

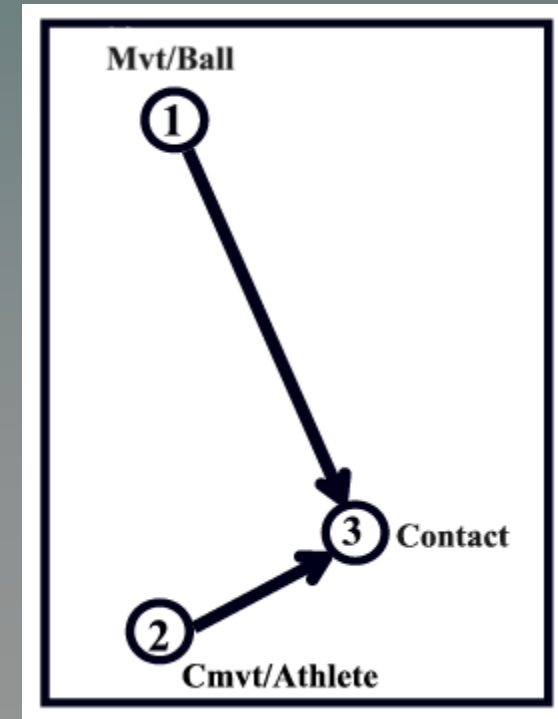
4-Dimensional Symmetry

A Theoretical Model of Human Peak Performance

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DEFINITIONS

Symmetry: The equal distribution of parts on opposite sides of a dividing line or around an axis.

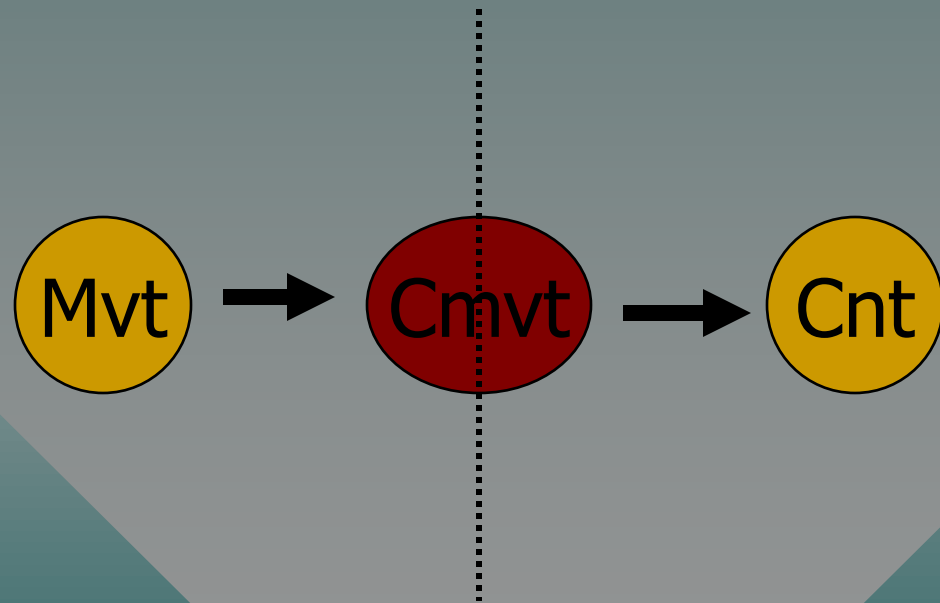
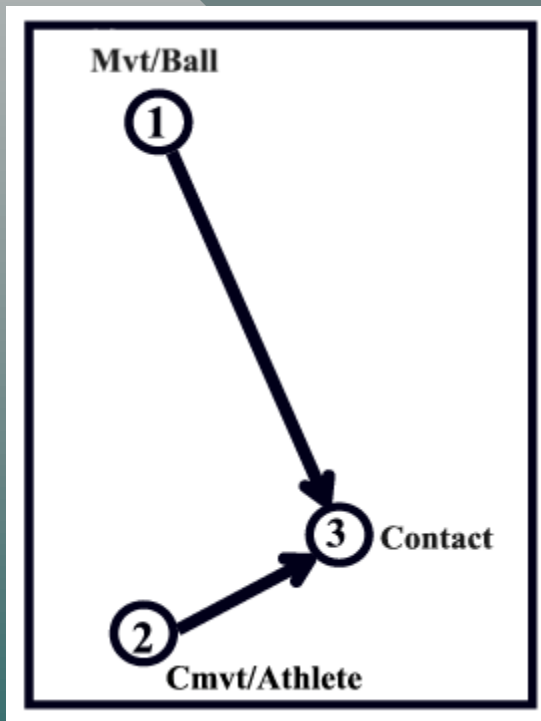
Asymmetry: The unequal distribution of parts on opposite sides of a dividing line or around an axis.

4D-Symmetry: The equal distribution of Spatial and Temporal dimensions on opposite sides of a dividing line or around an axis.

4D-Asymmetry: The unequal distribution of Spatial and Temporal dimensions on opposite sides of a dividing line or around an axis.

