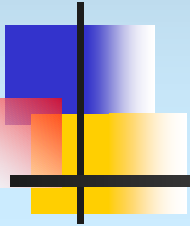


Enhancing Mobility in Older Adults



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University of Alabama at Birmingham



Basic Research



Applied Research



**Translational
Research**



Roybal Center

- Predictions of driving competence, driving habits, and other markers of mobility.
- Impact of Speed of Processing training on driving competence, mobility, and other everyday activities.



1990 Study

- Case Control study of 306 older drivers
- 5 Hour Assessment Battery
 - Visual sensory function
 - Cognitive function
 - Physical function
 - Medications
 - Health history
 - Ophthalmological exam

Welcome to UFOV[®] Test 1

This exercise will measure how fast you can identify a single object.

Touch continue for a demonstration.



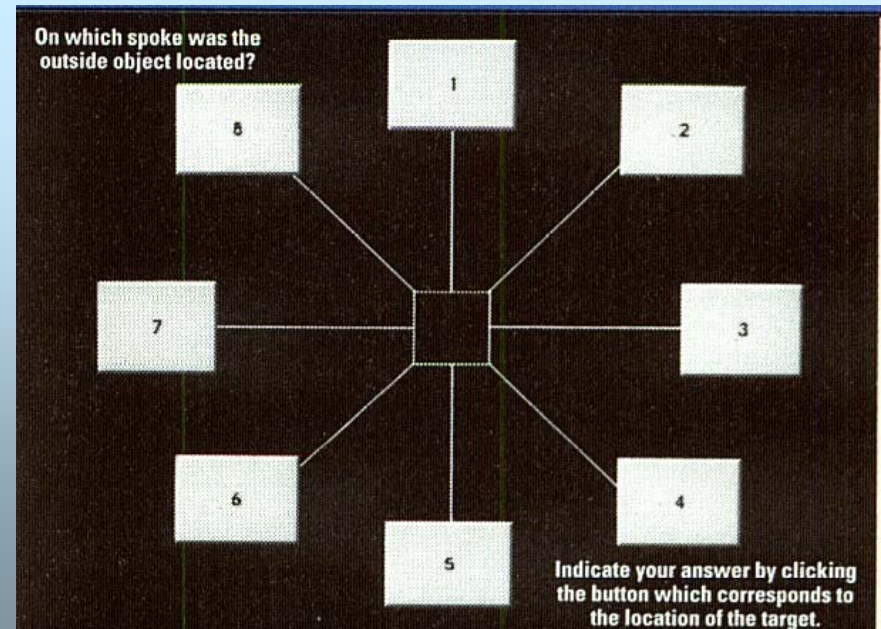
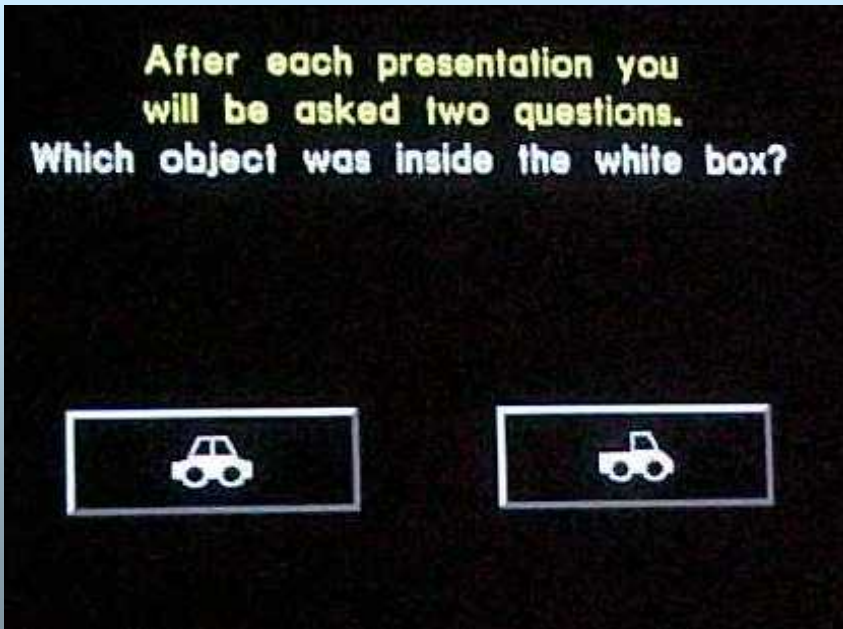
Which object was inside the white box?



Welcome to UFOV[®] Test 2

This exercise will measure how fast you can divide your attention between two objects.

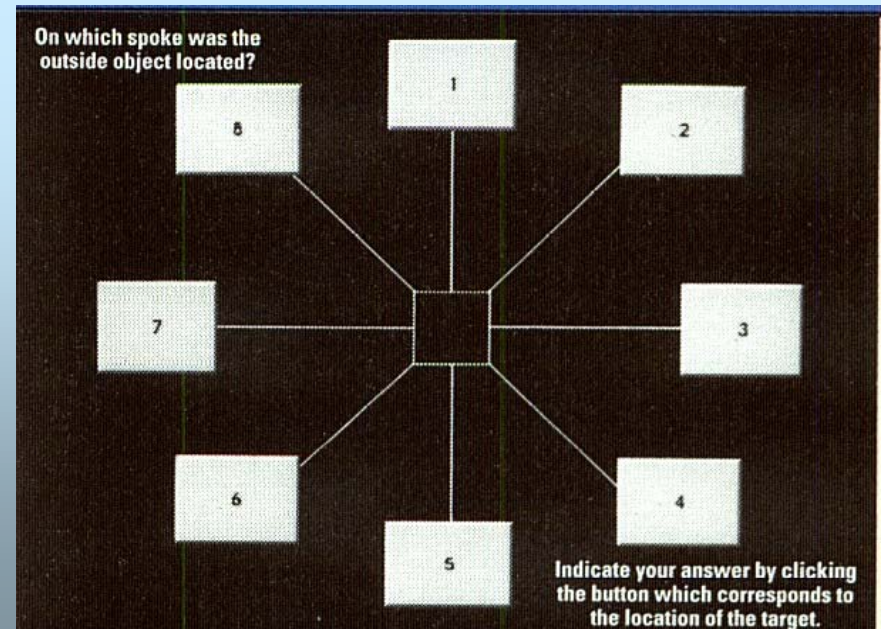
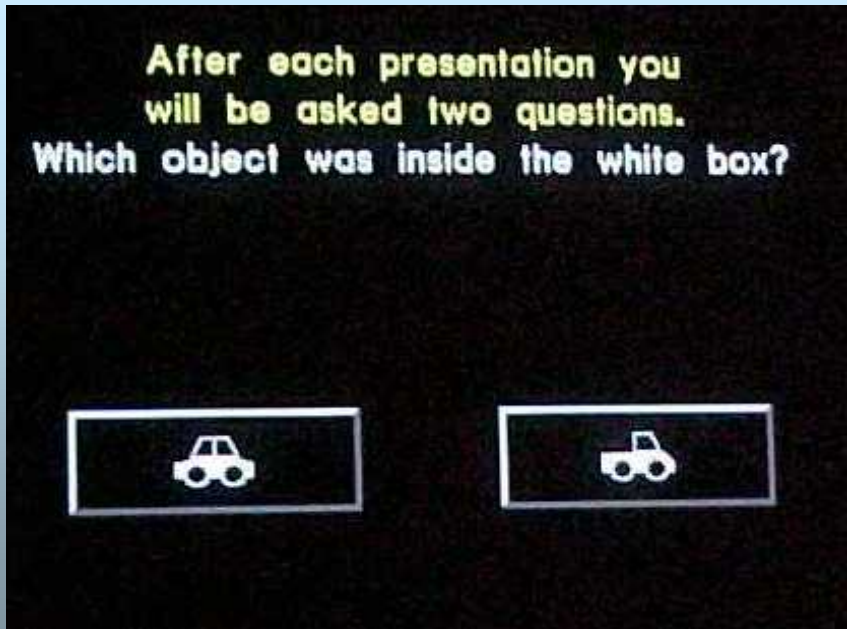
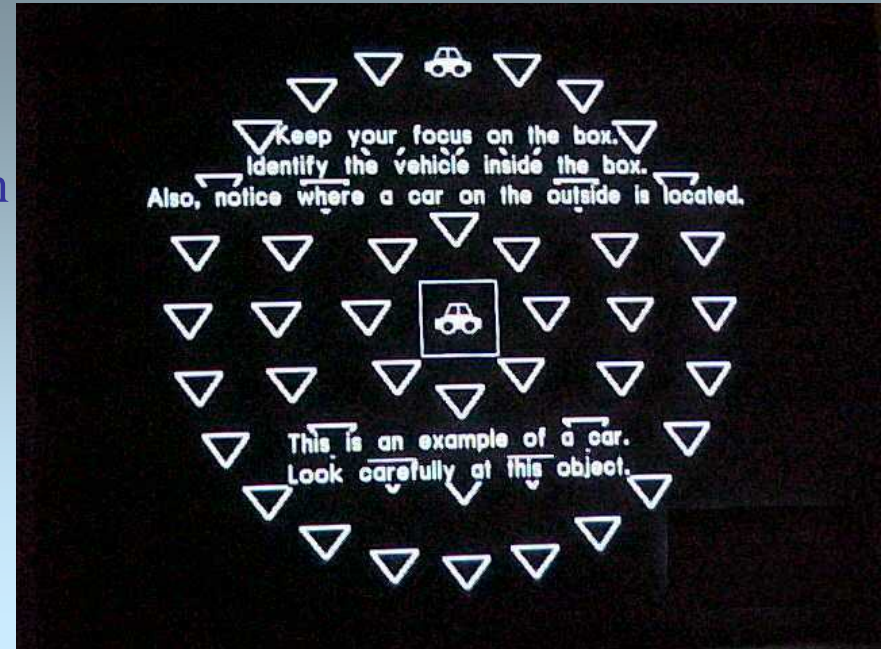
Touch continue for a demonstration.



