



Device Evaluation

Update on Data Collection and Analyses

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Defense Personnel Assessment Center

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OVERVIEW

- **Goals & Impact**
- **Data Collection**
- **BLUF**
- **Analyses, Results, & Recommendations**
- **Operational Implementation Considerations**
- **Backup Slides**

GOALS & IMPACT

- Facilitate device expansion of the ASVAB iCAT and PiCAT by evaluating examinee performance differences among electronic devices (e.g., tablets, smart phones).
- Allow for more flexibility for ASVAB administration to reduce time spent in MEPS, increase number of enlistees, and increase schools' participation in CEP.
- Make a recommendation for which types of electronic devices should be approved or prohibited for ASVAB administration.
- Inform a Next Generation user interface that incorporates a Responsive Design approach, which automatically formats the test display to alternative devices.

DATA COLLECTION

- Data collection concluded February 1, 2020.
- THANK YOU to USMEPCOM and Services for support with this effort.

Source	Location	Dates	# Tested
Air Force	Lackland AFB	11JAN2020	1,078
Army	Fort Drum	25–29MAR2019	330
Coast Guard	CG Training Center	30–31MAY2019	225
Marines	Fort Lee	2–3APR2019	177
Marines	Camp Johnson	16–17APR2019	258
Marines	Fort Leonard Wood	23–24APR2019	446
Marines	Twentynine Palms	6–8MAY2019	280
Marines	Camp Lejeune	13MAY2019	90
Navy	IWTC/Corry Station	26JUN2019	301
Navy	NATTC	27JUN2019	147
USMEPCOM	17 MEPS (var. locations)	JUL19–JAN20	7,195

DATA COLLECTION—STATUS

• **TOTAL Participants (recruits + applicants): 10,527**

Applicants/MEPS	# Tested	Applicants/MEPS	# Tested
Baltimore	1,269	Knoxville	152
Boston	759	Lansing	699
Buffalo	223	Nashville	138
Cleveland	606	Oklahoma City	590
Columbus	148	Omaha	134
Denver	703	Pittsburgh	210
Des Moines	110	Salt Lake City	72
El Paso	52	San Jose	224
Fort Lee	1,106		
TOTAL			7,195

DATA COLLECTION: EVALUATION DESIGN— SAMPLING PLAN

Examinee Group	Form ID Assignments ^a	ASVAB Subtest ^b							Test Time (minutes) ^c	Number of Items ^c	Planned Number of Subjects	Actual Number of Subjects
		GS	AR	WK	PC	MK	MC	AO				
1	F01/F02		X						30	12	1750	1718
2	F03/F04		X						30	12	585	581
3	F05/F06						X		30	24	585	608
4	F07/F08							X	30	30	1750	1742
5	F09/F10	X			X				30	30	585	600
6	F11/F12			X				X	30	40	585	585
7	F13/F14					X			30	24	585	595
8	F15/F16				X				28	14	585	590
9	F17/F18			X	X	X		X	88	78	1165	1642
10	F19/F20	X	X		X		X		90	66	1165	1642
TOTALS										186	9340	10303

DEVICE EVALUATION QUESTIONS

- Does device differentially impact examinee performance (score; response time) on ASVAB subtests?
- Does device familiarity differentially impact examinee performance on ASVAB subtests?
- Does device differentially impact item difficulty?
- Are there item features (e.g., inclusion of graphic) that interact with the device that increase the probability that item difficulty is differentially impacted?

DATA COLLECTION: EVALUATION DESIGN—METHODS

Device ID	Device Type	Model	Web Browser
1 CONTOL	Notebook CONDITION	Dell XPS 13	Internet Explorer
2	Notebook	Apple MacBook Pro	Safari
3	Smart phone	Apple iPhone XS	Safari
4	Tablet	Apple iPad Pro	Safari
5	Tablet	Samsung Galaxy Tab A	Chrome
6	Smart phone	Samsung Galaxy S9+	Chrome
7	Notebook	Dell Chromebook 3380	Chrome

EVALUATION DESIGN—METHODS (CONT.)

Device ID	Device Type	Model	Operating System
1 CONTOL	Notebook CONDITION	Dell XPS 13	Windows
2	Notebook	Apple MacBook Pro	MacOS
3	Smart phone	Apple iPhone XS	iOS
4	Tablet	Apple iPad Pro	iOS
5	Tablet	Samsung Galaxy Tab A	Android
6	Smart phone	Samsung Galaxy S9+	Android
7	Notebook	Dell Chromebook 3380	Chrome

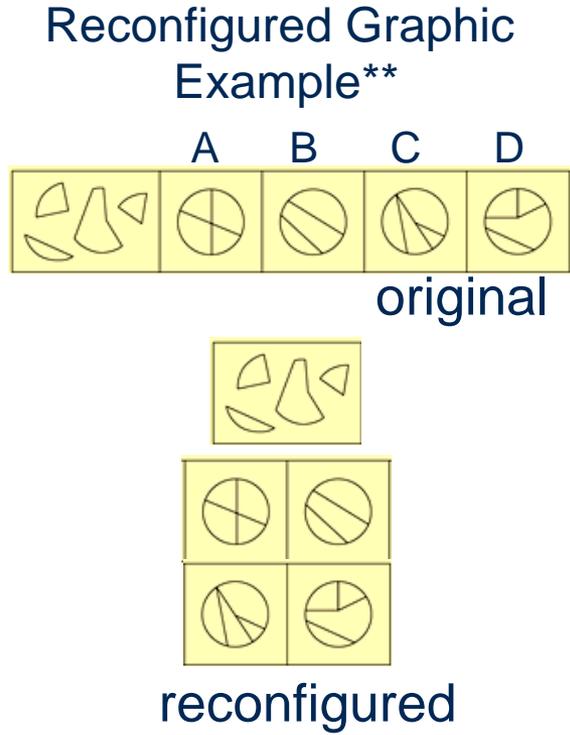
EVALUATION DESIGN—METHODS (CONT.)

