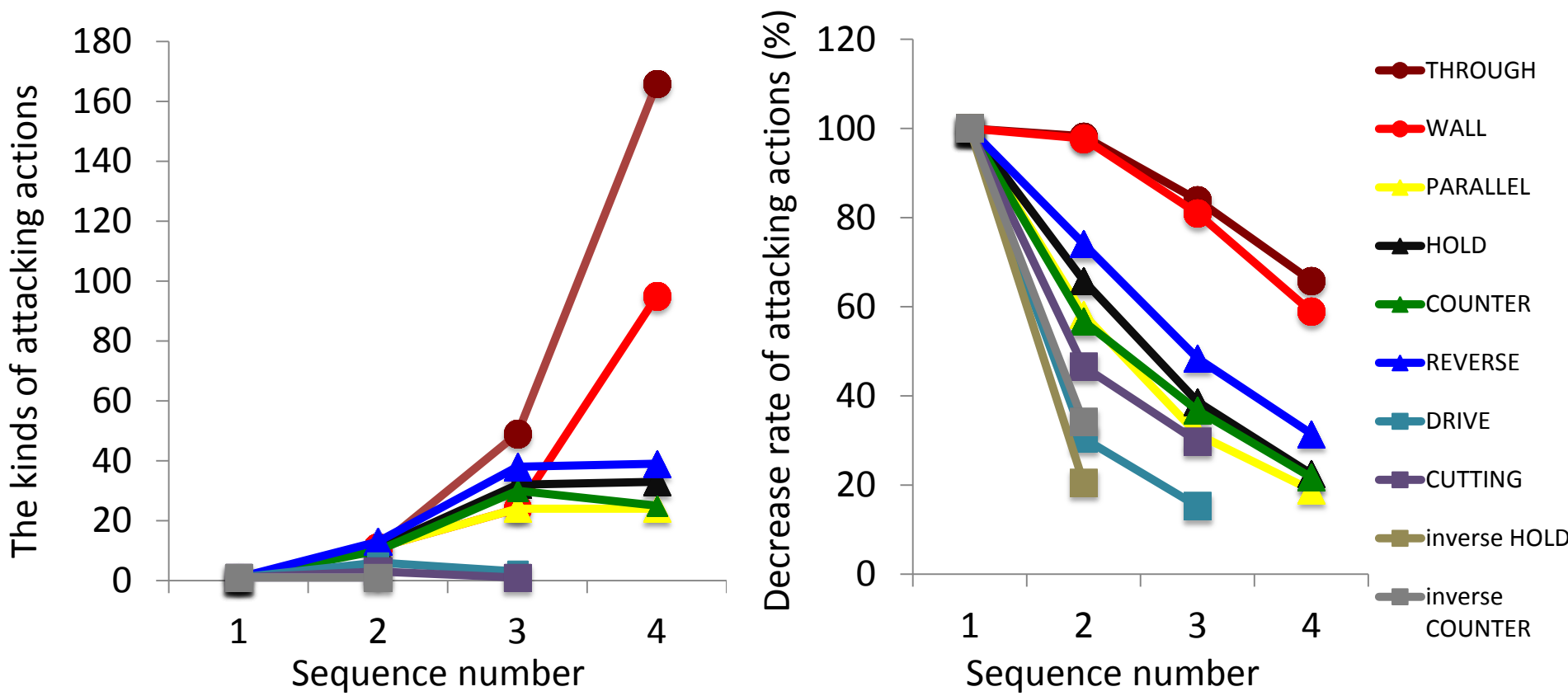
More than Occurrence rate of 1%

ttwt			
twth	ttwtp	ttwtt	
	ttwtp	ttwtpr	

1				<div> <div>45 kinds of attacking sequence</div> <div>15 clusters of attacking sequence</div> </div>				
2								
3	twd							
4	twdp	twdr	twf		twpr			
5					wprf	twprh	twprp	twprrr
6								
7								