DEFINITIONS (Con't)

THE CONTACT SEQUENCE (CSQ) (Tennis Environment)



Thesis

- **The underlying VCM performance configuration causal to the NPS and its coincident Psychological, Emotional and Spiritual behaviors is a performance configuration of *4D VCM Asymmetry*.**

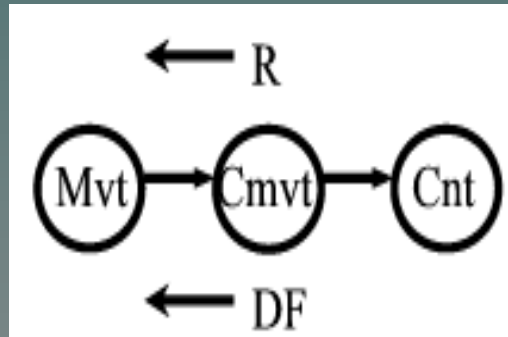
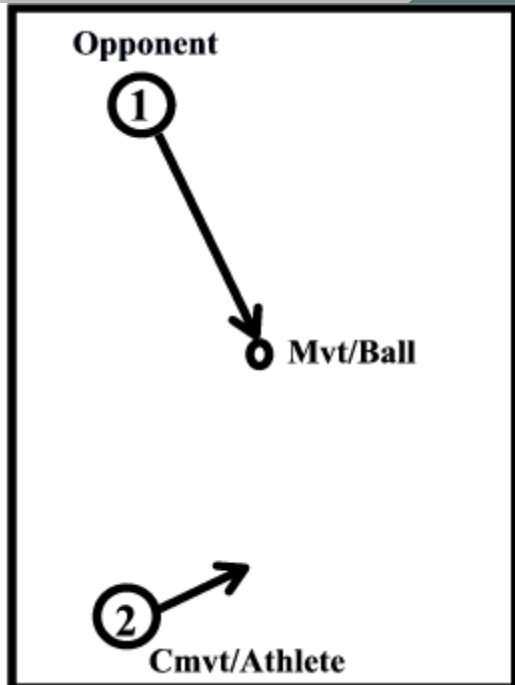
4D VCM Asymmetry → NPS/Normal PES Behaviors

Thesis

- **The underlying VCM performance configuration causal to the PPS and its higher-order Psychological, Emotional and Spiritual behaviors is a performance configuration of *4D VCM Symmetry*.**

4D VCM Symmetry → PPS/Higher-Order PES Behaviors

Variable Depth of Focus Input (VDF) (Visual Asymmetry)



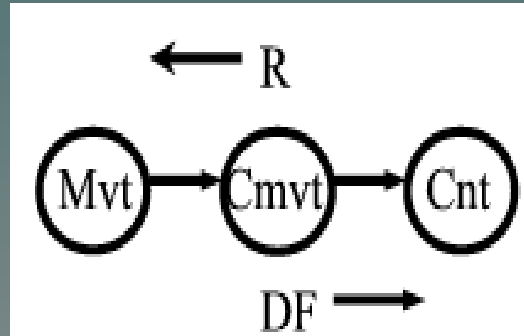
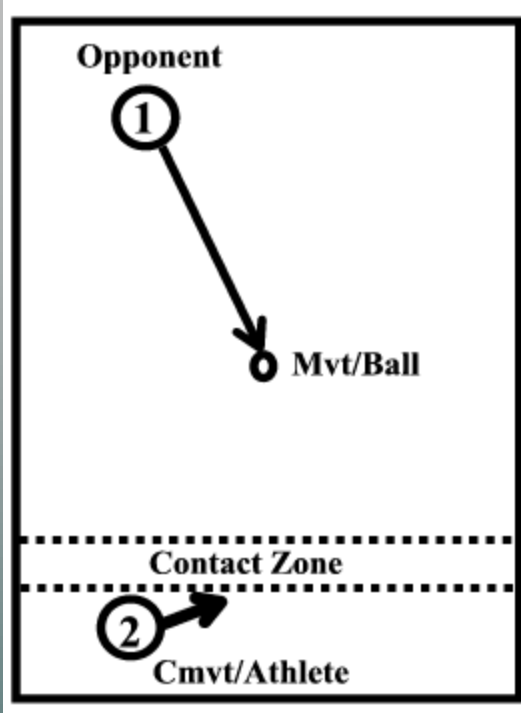
Visual Cmvts
R=Rotation
DF=Depth of Focus

$R \rightarrow \text{Mvt} / \text{DF} \rightarrow \text{Mvt}$

$\text{Mvt}=2 / \text{Cnt}=0$

- VDF Input gives you an unequal visual distribution of the available visual information in the CSQ environment.
- VDF Input is *Visual Asymmetry*.

Fixed Depth of Focus Input (FDF) (Visual Symmetry)



Visual Cmvts
R=Rotation
DF=Depth of Focus

$R \rightarrow \text{Mvt} / \text{DF} \rightarrow \text{Cnt}$

$\text{Mvt}=1 / \text{Cnt}=1$

- FDF Input gives you an equal visual distribution of the available visual information in the CSQ environment.
- FDF Input is *Visual Symmetry*.