Welcome to UFOV[®] Test 3

This exercise will measure how fast you can divide your attention between two objects when the outside object is surrounded by clutter.

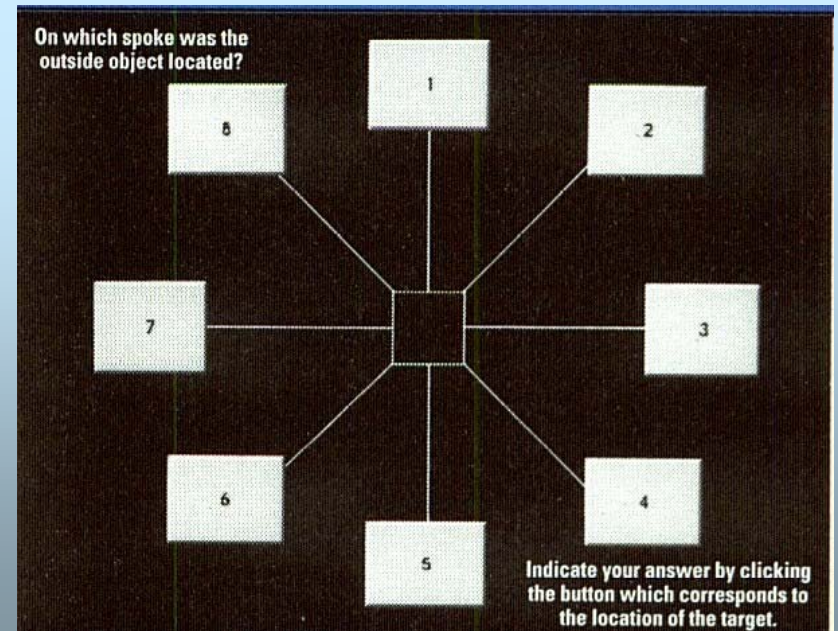
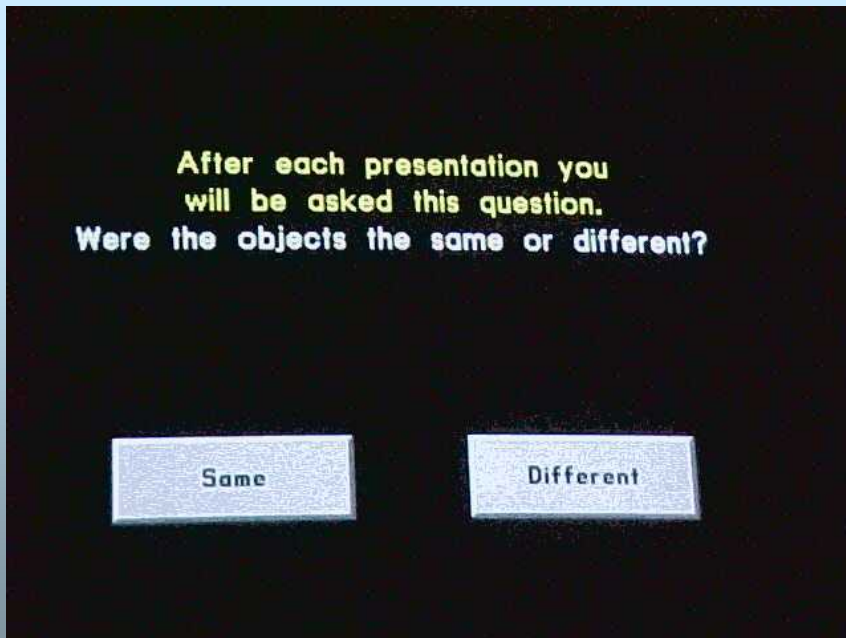
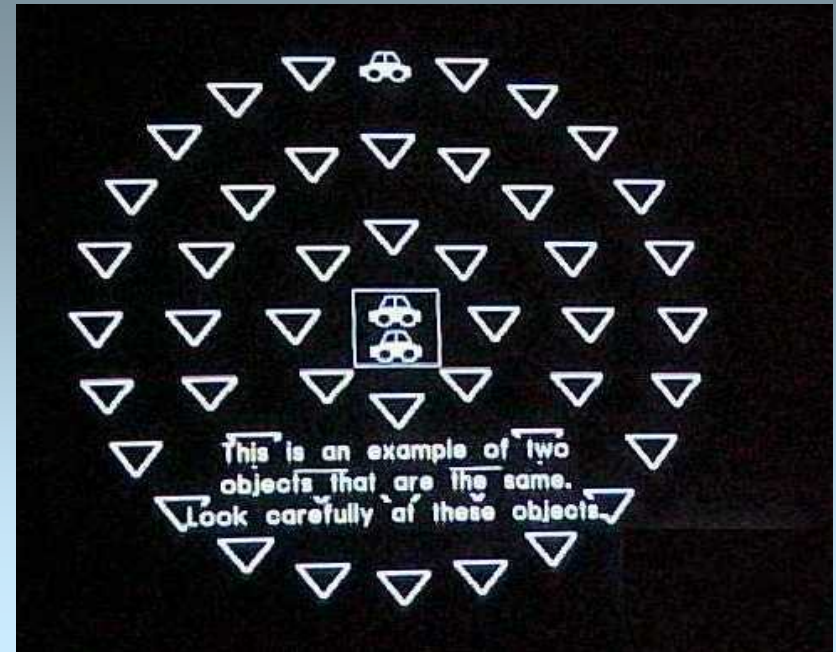
Touch continue for a demonstration.



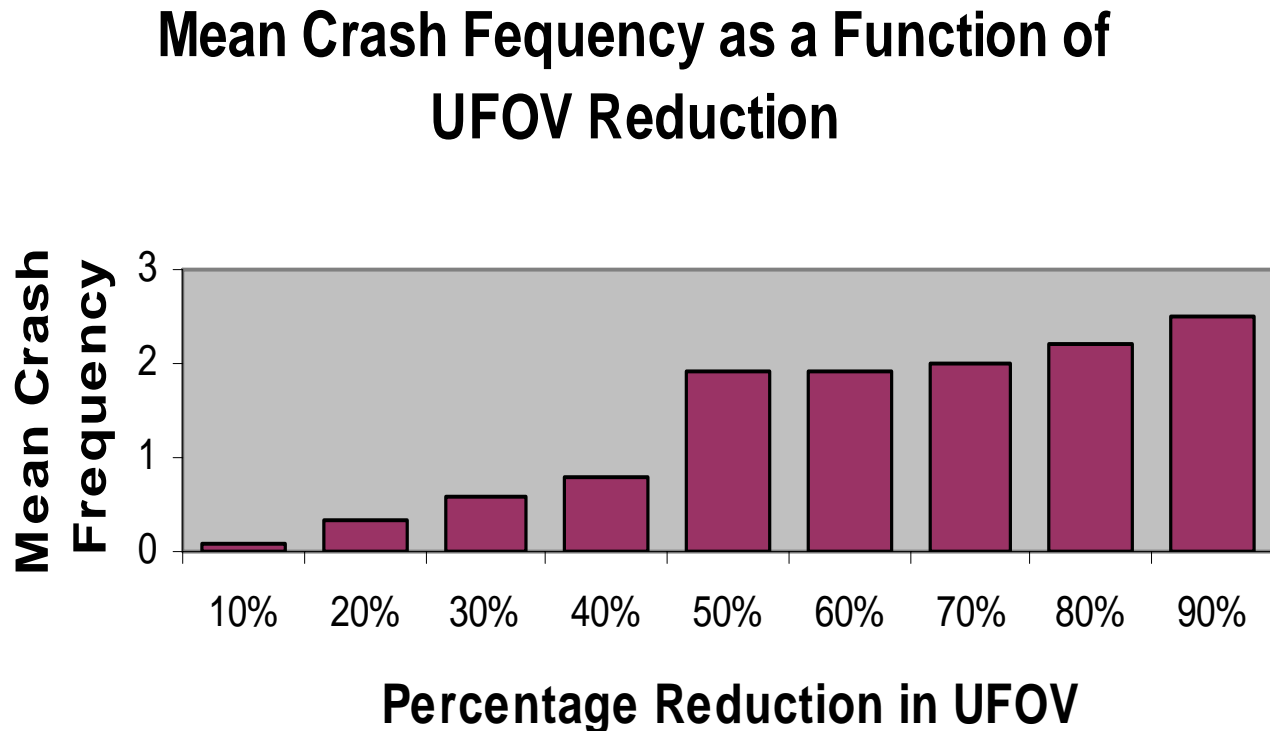
Welcome to UFOV[®] Test 4

This exercise will be like the previous exercise except the center task will be more difficult.