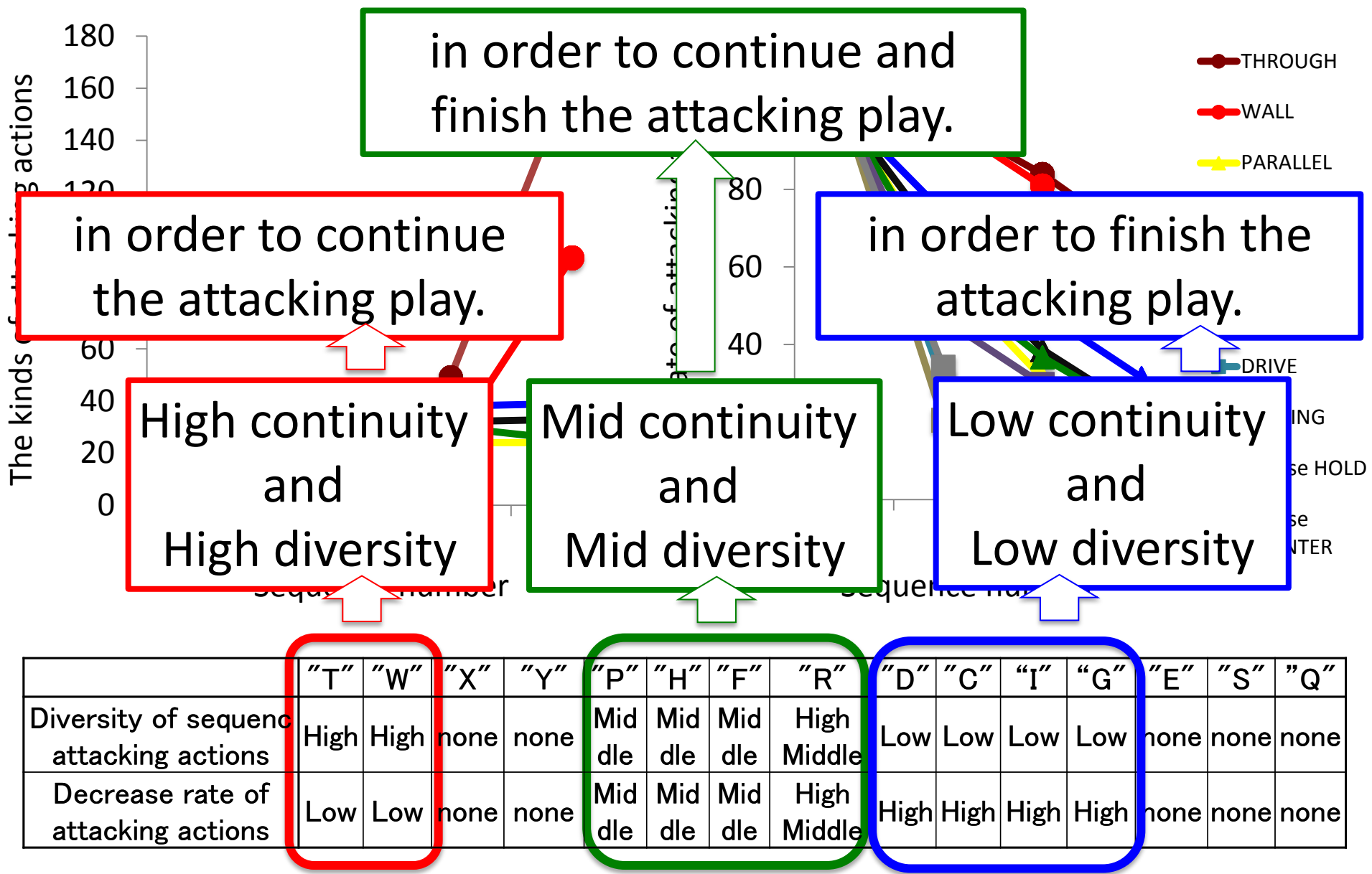
1	t																							
2	tw																							
3	tw																	tw						
4	tw				tw			tw	tw				tw	tw				tw	tw	tw				
5	tw	tw	tw	tw	tw	tw	tw	tw	tw	tw	tw	tw	tw	tw	tw	tw	tw	tw	tw	tw				
6					tw	tw													tw	tw	tw	tw	tw	tw
7					tw	tw													tw	tw	tw	tw	tw	tw