Visual Efficiency

- **Systems Analysis:** any system that accomplishes the same objective as another system but with fewer variables is a more efficient system.
 - **VDF Visual Cmvts:**
 - Rotation Cmvts: variable
 - Depth of Focus Cmvts: variable
 - Efficiency Rating: **2 variables**

Visual Efficiency

(Con't)

- **Systems Analysis:** any system that accomplishes the same objective as another system but with fewer variables is a more efficient system.
 - **FDF Visual Cmvts:**
 - **Rotation Cmv:** variable
 - **Depth of Focus Cmv:** CONSTANT
 - **Efficiency Rating:** **1 variable/1 constant**

Input Accuracy

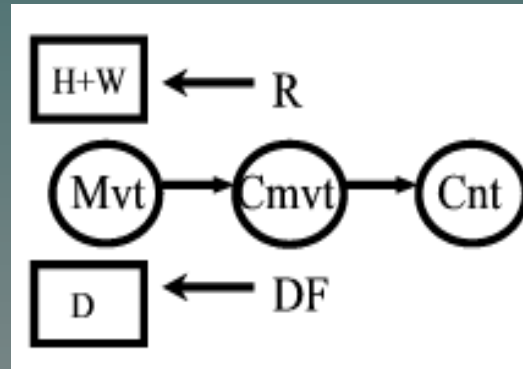
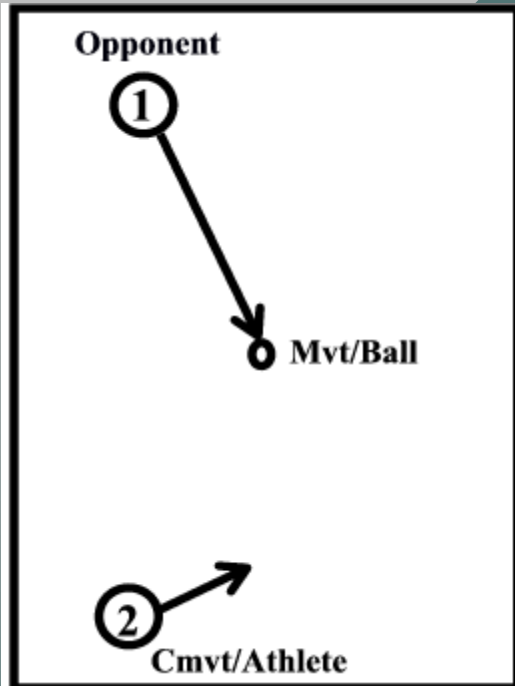
- **Prefocusing Eliminates Refocusing**
 - Prefocusing on the Contact Zone eliminates the Depth of Focus variable by changing it to a constant.
 - Eliminating the Depth of Focus variable eliminates the 70 degree/second relative velocity limitation.

Input Accuracy (Con't)

- **Triangulation vs. Point-to-Point**
 - Locating the OCP along a predefined Depth of Focus/Contact (**triangulation**) is more accurate than locating the OCP along the variable flight line of Movement (**point-to-point**).

Spatial Asymmetry

VDF Input



Visual Cmvts

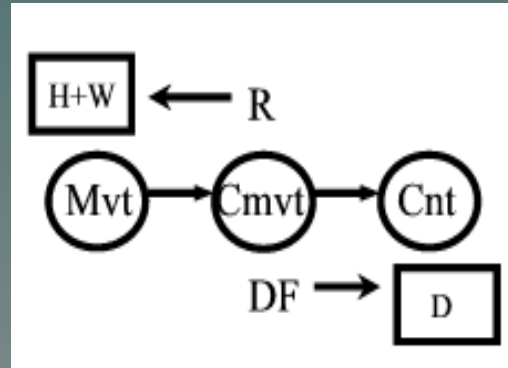
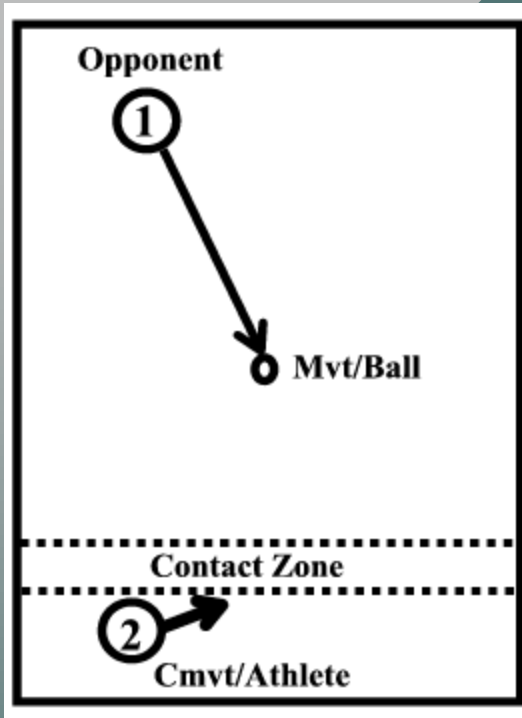
R=Rotation
DF=Depth of Focus

R → H+W of Mvt
DF → Depth of Mvt

- Visual Cmvts dedicated to the spatial location of Mvt – 2
- Visual Cmvts dedicated to spatial location of Contact - 0
- **Distribution pattern: Mvt – 2 / Cnt – 0**
- This is unequal visual distribution of spatial information re: the opposing elements of the CSQ environment.
- This is *Spatial Asymmetry*.

Spatial Symmetry

FDF Input



Visual Cmvts

R=Rotation
DF=Depth of Focus

R → H+W of Mvt
DF → Depth of Cnt

- Visual Cmvts dedicated to the spatial location of Mvt – 1
- Visual Cmvts dedicated to the spatial location of Contact – 1
- **Distribution pattern: Mvt – 1 / Contact – 1**
- This is equal visual distribution of spatial information re: the opposing elements of the CSQ environment.
- This is *Spatial Symmetry*.