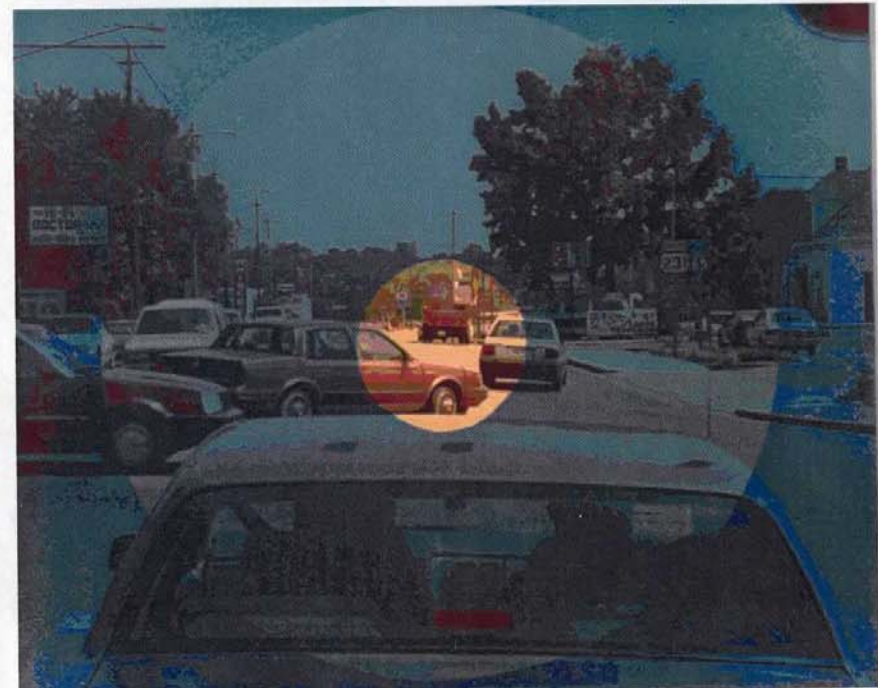
Touch continue for a demonstration.



Relationship Between UFOV[®] Reduction and Crashes



Ball et al. (1993). Visual Attention Problems as a Predictor of Vehicle Crashes in Older Drivers, *Investigative Ophthalmology & Visual Science*, 34, 3110-3123.





UFOV[®] Is Highly Predictive of Crash Involvement in Older Drivers

Older drivers with a 40% or greater impairment in the useful field of view (as measured by UFOV[®]) are 2.2 times more likely to incur a crash over the next three years than other drivers.

Owsley et al. (1998). *“Visual Processing Impairment and Risk of Motor Vehicle Crash Among Older Adults”*, JAMA.



Risk for Injurious and Non-Injurious Crashes by % UFOV[®] Reduction

	Injurious (N=78)			Non-injurious (N=101)			Non-crash (N=115)
	%	OR	CI	%	OR	CI	%
<23	7.7	1.0	Ref.	19.8	1.0	Ref	47.0
23-40	26.9	5.3	1.9-14	29.7	2.3	1.1-4.5	31.3
41-60	37.2	16.3	5.8-36	27.0	4.6	2.1-10.1	13.9
>60	28.2	22.0	7.0-69	23.4	7.1	2.9-17.5	7.8

Owsley, C., McGwin, G., & Ball, K. (1998). Vision Impairment, Eye Disease, and Injurious Motor Vehicle Crashes in the Elderly. *Ophthalmic Epidemiology*, 5, 101-113.



Roybal Center Renewal

- Maryland Field Study -- Collaborative with Maryland MVA and NHTSA
- Impact of Cognitive Training on Everyday Abilities -- Collaborative
 - ACTIVE - Six field sites
 - SKILL - Western Kentucky University
 - ACCELERATE - University of Iowa



Background

In order to identify functional ability risk factors for adverse outcomes among older drivers (driving cessation, falls, motor vehicle crashes), a collaborative study was initiated in 1998 between the Maryland MVA, NHTSA, and the NIA-funded UAB Center for Research on Applied Gerontology.



Background

This study was a part of an even broader agenda in Maryland to foster the continuing safe mobility of older drivers.



First Initiative

- Identify and assess the ability of older individuals to remain safely mobile.
 - Functional ability tests were selected/developed, and added to the already existing vision screen.
 - A pilot program was carried out in Maryland.



Focus

- To keep older drivers safely on the road using functional ability screening tests which assess vision, physical ability, cognition and perception.
- These tests are intended to detect *warning signs* for potentially unsafe drivers and guide determinations about driving remediation and training needs.



Focus

- The results of the functional capacity screening tests are intended to be used at driver's license renewal for early prevention/intervention to prolong independent safe mobility.
- Currently the Maryland Medical Advisory Board uses these same test results for driver referrals, and to determine the appropriate course of action to achieve safe mobility.



Recruitment

- 5,188 individuals over 55 were approached while renewing their licenses at a MVA field site.
- 2,207 were enrolled and underwent screening.



MVA Sample: Participants versus Decliners

- Participants did not differ from decliners in age, gender, race, prior collisions or citations.
- Prospective data spanning 1.5 – 3 years indicated that decliners also were no more likely to have *future* crashes and citations.
- These data confirm that the MVA sample is representative of the relatively healthy (mobile) population of older drivers who present for license renewal.



Brief Screening Battery

- Useful Field of View (UFOV[®] subtest 2)
 - Information Processing Speed with divided attention
- Gross Impairment Screening Battery
 - Physical, Visual, Cognitive Function
- Questionnaires
 - Self-reported Mobility, Driving Habits, Health history, Medications



Statistical Approach

- Focus on prospective crash data
- Focus on at-fault crashes



Maryland Results

- Those who failed the UFOV[®] screening test were 3.72 times more likely to have a motor vehicle crash over the next two years.



Driving Cessation

- A subsample of 643 participants was randomly selected for 3 telephone follow-up interviews.
- Among those contacted, 2% had stopped driving at interview one; 5% at interview two; and 7% at interview three.
- 49% of those no longer driving were impaired at screening on UFOV[®], 42% on Trails, 41% on MVPT, and 35% were impaired on Rapid Walk.
- Impairments were more likely to lead to driving cessation than crash involvement during the prospective period.



Caveats

Older adults with impairments were found to limit their driving exposure prior to driving cessation (avoid difficult driving situations, driver fewer miles and fewer days per week).

- Crash analyses did not take into account all these behavioral changes during the prospective period, but will do so in the longitudinal follow-up.
- Limiting exposure no doubt reduces, but is not sufficient to offset increased crash risk.



Why Screen?

- Measures of cognitive ability in particular are related to increased crash risk and reduced mobility in the renewal sample.
- Can these functions be improved?
- Will improvement in these functions result in reduced crash risk and continued safe independent mobility?

<u>STUDY</u>	<u>N</u>	<u>INCLUSION CRITERIA</u>	<u>AGE RANGE</u>	<u>TRAINING MODE</u>	<u>FOLLOW UP PERIOD</u>	<u>TRANSFER OF TRAINING (effect size)</u>
UAB Training Study	97	Community	62 – 95	Group	N/A	UFOV® (.62), TIADL
ACCEL	158	Community MMSE \geq 25 VA \geq 20/40 CS \geq 1.35 Poor UFOV	65 – 87	Group, individual	N/A	UFOV® (1.87), TIADL
SKILL	613	Community MMSE \geq 23 VA \geq 20/80 CS \geq 1.35 Poor UFOV	62 – 94	Group, individual	N/A	UFOV® (1.94), TIADL

<u>STUDY</u>	<u>N/A</u>	<u>Inclusion Criteria</u>	<u>Age Range</u>	<u>Training Period</u>	<u>Follow-Up Period</u>	<u>Transfer of Training (Effect Size)</u>
DRIVING STUDY	104	Community VA \geq 20/40 Poor UFOV®	55 – 86	Individual	18 months	UFOV®(2.50), Driving Simulator On-road driving performance
ACTIVE	2832	Community MMSE \geq 23 VA \geq 20/70	65 – 94	Group	2 years	UFOV® (1.463 – .867)
Home Based Training	266	Community MMSE \geq 23 VA \geq 20/40 Poor UFOV®	65 – 91	Individual	N/A	UFOV® (80%) Relative to ACCEL

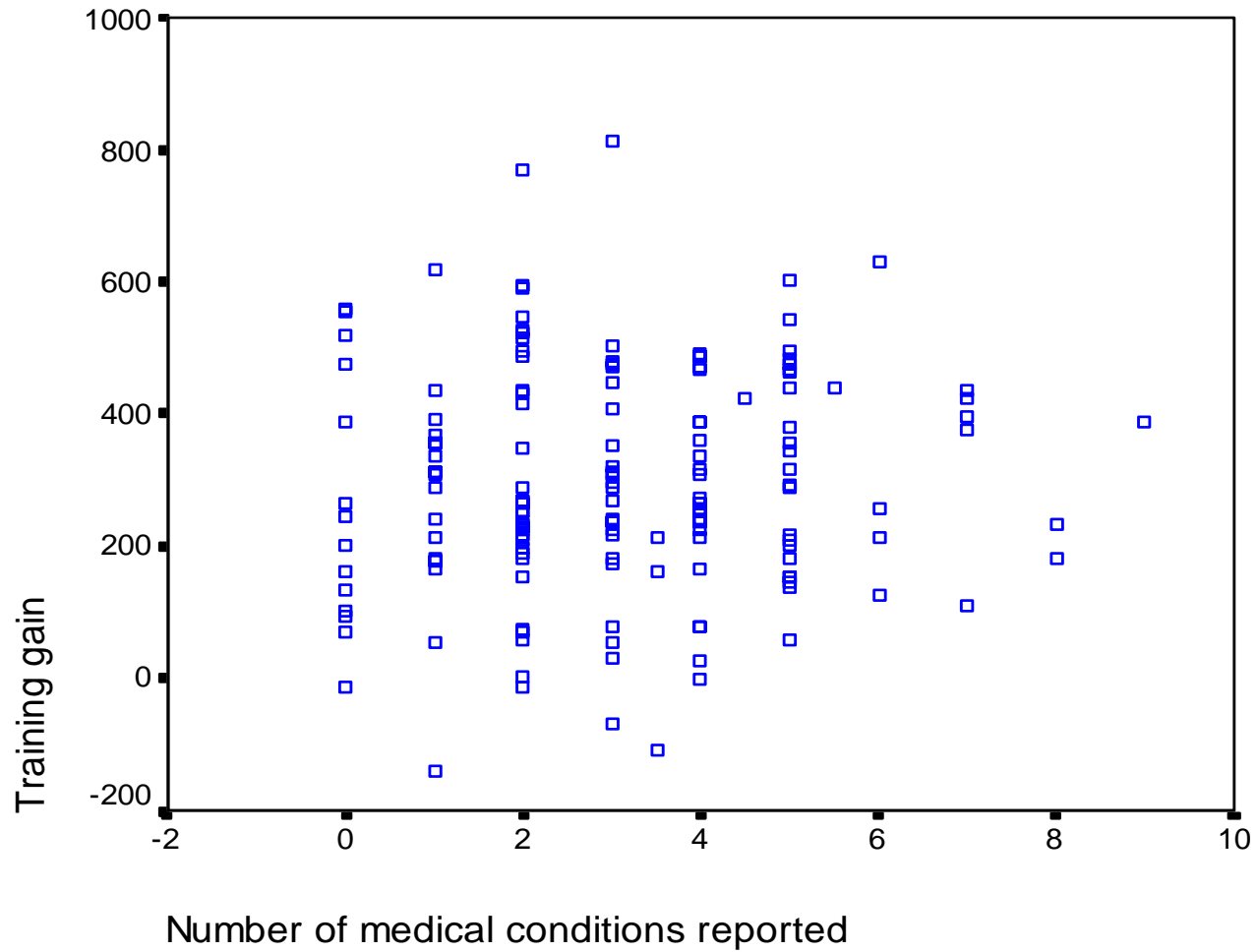


Who Benefits from Training?