Continuity and diversity of attacking actions

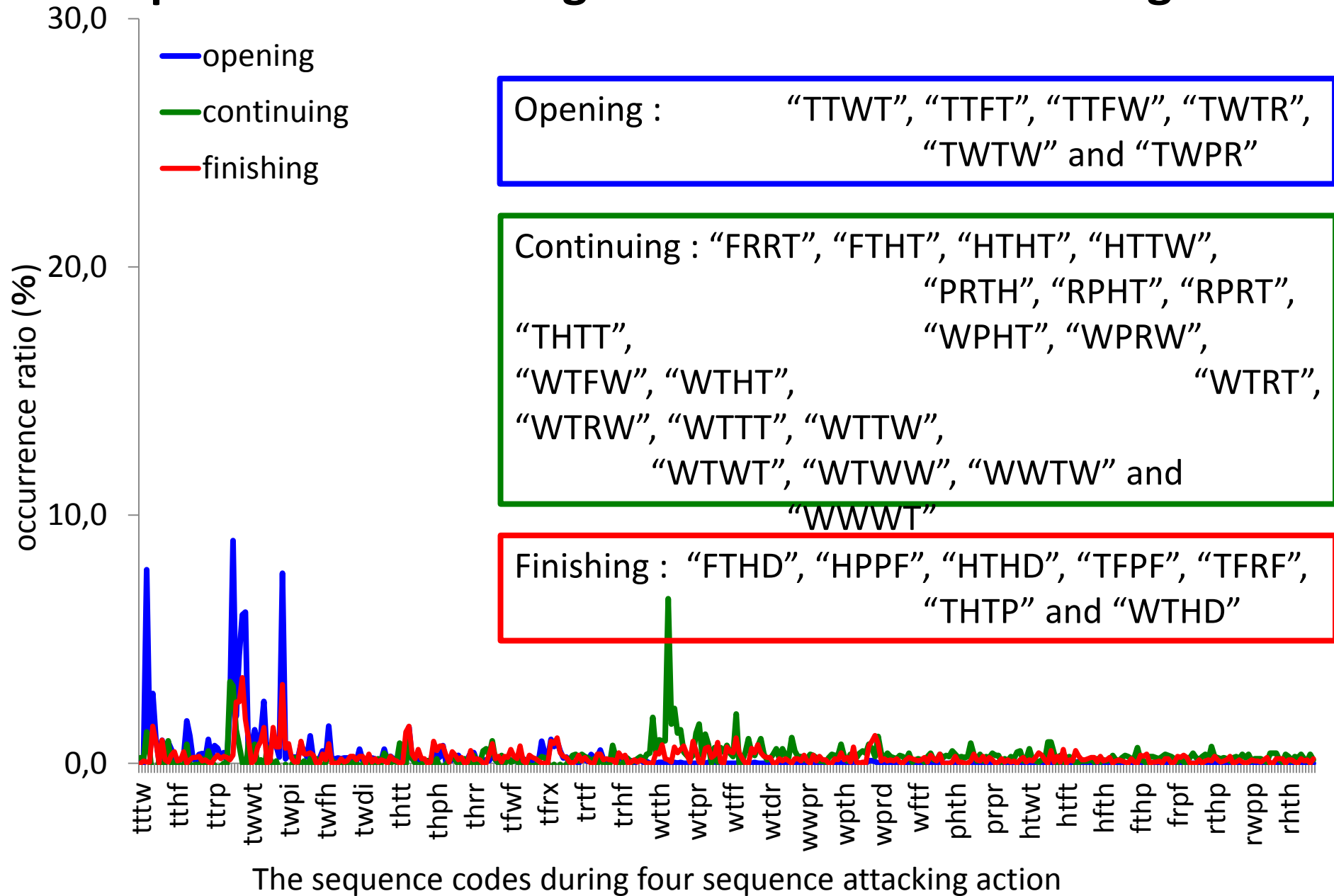


	"T"	"W"	"X"	"Y"	"P"	"H"	"F"	"R"	"D"	"C"	"I"	"G"	"E"	"S"	"Q"
Diversity of sequence attacking actions	High	High	none	none	Mid dle	Mid dle	Mid dle	High Middle	Low	Low	Low	Low	none	none	none
Decrease rate of attacking actions	Low	Low	none	none	Mid dle	Mid dle	Mid dle	High Middle	High	High	High	High	none	none	none

Continuity and diversity of attacking actions



Sequence codes during four continuous attacking action



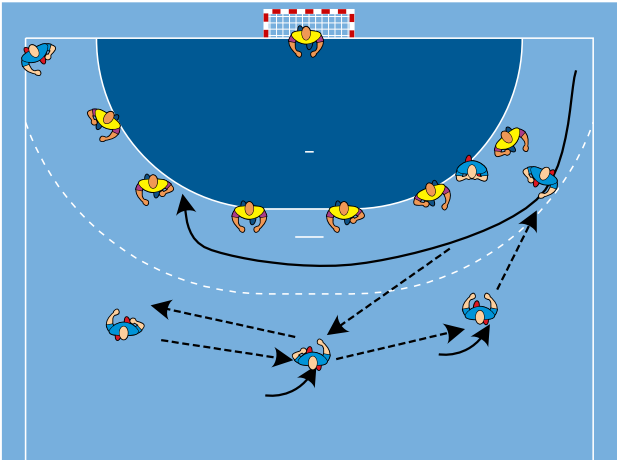
Sequence code of attacking action during “opening” phase

sequence

1	t										
2	tt				tw				tp	th	tf
3	tff		tth	ttr	ttw	twp	twr	twt		tww	
4	ttft	ttfw			ttwt	twpr		twtr	twtw		