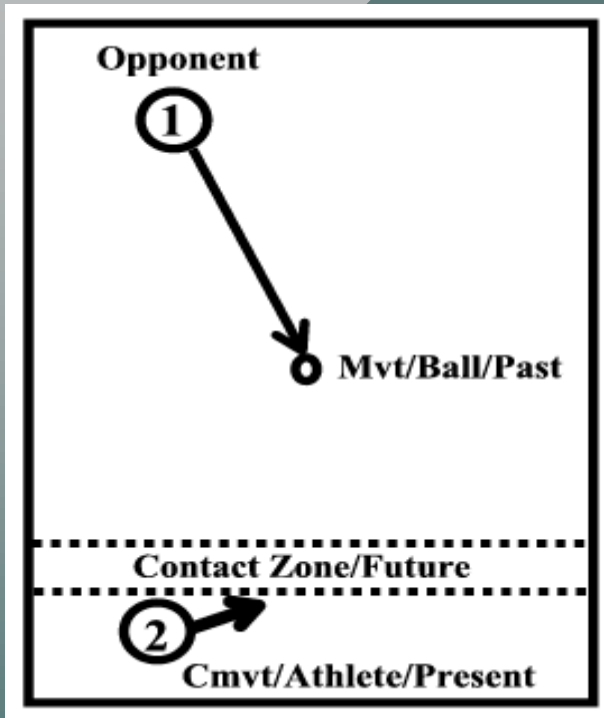
The CSQ and Time

CSQ in Time

Mvt → Cmv → Cnt
1 → 2 → 3
Past → Present → Future

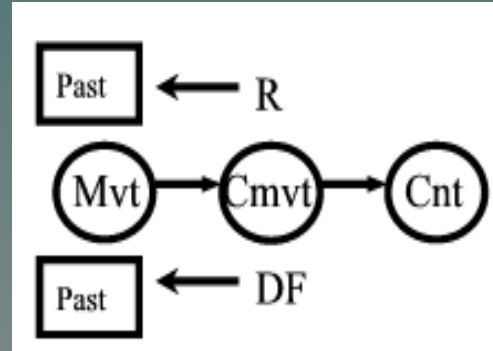
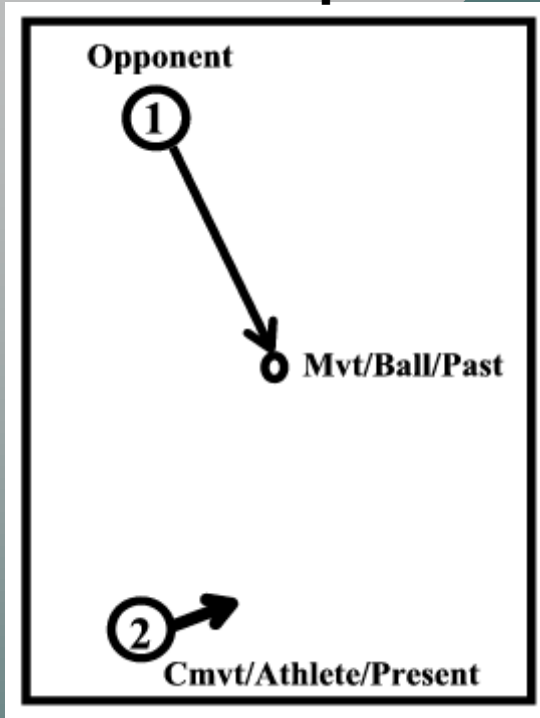
CSQ in Space

Mvt → Cnt ← Cmv
1 → 3 ← 2
Past → Future ← Present



Temporal Asymmetry

VDF Input



Visual Cmvts

R=Rotation

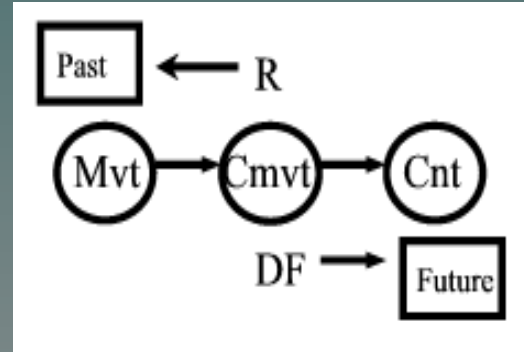
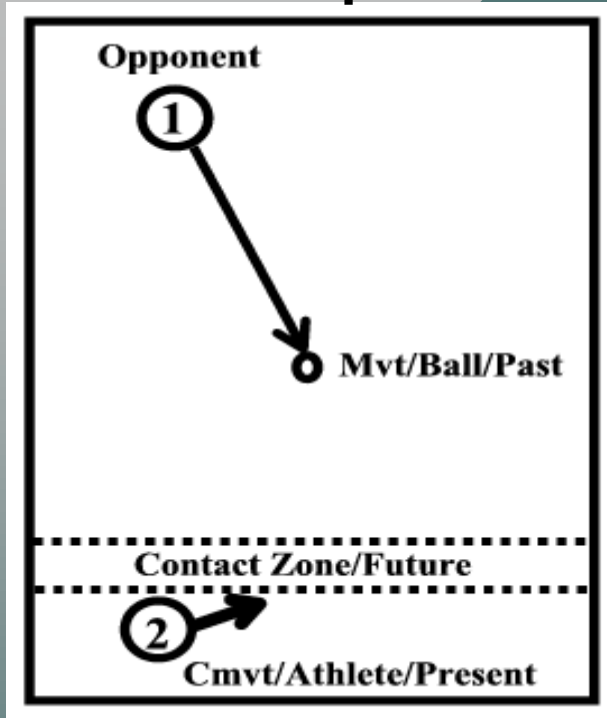
DF=Depth of Focus

R → Past Mvt
DF → Past Mvt

- Visual Cmvts dedicated to Past Mvt = 2
- Visual Cmvts dedicated to Future Cnt = 0
- **Distribution Pattern: Past-2/Future-0 = PAST ONLY**
- This is unequal distribution of the temporal information re: the opposing elements of the CSQ.
- This is *Temporal Asymmetry*.

