cMRT Conflict Models

Reverse-Engineering the original Horrey & Wickens (2003) Conflict Matrix

	V_{f}	V _a	A _s	A _v	Cs	Cv	R _s	R _v
v,	0.8	0.6	0.6	0.4	0.7	0.5	0.4	0.2
> _e		0.8	0.4	0.6	0.5	0.7	0.2	0.4
Ą			0.8	0.4	0.7	0.5	0.4	0.2
Av				0.8	0.5	0.7	0.2	0.4
Cs					0.8	0.6	0.6	0.4
C,						0.8	0.4	0.6
R							0.8	0.6
R								1.0

Wickens/Horrey Conflict Model for In-Vehicle Technology Domain

Conflict Specification Heuristic:

0.0 = no conflict; full resource sharing

1.0 = impossible to share resource concurrently

Add 0.2 for each common dimension in MRT cube "Tweak" according to domain knowledge/experience

Constructing the Conflict Model

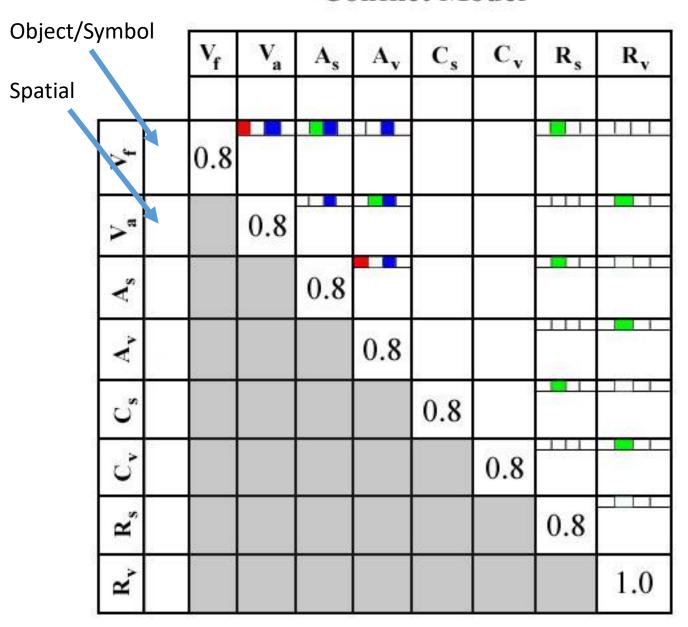
Step-by-Step Procedure

	V_f	V _a	A _s	$A_{\mathbf{v}}$	Cs	C _v	R _s	R _v
v,	0.8							
> a		0.8						
As			0.8					
$A_{\mathbf{v}}$				0.8				
Cs					0.8			
Cv						0.8		
R							0.8	
R								1.0

Apply <u>intra-resource conflict</u> parameters along the diagonal

0.8 acknowledges possibility of some sharing when great effort is applied

Rv-Rv = 1.0 since two tasks cannot share a vocal response channel simultaneously



Identify structural similarity for each <u>inter-resource conflict</u> pairing (i.e., shared dimensions of the MRT cube)

Modality Code Stage

Identify structural similarity for each inter-resource conflict pair (i.e., shared dimensions of the MRT cube)

	$V_{\mathbf{f}}$	V _a	A _s	$A_{\mathbf{v}}$	Cs	C _v	R _s	R_{v}
V _f	0.8	0.6	0.6	0.4		8	0.4	0.2
>a		0.8	0.4	0.6		3	0.2	0.4
As			0.8	0.6			0.4	0.2
Av				0.8			0.2	0.4
C					0.8		0.4	0.2
C,						0.8	0.2	0.4
R _s							0.8	0.2
R								1.0

Translate MRT dimensional overlap for Perceptual and Response stages into conflict values

0.2 added per shared dimension

0.2 added as "Cost of Concurrency"

Modality Code Stage

Assigning a Conflict Score for Cognitive Stage Resources

"...since cognitive resources do not involve the A-V distinction, their conflict with perceptual resources (that do involve this distinction) is defined as an average value between sharing and separate modality resources. (Hence, the odd numbers within the cognitive cells.)"

Wickens (2002; p. 170)

	V_f	V _a	A _s	$A_{\mathbf{v}}$	Cs	C _v	R _s	R_{v}
ک	0.8	0.6	0.6	0.4			0.4	0.2
> _a	0.6	0.8	0.4	0.6		8	0.2	0.4
As	0.6	0.4	0.8	0.6			0.4	0.2
A	0.4	0.6	0.4	0.8		8	0.2	0.4
Cs					0.8		0.4	0.2
Cv						0.8	0.2	0.4
R							0.8	0.2
R								1.0

Reflect Perceptual Stage scores into "negative" side of diagonal to aid in the computation of Cognitive stage conflict