- Medical Conditions
- Education
- MMSE
- Number of people in training session
- Age
- Need for training

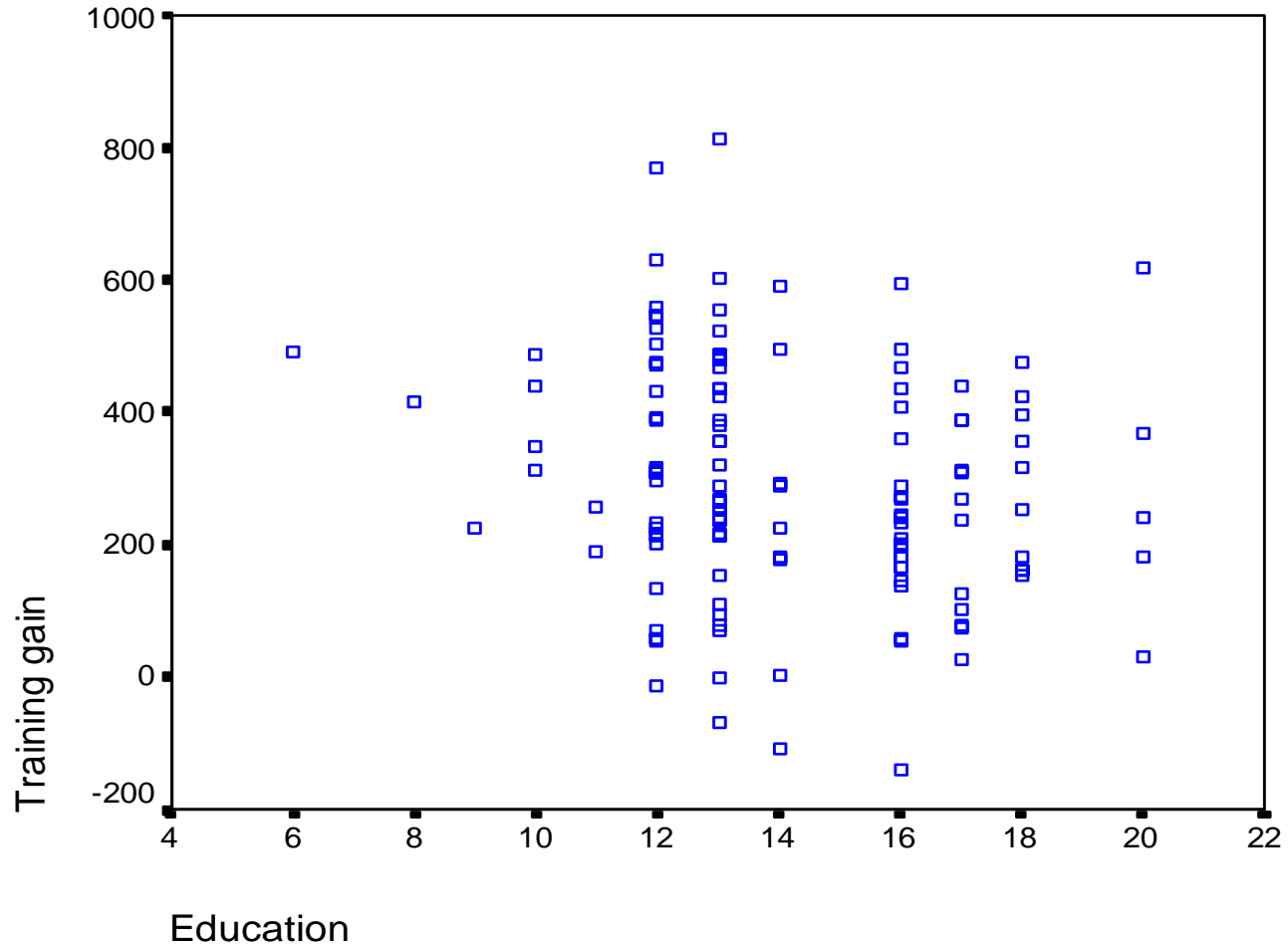
Results

$r = .107, p = .181$



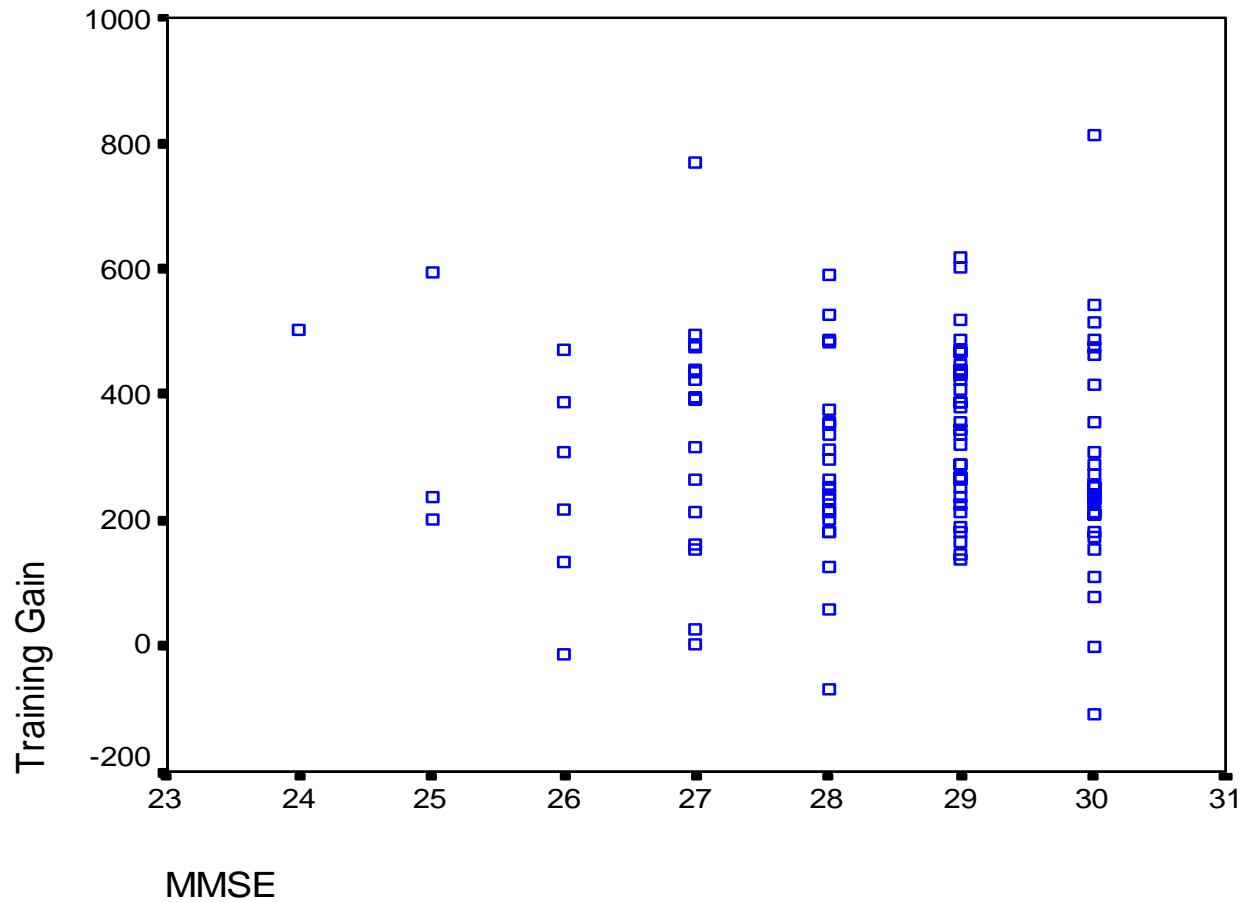
Results

$r = -.193, p = .026$



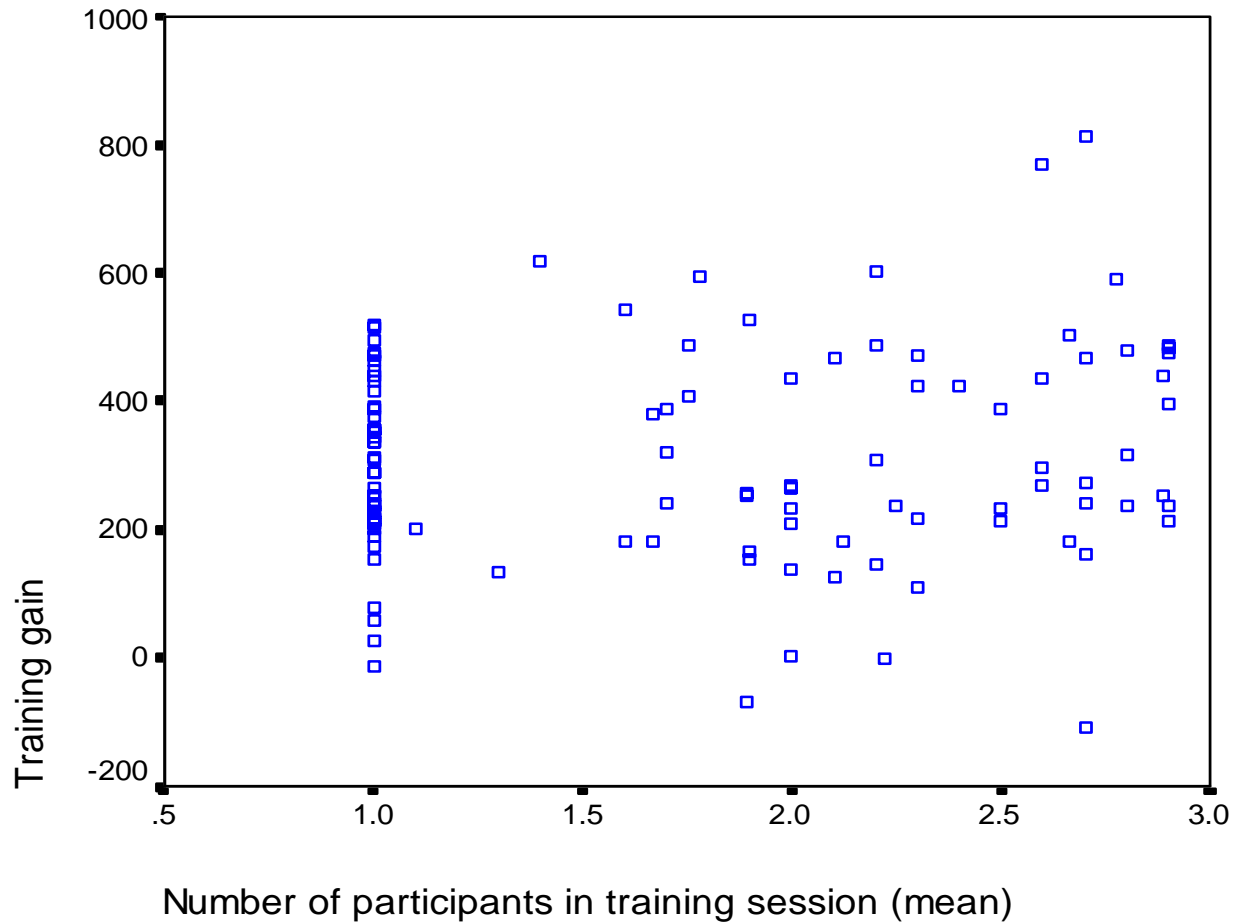
Results

$r = -.066, p = .490$



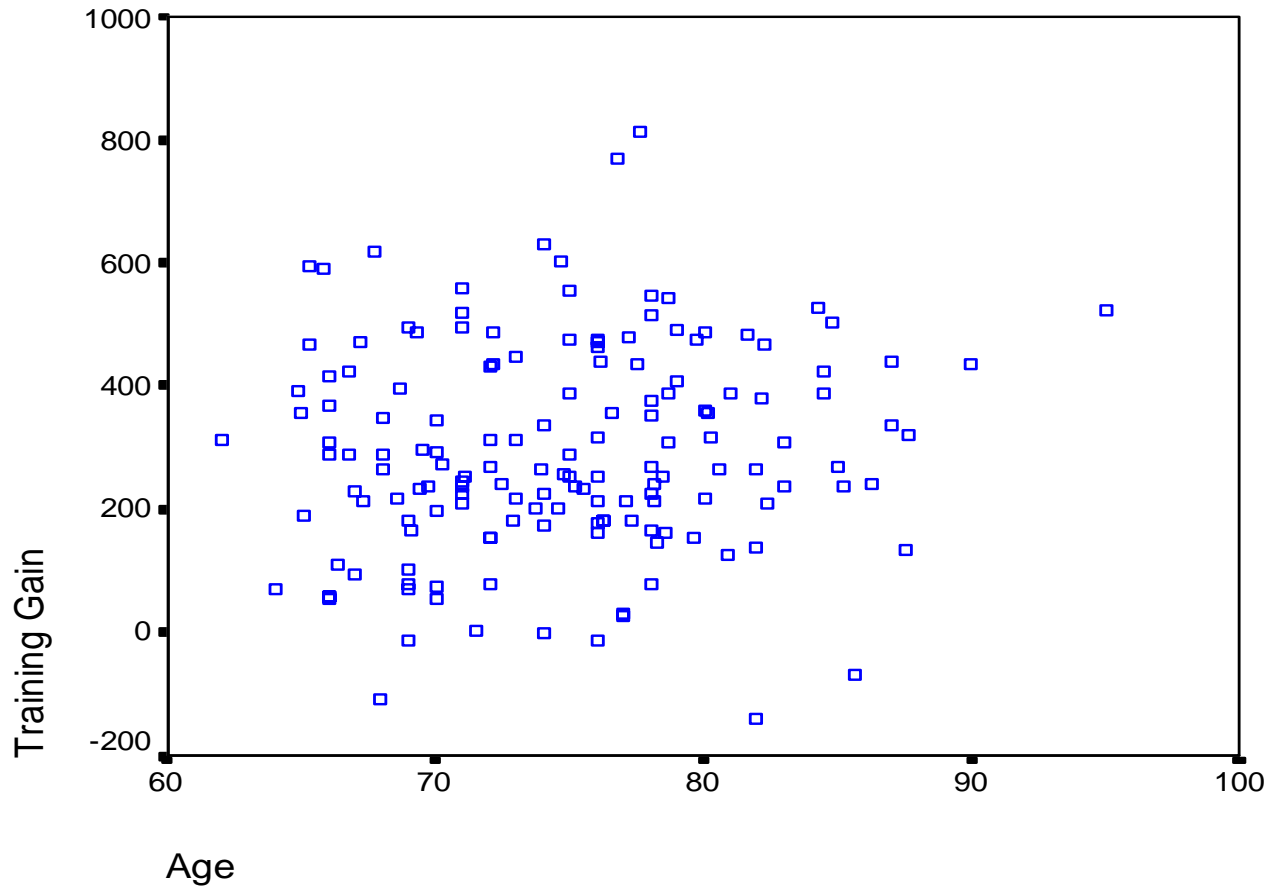
Results

$r = .121, p = .201$



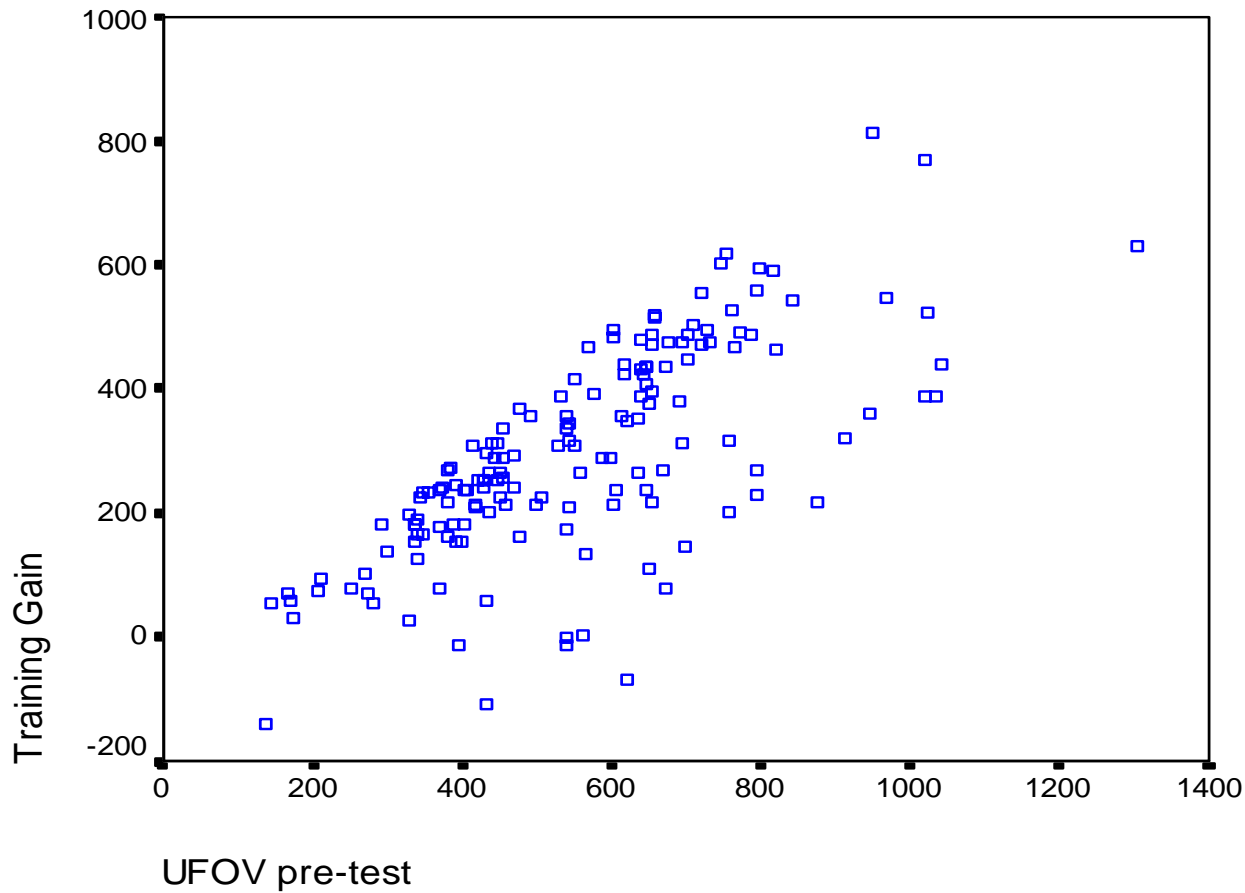
Results

$r = .116, p = .147$



Results

$r = .716, p = .0001$





Conclusions

- Pre-Test UFOV[®] performance was by far the most significant predictor of training gain in all samples
- Averaged across all studies, age added a small but significant increment to the prediction of training.
- For those studies that included it, visual acuity added incrementally to the prediction of training gain.
- Thus, in response to the question, “Who benefits from speed of processing training?”, the answer appears to be almost anyone with room to improve.