Temporal Symmetry

FDF Input



Visual Cmvts

R=Rotation

DF=Depth of Focus

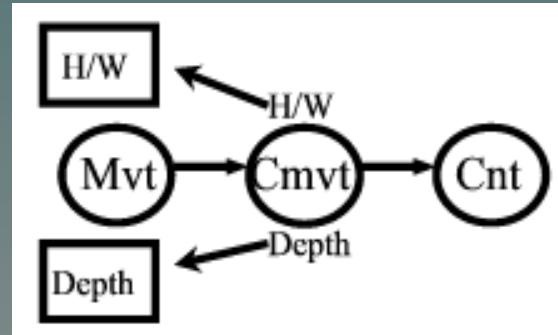
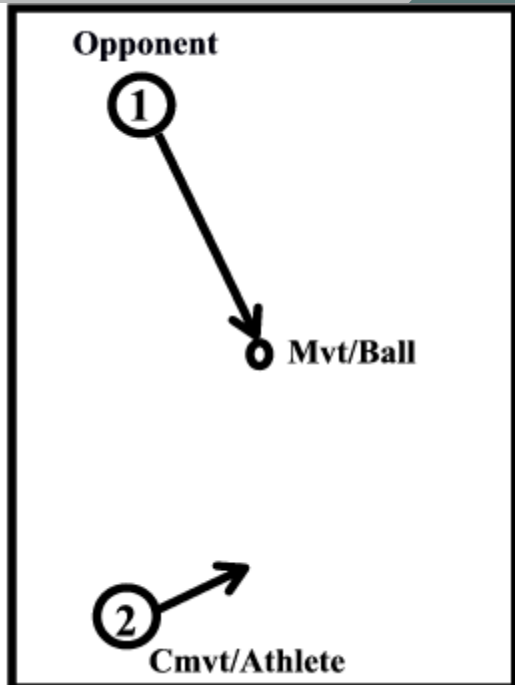
R → Past Mvt
DF → Future Cnt

- Visual Cmvts dedicated to Past Mvt = 1
- Visual Cmvt dedicated to Future Cnt = 1
- **Distribution Pattern: Past-1/Future-1 = PRESENT**
- This is equal distribution of the temporal information re: the opposing elements of the CSQ.
- This is *Temporal Symmetry*.

Visual Input Summary

	VDF Input	FDF Input
1. Efficiency:	R=Variable/VDF=Variable 2 Variables	R=Variable/FDF =Constant 1 Variable/1 Constant
2. Accuracy:	Refocus=Variable Point-to-Point location of OCP	Prefocus=Constant Triangulation of OCP
3. CSQ distribution:	Mvt only=Asymmetry	1/2 Mvt / 1/2 Cnt=Symmetry
4. Spatial distribution:	R=HW of Mvt/VDF=D of Mvt Spatial Asymmetry	R=HW of Mvt/FDF=D of Cnt Spatial Symmetry
5. Temp distribution:	R=Past / VDF=Past Past/Past = Past Temporal Asymmetry	R=Past/FDF=Future Past/Future = PRESENT Temporal Symmetry

Variable Depth of Contact Output (VDC) (Motor Asymmetry)

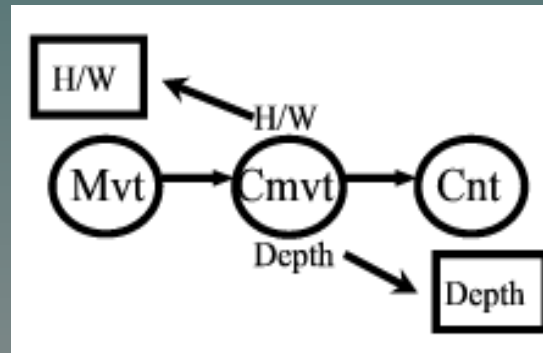
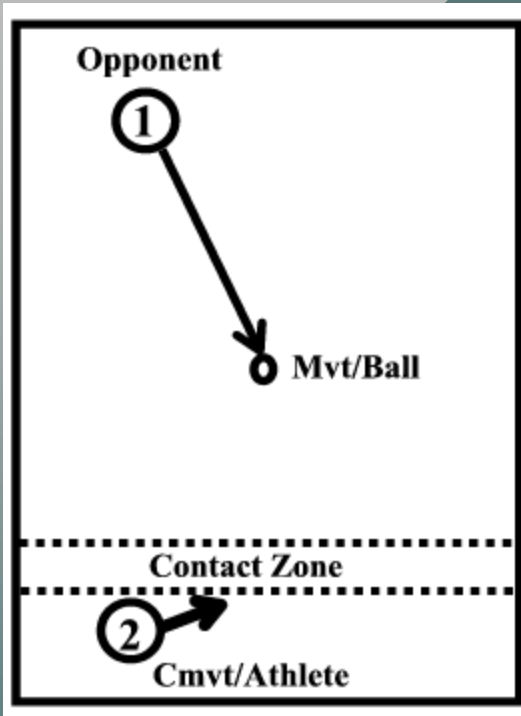


**H/W=Height/Width
of Cmvt
D=Depth of Cmvt**

**H/W Cmvt → H/W Mvt
D Cmvt → D Mvt**

- VDC Output gives you an unequal distribution of motor output toward Mvt only.
- VDC Output is *Motor Asymmetry*.