Modality Code Stage

	V_f	V _a	A _s	$A_{\mathbf{v}}$	Cs	C _v	R _s	R _v
Vf	0.8	0.6	0.6	0.4	0.7	0.5	0.4	0.2
Va	0.6	0.8	0.4	0.6	0.5	0.7	0.2	0.4
As	0.6	0.4	0.8	0.6	0.7	0.5	0.4	0.2
A	0.4	0.6	0.6	0.8	0.5	0.7	0.2	0.4
Cs		0.7		0.5	0.8	0.6	0.4	0.2
Cv						0.8	0.2	0.4
Rs	S						0.8	0.2
R								1.0

Compute Cognitive Stage Conflicts

Cognitive-Spatial example: Vf-Cs = (Vf-Vf + Vf-As)/2 = (0.8+0.6)/2 = 0.7

Cognitive-Verbal example: Vf-Cv = (Vf-Va + Vf-Av)/2 = (0.6+0.4)/2 = 0.5

Modality Code Stage

	V_{f}	V _a	A _s	$A_{\mathbf{v}}$	Cs	C _v	R _s	R _v
V,	0.8	0.6	0.6	0.4	0.7	0.5	0.4	0.2
>a	0.6	0.8	0.4	0.6	0.5	0.7	0.2	0.4
As	0.6	0.4	0.8	0.6*	0.7	0.5	0.4	0.2
A	0.4	0.6	0.6	0.8	0.5	0.7	0.2	0.4
C		0.7		0.5	0.8	0.6	0.4	0.2
Cv						0.8	0.2	0.4
R					7		0.8	0.2
R _v					\$ 2			1.0

Modality Code Stage

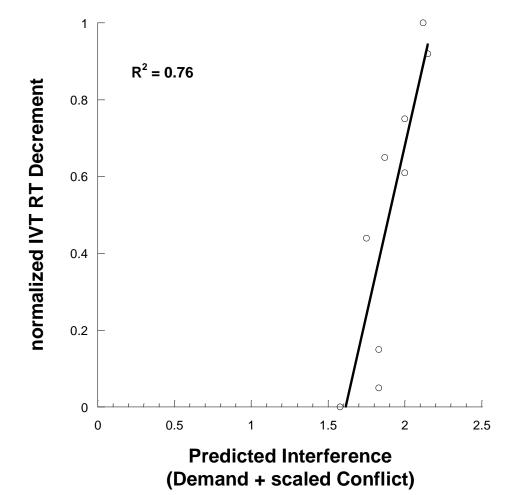
Horrey & Wickens (2003) liberally "tweaked" the Cognitive-Response conflict levels to reflect the cognitive costs of response selection in the in-vehicle technology domain.

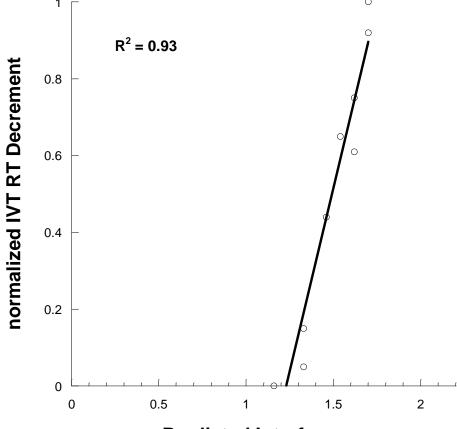
	V_{f}	V _a	A _s	A _v	Cs	Cv	R _s	R _v
v v	0.8	0.6	0.6	0.4	0.7	0.5	0.4	0.2
> a		0.8	0.4	0.6	0.5	0.7	0.2	0.4
As			0.8	0.4	0.7	0.5	0.4	0.2
A _v				0.8	0.5	0.7	0.2	0.4
Cs					0.8	0.6	0.6	0.4
C,						0.8	0.4	0.6
χ.							0.8	0.6
R					<i>y</i>			1.0

Wickens/Horrey Conflict Model for In-Vehicle Technology Domain

Calculation of Horrey & Wickens (2003) cMRT Prediction Validation Exercise using Revised Conflict Model

Condition	Observed	Demand	Scaled Conflict	Prediction 1 (D + Scaled C)	Normalized Demand	Prediction 2 (norm D + Scaled C)
City-HUD	0.61	1.13	0.87	2.00	0.753	1.62
City-HDD	0.92	1.25	0.87	2.15	0.833	1.70
City-Audio	0.05	1.50	0.33	1.83	1.000	1.33
Straight-HUD	0.44	0.88	0.87	1.75	0.586	1.46
Straight-HDD	0.65	1.00	0.87	1.87	0.667	1.54
Straight-Audio	0.00	1.25	0.33	1.58	0.833	1.16
Curves-HUD	0.75	1.13	0.87	2.00	0.753	1.62
Curves-HDD	1.00	1.25	0.87	2.12	0.833	1.70
Curves-Audio	0.15	1.50	0.33	1.83	1.000	1.33





Predicted Interference (normalized Demand + scaled Conflict)