ACTIVE: Primary Aim

ACTIVE

(Advanced Cognitive Training for Independent and Vital Elderly)

To test the effectiveness and durability of three distinct cognitive interventions in improving the performance of elderly persons on basic measures of cognition and on measures of cognitively demanding daily activities.



Interventions

Three cognitive training interventions:

- Memory
- Reasoning
- Speed of Processing



Multi-Site Clinical Trial

Six Field Sites:

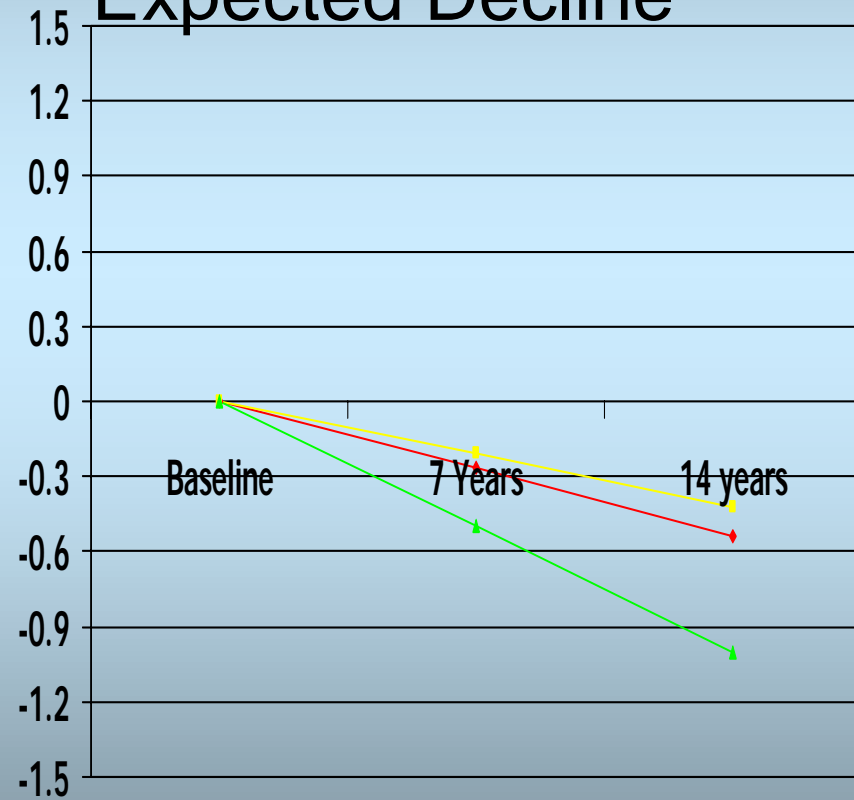
- University of Alabama at Birmingham, Karlene Ball PhD
- Hebrew Rehabilitation Center for the Aged, John Morris PhD
- Indiana University School of Medicine, Fredrick Unverzagt PhD
- Johns Hopkins University, George Rebok PhD
- Pennsylvania State University, Sherry Willis PhD
- Univ of Florida/Wayne State Univ, Michael Marsiske PhD

Coordinating Center:

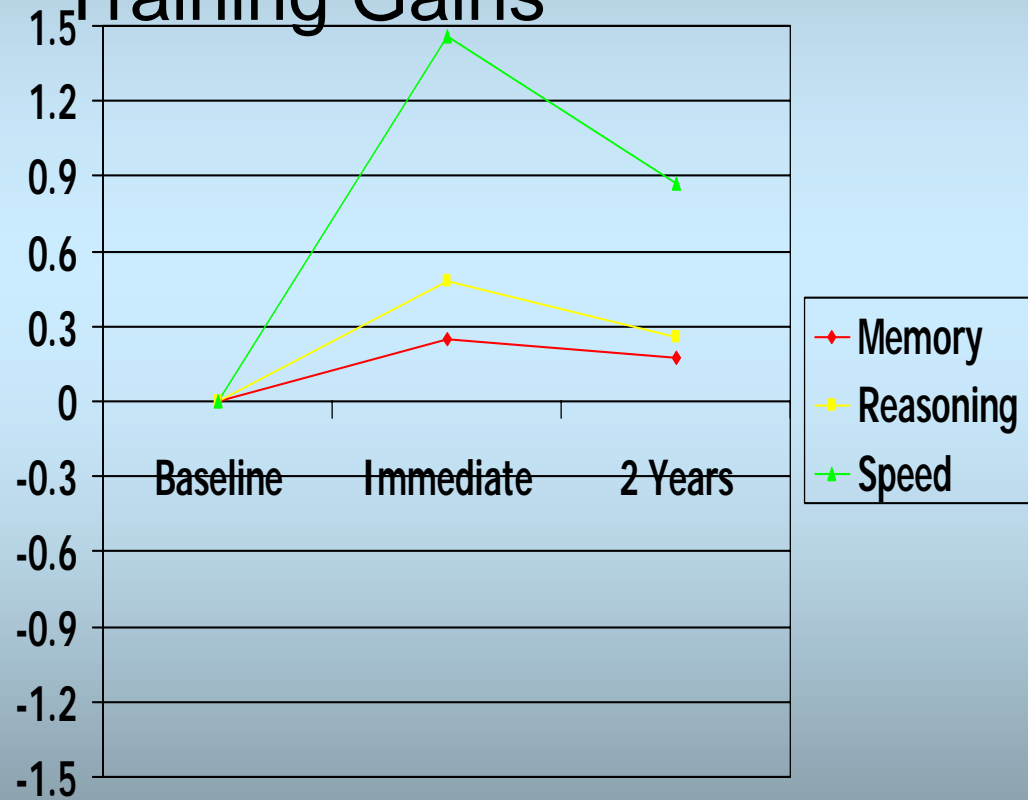
- New England Research Institutes, Sharon Tennstedt PhD

Primary Result

Expected Decline



Training Gains



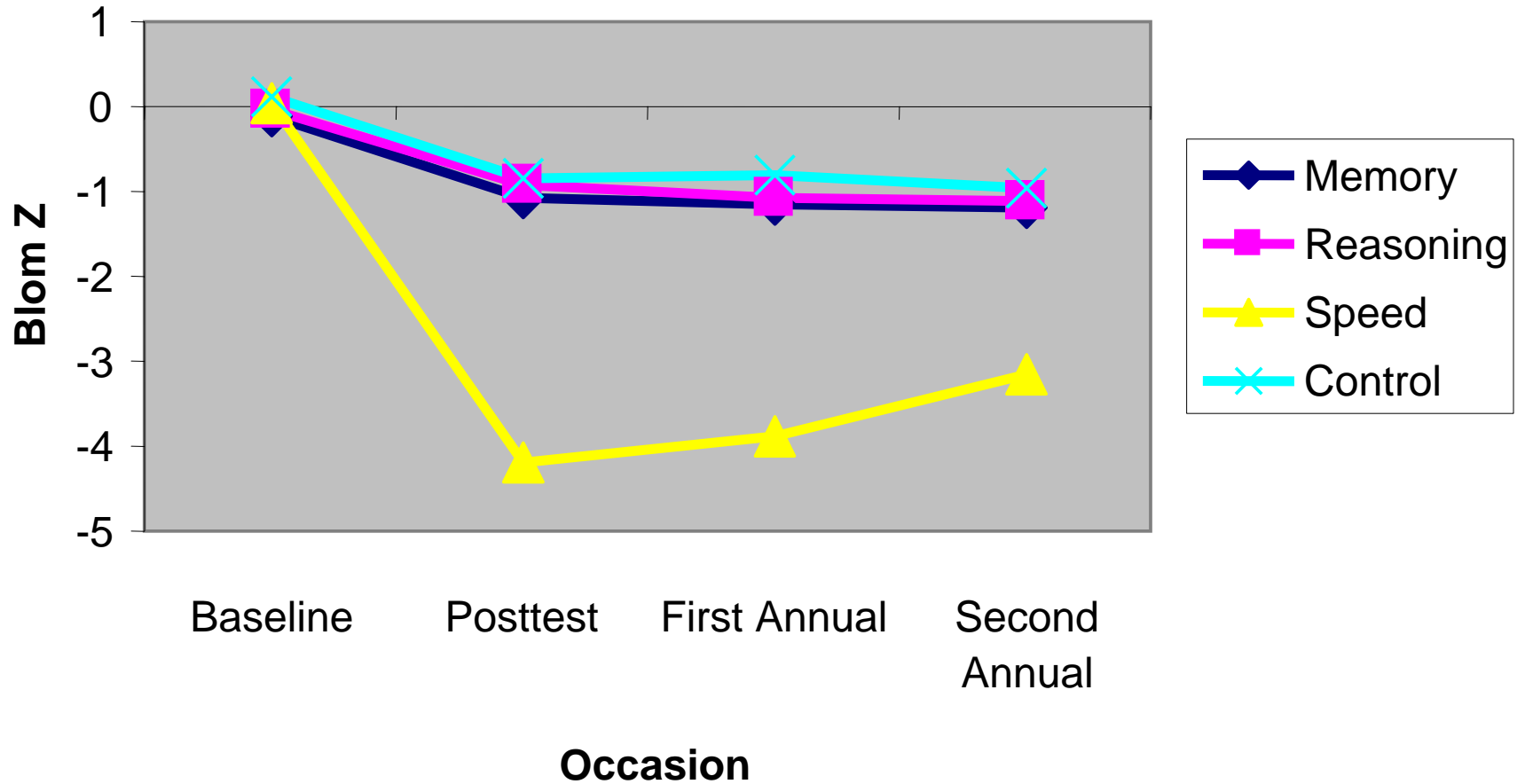


Initial Training Effects

- Each intervention reliably improved the targeted cognitive ability at post test in:
 - 87% of Speed trained
 - 74% of Reasoning trained
 - 26% of Memory trained