Fixed Depth of Contact Motor Output (FDC) (Motor Symmetry)



**H/W = Height/Width
of Cmvt**
**Depth = Depth of
Cmvt**

$$H/W \text{ Cmvt} = H/W \text{ Mvt}$$

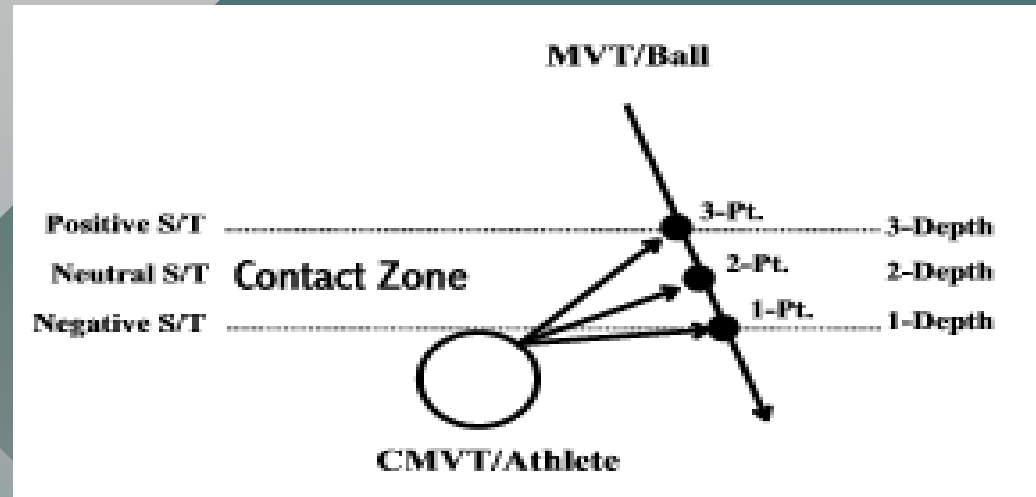
$$D \text{ Cmvt} = \text{Depth of Cnt}$$

- FDC Motor Output gives you an equal distribution of motor information toward Mvt and Cnt simultaneously.
- FDC Motor Output is *Motor Symmetry*.

Motor Efficiency

- **Systems Analysis:** any system that accomplishes the same objective as another system but with fewer variables is a more efficient system.
- **VDC Output:**
 - H/W of C_{mvt} ~ H/W of M_{vt} = 1 Vector Variable
 - Depth of C_{mvt} ~ Depth of M_{vt} = 1 Vector Variable
 - **Efficiency Rating: 2 Vector Variables**
- **FDC Output**
 - H/W of C_{mvt} ~ H/W of M_{vt} = 1 Vector Variable
 - Depth of C_{mvt} ~ Depth of Contact = 1 Vector CONSTANT
 - **Efficiency Rating: 1 variable/1 CONSTANT**

Spatial/Temporal Accuracy



**3-Depth: CmvT controls S/T of CZ: Positive CSQ in S/T
(High accuracy)**

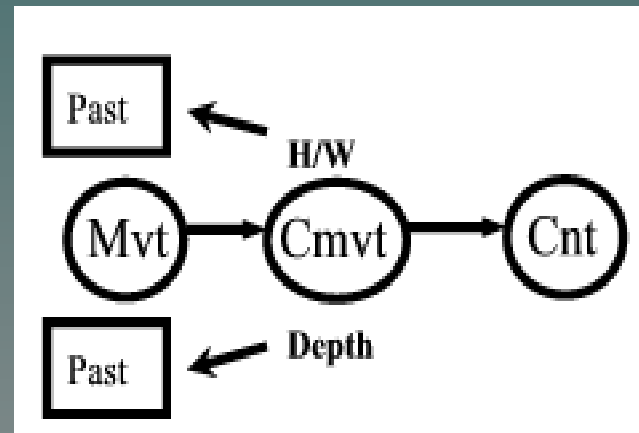
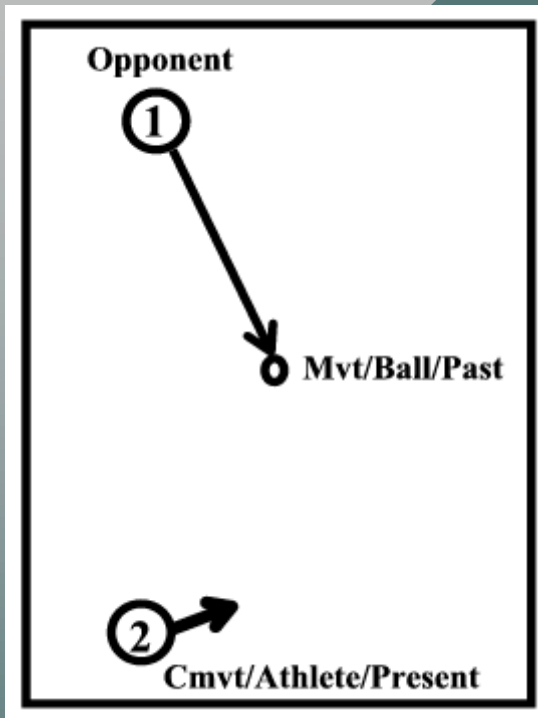
**2-Depth: 50/50 control of S/T of CZ: Neutral CSQ in S/T
(Medium Accuracy)**

