	ACTIVE MAINTENANCE N = 16,729		MANIPULATION OF INFORMATION N = 26,727						MAINT. + MANIP. N = 19,153		CONTINUOUS UPDATING N = 11,616			SECONDARY MEASURES N = 24,321			WM N = 100,134
Cohort	Digit Span Forward	Spatial Span Forward	Digit Span Backward	Digit Span Ordering	Letter-Number Span	Arithmetic	TBX List Sorting	Spatial Span Backward	Digit Span	Spatial Span	*N*-back	PASAT	CANTAB SWM	CPT	TMT-B	COWAT	Total
ACPRC	--	--	--	--	--	--	--	--	699	--	--	--	--	--	--	--	699
ADNI	458	--	458	--	--	--	--	--	458	--	--	--	--	--	515	--	1,889
ASPIS	--	--	--	--	--	--	--	--	--	--	2,104	--	--	1,052	--	--	3,156
CAMH	80	66	--	--	79	--	--	66	80	33	--	--	--	33	79	80	596
CHS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1,570	--	1,570
CNP	1,272	--	1,272	1,272	628	--	--	--	636	635	--	--	--				5,715
DCC	710	645	710	--	--	--	--	645	710	--	--	--	645	645	708	710	6,128
DNS	455	--	455	454	--	--	--	--	455	--	--	313	--	--	451	453	3,036
FHS	2,033	--	2,018	--	--	--	--	--	2,018	--	--	--	--	--	3,917	1,995	11,981
GCAP	1,357	--	1,362	--	1,148	1,469	--	--	1,362	--	1,212	--	--	177	1,445	1,462	10,994
GenADA	--	--	--	--	--	--	--	--	782	--	--	--	--	--	--	--	782
LBC1936	989	989	989	--	--	--	--	989	989	989	--	--	--	--	989	--	6,923
LLFS	4,497	--	4,481	--	--	--	--	--	4,481	--	--	--	--	--	--	--	13,459
LOAD	1,034	--	1,034	660	--	--	--	--	1,034	--	--	--	--	--	--	--	3,762
LOGOS	--	--	--	--	--	--	--	--	--	--	860	--	859	847	--	--	2,566
MUNICH	--	--	--	--	--	1,312	--	--	1,312	337	511	--	--	331	516	525	4,844
PING	--	--	--	--	--	--	1,359	--	--	--	--	--	--	--	--	--	2,718
PNC	--	--	--	--	--	--	--	--	--	--	4,212	--	--	4,247	--	--	8,459
TOP	2,100	--	2,124	--	1,504	--	--	--	2,124	--	836	--	--	--	--	989	9,677
ZHH	44	--	44	--	195	--	--	--	52	196	64	--	--	150	217	218	1,180
Total	15,029	1,700	14,947	2,386	3,554	2,781		4,418	16,963	2,190	9,799	313	1,504	7,482	10,407	6,432	100,134

Table 2. Working memory measures currently available in COGENT. See Table 1 for Cohort descriptions. Note that an individual participant can have multiple working memory datapoints (and many do), each of which can be utilized in Genomic SEM as the program fully accounts for sample overlap. Abbreviations: TBX, NIH Toolbox; PASAT, Paced Auditory Serial Addition Test; CANTAB SWM, Cambridge Neuropsychological Test Automated Battery - Spatial Working Memory; CPT, Continuous Performance Test; TMT-B, Trail Making Test - Part B; COWAT, Controlled Oral Word Association Test.

Phenotypic Factor Models. We will perform phenotypic factor analysis of the working memory data within each sample with Onyx SEM [60] to compare with the genetic structural models. In the phenotypic SEM, the latent working memory factor represents the phenotypes themselves, and the phenotypic covariance matrix is empirically estimated from the raw phenotypic data. The fit function used will be maximum likelihood (ML), and goodness-of-fit of the models will be assessed by the Root Mean Square Error of Approximation (RMSEA) in addition to SRMR, AIC, and CFI described above [59,60,65].

For this application, we generated a CFA model in an exemplary COGENT working memory dataset comprised of 315 healthy German adults who completed Arithmetic, Digit Span, Spatial Span, *N*-back, CPT, Trails B, and COWAT. These are 7 of the most common working memory measures available in COGENT. In **Figure 3**, the common factor *phenotypic* model of working memory is a very good fit to the data [67]. The common factor *Gwm* model will be derived similarly using the genetic covariance structure of working memory in Genomic SEM [59,65].

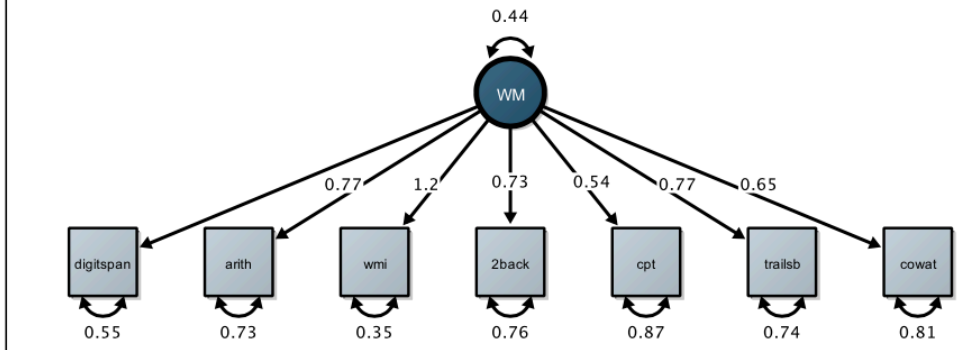

Figure 3. Phenomic SEM of Working Memory ("WM"). A subset of 315 healthy control adults from our Munich, Germany cohort completed a neuropsychological battery comprised of many core measures we propose to study. All 7 subtests loaded on a common working memory factor that accounted for 44% of the variance in performance. This model fit the data well: χ = 14.33, RMSEA = .043, SRMR = .033, CFI = .981, TLI = .968. Genetic factor models of *Gwm* in Genomic SEM will be derived and tested mirroring as above but based on the genetic covariance structure of the underlying working memory subtests and domains.