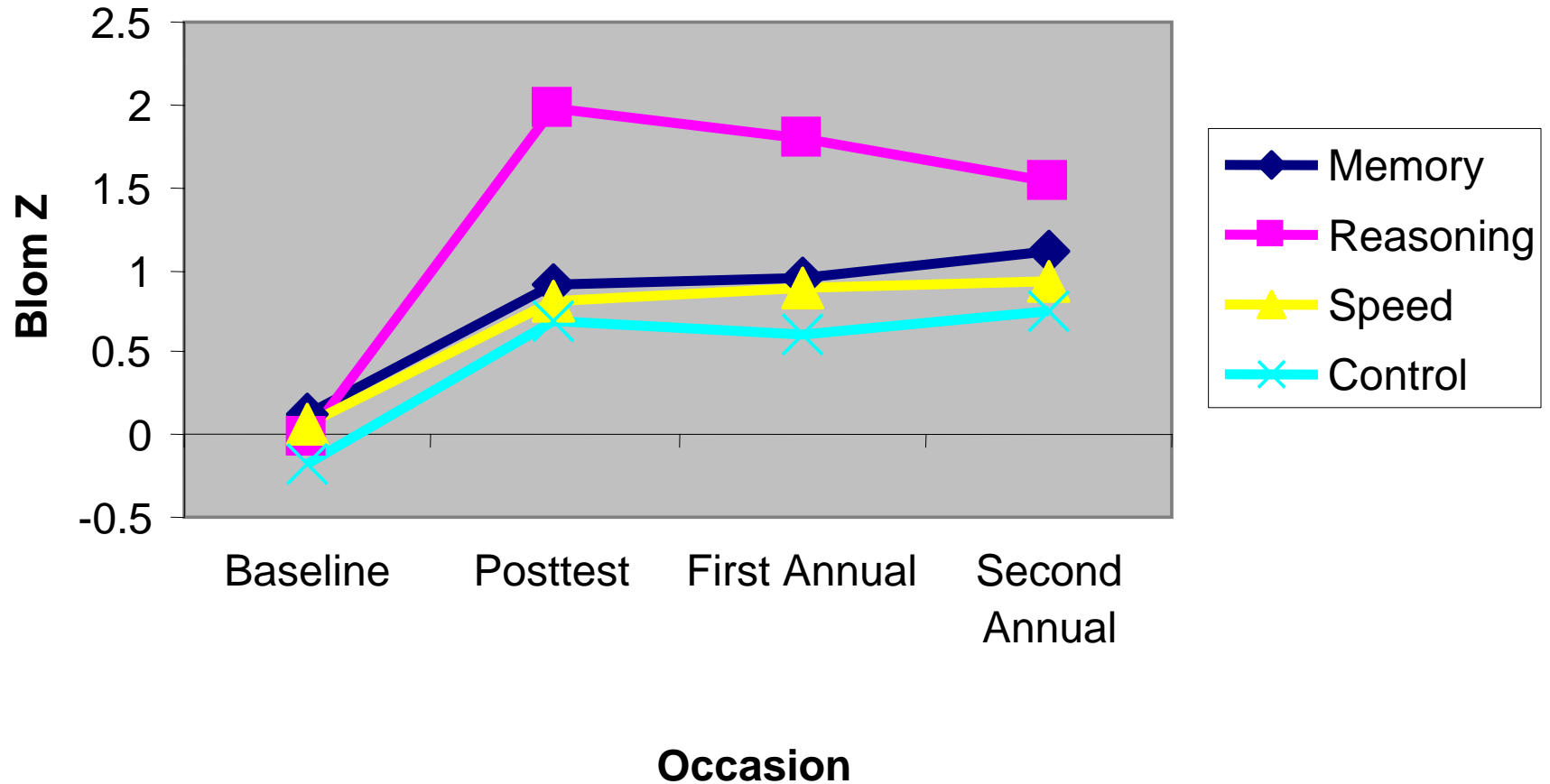
ACTIVE

Speed Proximal Composite



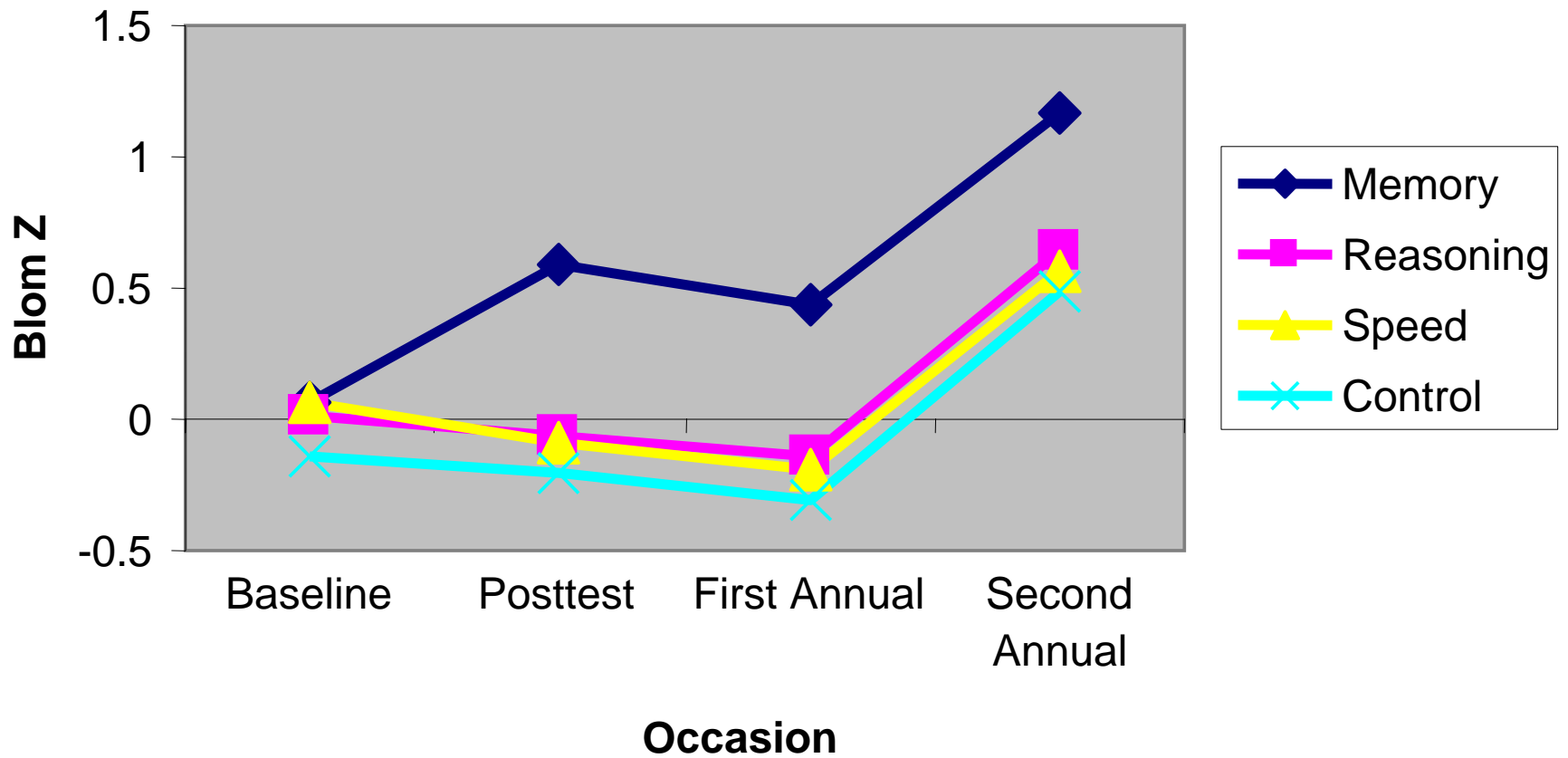
ACTIVE

Reasoning Proximal Composite



ACTIVE

Memory Proximal Composite





Booster Training Effects

- Booster training enhanced performance of Speed and Reasoning participants.
- Cognitive gains were maintained for 2 years, particularly among booster participants.

Net Effect of Booster Training on Proximal and Primary Outcome Composites

		Memory booster	Reasoning booster	Speed booster
Memory Composite	A1	0.044	-0.043	-0.004
	A2	0.060	-0.012	0.042
Reasoning Composite	A1	-0.009	0.304***	0.125**
	A2	-0.036	0.152**	-0.039
Speed Composite	A1	-0.030	-0.043	-0.919***
	A2	-0.020	-0.065	-0.347***
Problem-solving composite	A1	-0.007	-0.001	0.019
	A2	-0.033	-0.037	-0.060
Functioning composite	A1	-0.088	-0.206 [†]	-0.246*
	A2	-0.096	-0.196	-0.217 [†]
Everyday Speed composite	A1	-0.044	-0.068	-0.154*
	A2	-0.030	-0.018	-0.096
Driving composite	A1	-0.082	-0.059	-0.088
	A2	-0.025	-0.052	-0.055



Significance

- Cognitive interventions helped normal elderly persons perform better on multiple measures of the specific cognitive ability for which they were trained.
- Training gains were comparable with, or greater than, the amount of decline that has been reported in previous studies over a 7 - 14 year period among older adults without dementia.