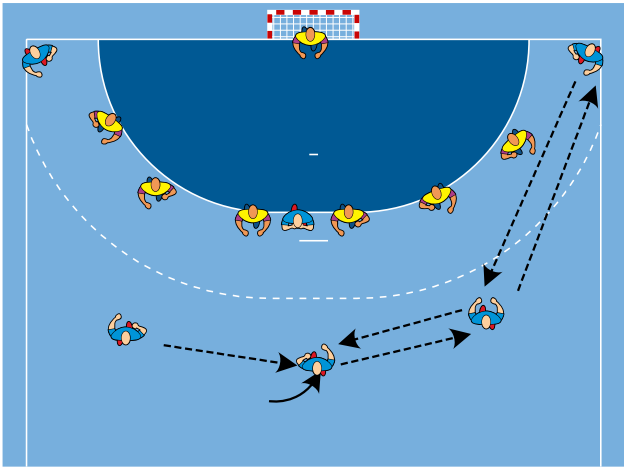
Pictorial figure of more used sequence code

TTFT



TTFT

TTWT



TTWT

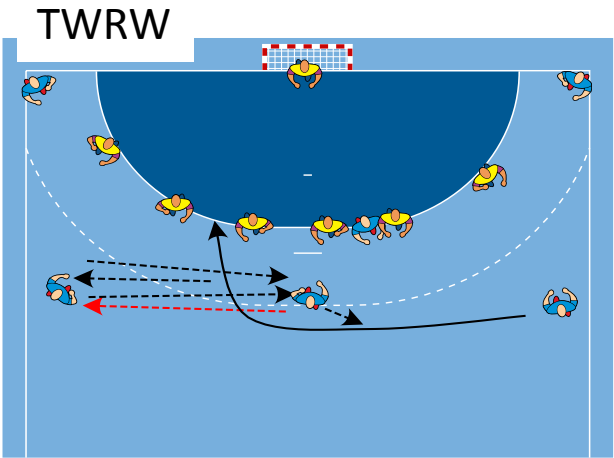
Sequence code of attacking action during “break and continuing” phase

sequence

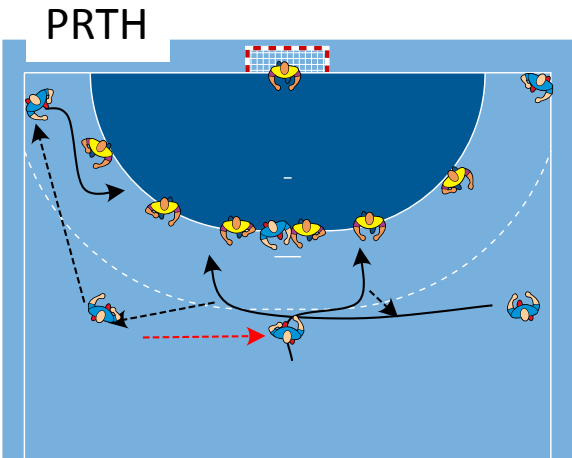
1	t	w														
2	th	wt						ww				wp		wf		
3	thtt	wwf						wwf	wwt	wwh	www	wph	wpr	wft	wfw	
4	thtt	wtrt	wtrw	wttt	wttw	wtwt	wtww	wtfw	wtht				wpht	wprw		

1	p					h			f						r						d							
2	pt	pw	ph	pf	pr		ht		hw	ft		fw	fh	fr		rt	rw		rh	rp	rf	rr		dr	dt			
3		pwt	pht	pft	prt	prw	htt	htw	hth		ftt	ftw	fth	fww	fht	frt	frw	frr	rtt	rtw	rw _t	rww	rht	rpr	rft	rrt	rr _w	
4					prth		httw		htht				ftht					frrt					prpt					