**1-Depth: Mvt controls S/T of CZ: Negative CSQ in S/T
(Low Accuracy)**

Output Accuracy

- **Fixed-DC Eliminates Variable-DC**
- **Triangulation vs. Point-to-Point**
 - Contacting the OCP along a predefined Depth of Contact (**triangulation**) is more accurate than contacting the ball somewhere along the variable flight line of Movement (**point-to-point**).

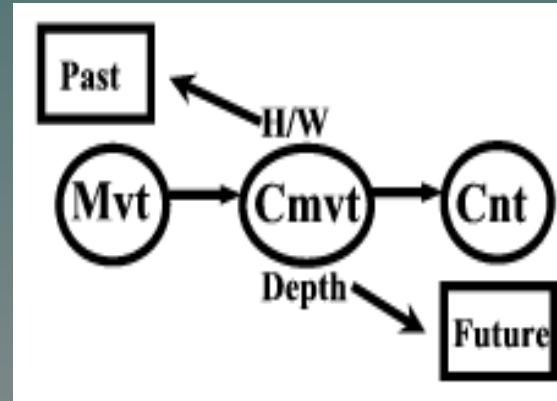
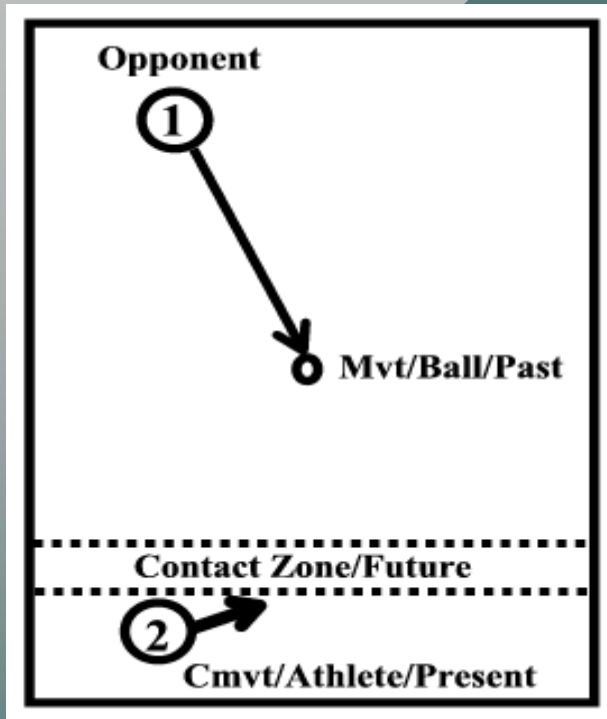
Cmvt "In the Past"



H/W Cmvt = Past Mvt
Depth Cmvt = Past Mvt

- Motor Output dedicated to Past Mvt = 2
- Motor Output dedicated to Future Contact = 0
- This is the unequal distribution of Motor Output toward the Past element of the CSQ.
- This is Cmvt *"In the Past"*

Cmvt "In the Present"



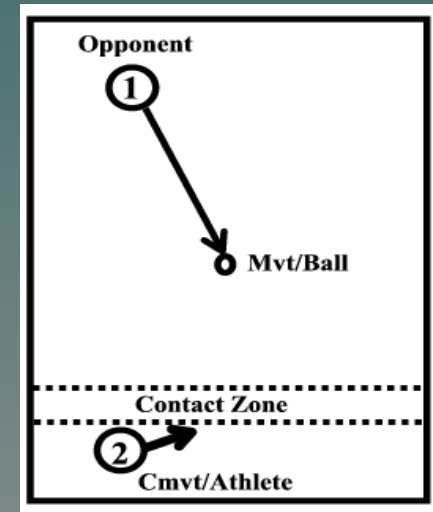
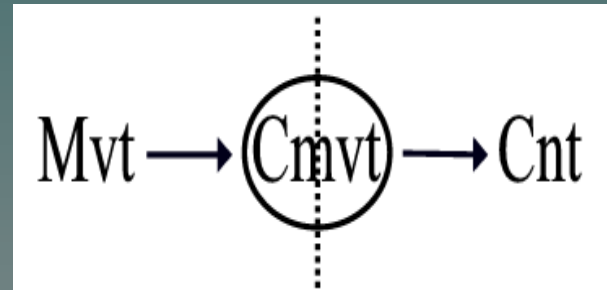
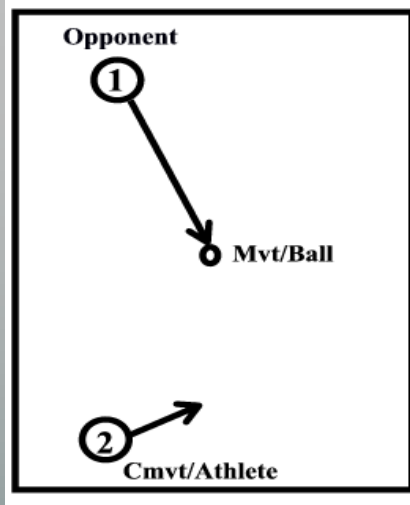
H/W Cmvt = Past Mvt
Depth Cmvt = Future Cnt