Impact on Daily Activities

- At baseline, many participants showed high levels of competence on these everyday cognitive tasks.
- Strong practice effects.
- Lack of functional decline among control participants over the two year observation.



Impact on Daily Activities

Since all participants were living independently, and most were functioning quite well at the outset of the study, only time will tell if those who received training will experience less decline in their daily living skills over time.



Could Intervention Help with Daily Activities?

- Do improvements in speed of processing significantly improve everyday abilities?
- Does intervention help with driving tasks?



Cognitive Intervention

- Speed of Processing training has been shown to result in:
 - Fewer dangerous maneuvers while driving
 - Improved hazard detection in simulations
 - Faster reaction times to road signs
 - Increased mobility
 - Improved Timed IADLs

Timed IADLs





Home-Based Training Study

- Developed and evaluated a modification of the standardized Speed of Processing training protocol for home use.
- Emphasis on accessibility and affordability.



Standard versus Home-based Training

■ STANDARD

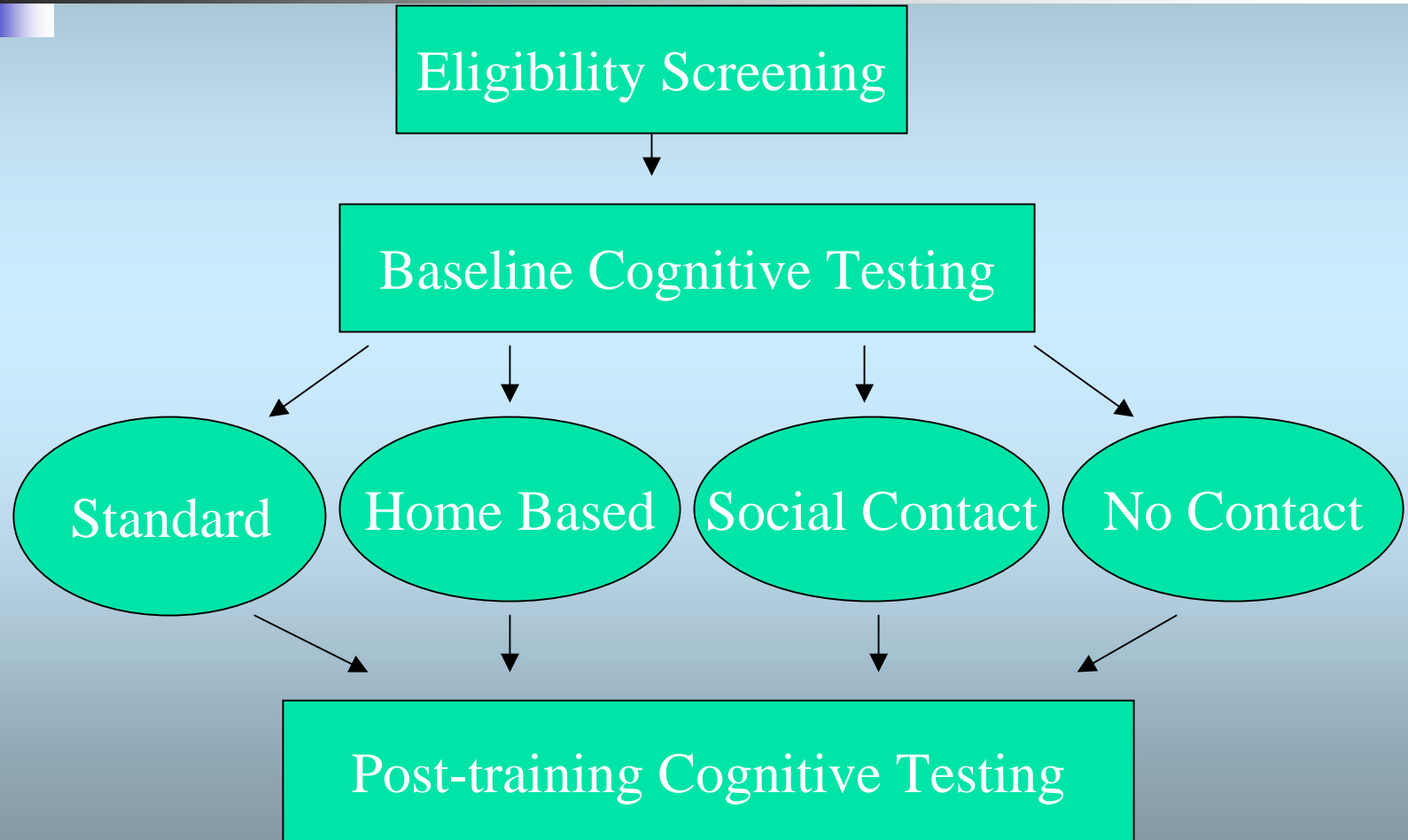
- Lab-based
- Trainer-facilitated
- Computer-based
- 8-10 sessions
- 5 weeks

■ HOME-BASED

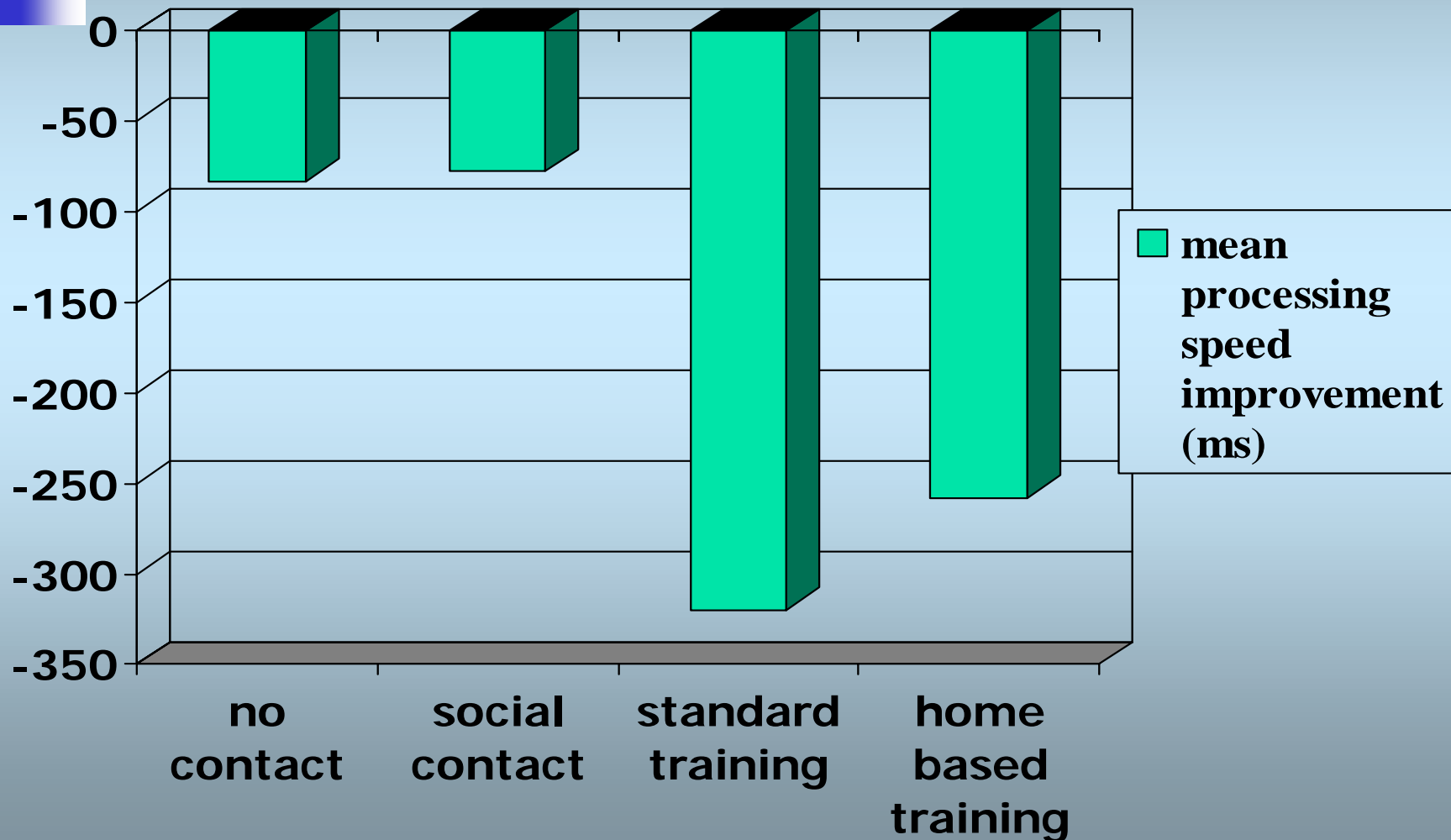
- Home-based
- Self-administered
- Videotape-based
- 8-10 sessions
- 5 weeks



Study Design



Results: Improvements in Processing Speed





Future Directions and Collaborations

- Mild Cognitive Impairment (MCI)
- ADRC
- Miami
- The Psychological Corporation (Medical)
- Depts. of Motor Vehicles (Prevention)
- Medical Community (Screening/Training)
- AARP/AAA (Driver Training & Mobility)
- State Farm (Incentives for training)



Conclusions

- Collectively these findings suggest a program of early detection and remediation for physical, visual and cognitive impairments. Such a program will help to sustain independent safe mobility in older adults with the associated benefits to quality of life.