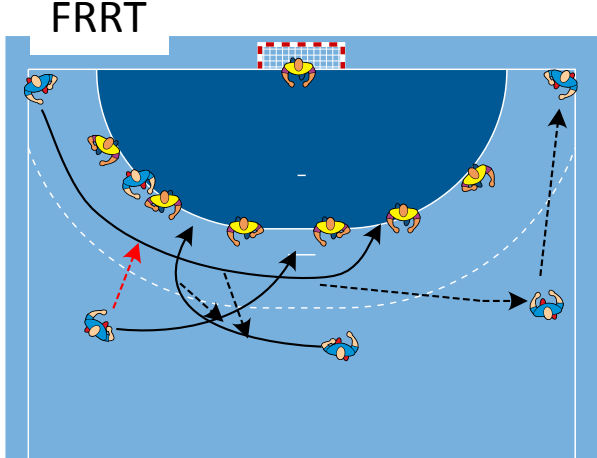
Pictorial figure of more used sequence code



WTRW



PRTH



FRRT

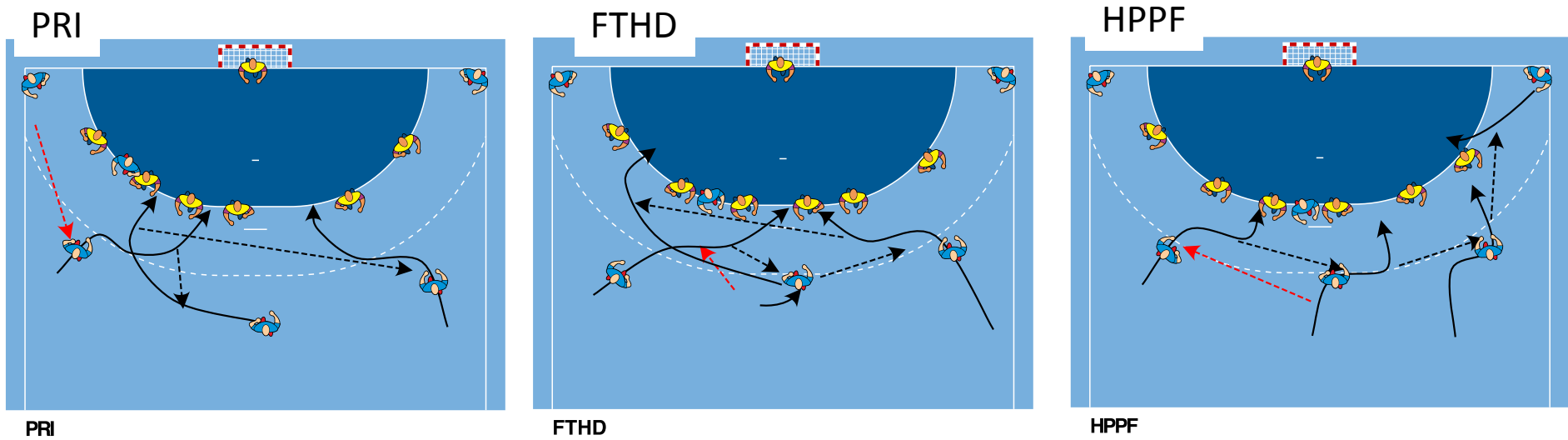
Sequence code of attacking action during “finishing” phase

sequence

1				w		p						h									
2				wf		ph	pp	pf	pr	pd	pi		hp			hh	hf	hr	hd	hc	hi
3								ppf		pri			hpp	hpf	hpi	hhi					
4								tfpf	tfrf	thtp	wthd		htthd			hppf					

1	f							r					d	
2	ft		ff	fr	fd	fc	fi	rp	rh	rf	rr	rd	df	di
3	ftd	fth						rpf						
4		fthd												

Pictorial figure of more used sequence code



Summary

1. Pattern of continuous attacking actions

In this study, the kinds of attacking sequence were 45 kinds.
The 45 kind of of attacking sequence was included to the 15 clusters.

2. Characteristic of attacking action

“T” and “W” had high continuity and high diversity.

“P”, “H”, “F” and “R” had Mid continuity and Mid diversity.

“D”, “C”, “I”, and “G” had Low continuity and Low diversity.

3. Differences among attacking phases

In “opening” phase, attacking action was started from “T” and “T” and “W” was used in second, third and fourth attacking actions.

In “breaking and continuing” phase, the use of “W”, “P”, “H”, “F” and “R” were observed during first attacking action. In second and third attacking action, “T”, “W”, “H”, “F” and “R” were observed.

In “finishing phase, In terminating attacking action, “C”, “D”, “F”, “G”, “I”, “P”, “Q” and “R” were observed more frequently.



Multumesc !

Thank you!

ありがとう！

Shiro Ichimura
shiro@rs.noda.tus.ac.jp