- Motor Cmvts dedicated to Past Mvt = 1
- Motor Cmvt dedicated to Future Contact = 1
- This is the equal distribution of Motor Output toward the opposing elements of the CSQ.
- This is Cmvt *"In the Present"*

Motor Output Summary

	VDC Output	FDC Output
1. Efficiency:	$H/W = V-V/DC = V-V$ 2 Vector Variables	$H/W = V-V/DC = V$ -Constant 1 V-Variable/1 V-Constant
2. Accuracy:	Point-to-Point location of OCP	Triangulation of OCP
3. CSQ distribution:	Mvt only=Asymmetry	1/2 Mvt / 1/2 Cnt=Symmetry
4. Spatial distribution:	HWD of Cmvt~HWD of Mvt Spatial Asymmetry	HW of Cmvt~HW of Mvt D of Cmvt ~ D of Cnt Spatial Symmetry
5. Temp distribution:	HW of Cmvt ~ Past Mvt D of Cmvt ~ Past Mvt Past/Past = Past Temporal Asymmetry Cmvt "in the Past"	HW of Cmvt~Past Mvt D of Cmvt ~ Future Cnt Past/Future = Present Temporal Symmetry Cmvt "in the Present"

Summary



4DA VCM Architecture

Asymmetrical CSQ Environment

CSQ "In the Past"

Normal Performance State

Normal-Order PES Behaviors

4DS VCM Architecture

Symmetrical CSQ Environment

CSQ "In the Present"

Peak Performance State

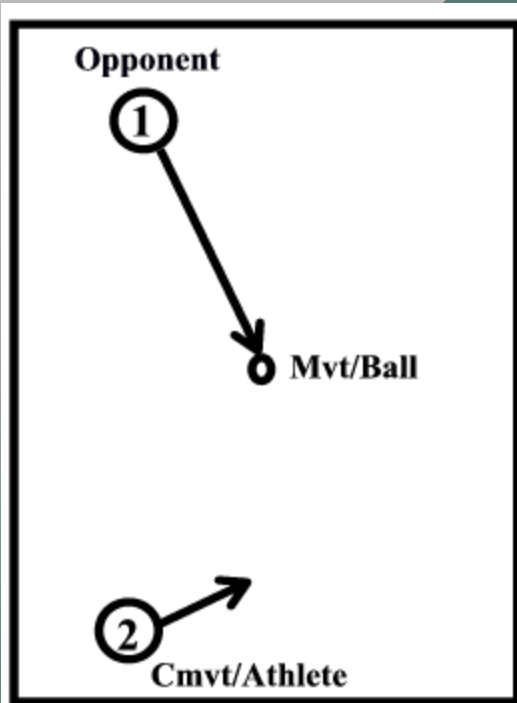
Higher-Order PES Behaviors

(Flow, The Zone)

BACKUP SLIDES

VCM Performance Configurations

PC (NPS)



Normal Performance State

VCM Performance Objectives

- Watch the ball (**VDF Input Configuration**)
- Concentrate on the ball (**Asymmetrical Processing Configuration**)
- Hit the ball (**VDC Output Configuration**)

VCM Performance Configuration (NPS)

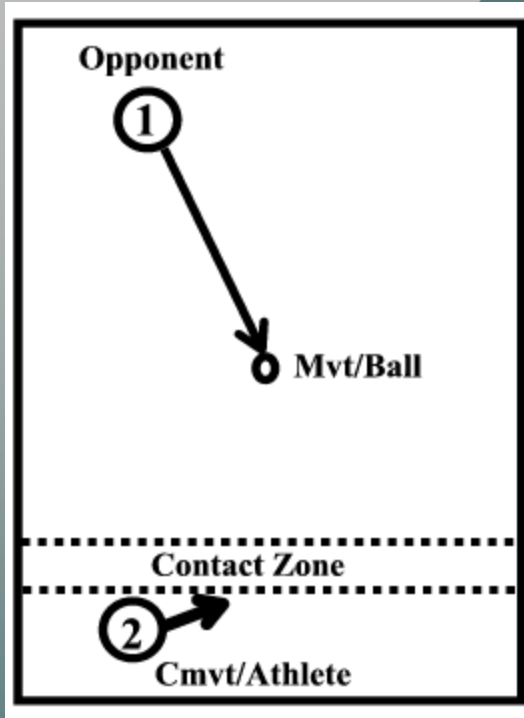
Visual: **VDF**

Cognitive: **Cognitive Asymmetry**

Motor: **VDC**

VCM Performance Configurations

PC (PPS)



Peak Performance State

VCM Performance Objectives

- Visualize a window across CZ (**Symmetrical Processing Configuration**)
- Locate the OCP (**FDF Input Configuration**)
- Hit the OCP (**FDC Output Configuration**)

VCM Performance Configuration (PPS)

Visual: **FDF**

Cognitive: **Cognitive Symmetry**

Motor: **FDC**