Device ID	Device Type	Model	Screen Size (inches)
1 CONTOL	Notebook CONDITION	Dell XPS 13	13
2	Notebook	Apple MacBook Pro	13.3
3	Smart phone	Apple iPhone XS	5.8
4	Tablet	Apple iPad Pro	11
5	Tablet	Samsung Galaxy Tab A	8
6	Smart phone	Samsung Galaxy S9+	6.2
7	Notebook	Dell Chromebook 3380	11.6

EVALUATION DESIGN—METHODS (CONT.)

- Item Special Features

Special Feature	Relevant Subtests
Graphic	AO, AR, EI, GS, MC, MK, AI, SI
Reconfigured Graphic	AO
Complex Graphic*	GS, MC, MK
Answer Choice as Graphic	AO, MC, SI
Long Stems/Extended Text	AR, PC
Stacked Fractions	AR, MK
Equation	MK
Square Root	MK
Exponents	MK
Pi	MK
Degree Symbol	MK



BLUF

- **Results of value include the following:**
 - The specific device an examinee uses to take the ASVAB does not significantly impact test scores.
 - Examinees perform better on the ASVAB when they are familiar with the device they use.
 - In general, examinees use less time responding to items on alternative devices in comparison to the XPS.*
- **Overall, based on these findings, ASVAB subtest scores among applicants should be comparable regardless of device used to take the tests so long as the examinee uses a device that is familiar to him/her AND the test delivery application is designed to be responsive to a variety of device types.**

*Note: Previous studies have shown that examinees are provided sufficient time for responding to test items on currently allowed administration devices such as the XPS.

ANALYSES, RESULTS, & RECOMMENDATIONS DATA CLEANING

- **Data were removed from analysis for the following reasons:**
 - Self-reported lack of motivation on either device
 - Inability to match records due to erroneous entry of user ID by participant
 - Incorrect test forms delivered to participants due to test administrator error
 - Inability of participant to complete due to various reasons
 - Applicant shipping orders
 - Recruit medical appointments
 - Personal choice
- **Final N = 8,517 (81% of all participants)**

ANALYSES—METHODS

- Does device and familiarity with device differentially impact examinee performance (score) on ASVAB subtests?
 - Conduct ANOVA across all device conditions (2 models)
 - Dependent variable: subtest score
 - Independent variables:
 - Device
 - Device familiarity
 - Sample
 - Administration order
 - Models:
 - Model 1: Mixed Effects Linear Model with device treated as a random effect
 - Model 2: Mixed Effects Linear Model with device treated as a fixed effect
 - ANOVA for each subtest

ANALYSES—RESULTS

ANOVA THETA SCORE DIFFERENCE

- **Models 1 & 2: Mixed Linear Effects Models with device treated either as random or fixed**
 - Both models produced consistent results within each subtest, except the following additional interactions were significant for Model 2 and therefore was used for interpreting additional results.
 - PC: Device X familiarity & Sample X familiarity
 - MC: Device X familiarity
 - For AO, AR, GS, MK, & WK subtests, there were no significant Theta Score Differences between devices and, thus, Model 1 was used to interpret additional results.

ANOVA THETA SCORE DIFFERENCE

Model 1: Mixed Linear Effects Models with Device Treated as Random

	Subtest				
	WK	MK	AR	GS	AO
Significant Interactions	NONE	Sample X Familiar* (ni)	Sample X Familiar** (ni)	Sample X Test Order* (ni)	Sample X Test Order* (ni)
				Sample X Test Order X Familiar* (ni)	

*p<0.05, **p<0.01, ni=not interpreted

ANOVA THETA SCORE DIFFERENCE

Model 1: Mixed Linear Effects Models with Device Treated as Random

	Subtest				
	WK	MK	AR	GS	AO
Device	Not Significant				
Familiar	N.S.	0.07**	0.07***	0.11***	0.05***
Not Familiar		0.48	0.05	0.18	-0.02
Familiar		0.55	0.12	0.29	0.03
Sample	0.17***	0.21***	0.21***	0.13***	0.34***
Applicants	0.22	0.41	-0.02	0.17	-0.16
Recruits	0.39	0.62	0.19	0.30	0.18
Test Order	N.S.	-0.06***	N.S.	N.S.	-0.02*
Device #1		0.55			0.02
Device #2		0.49			0.00

*p<0.05, **p<0.01, ***p<0.001, N.S.=not significant

ANOVA THETA SCORE DIFFERENCE

Effect Sizes for Sample by Device Familiarity Contrasts

Familiar/ Not Familiar With Device	MK	AR	GS: Device 1 Only	AO
Applicants	0.01	0.20	0.04	
Recruits	0.18	0.05	0.11	
ALL	0.06	0.17	0.09	0.13

ANOVA THETA SCORE DIFFERENCE

Model 2: Mixed Linear Effects Models with Device Treated as Fixed

	Subtest	
	PC	MC
Significant Interactions	Device X Familiar*	Device X Familiar*
	Sample X Familiar*	

*p<0.05

ANOVA THETA SCORE MEANS

Model 2: Mixed Linear Effects Models with Device Treated as Fixed

	PC Subtest						
Device	XPS	Macbook	iPhone	iPad	Gal Tab	Gal Phone	Chrome book
LSM	0.00	0.00	0.01	-0.03	0.02	-0.02	0.00
Not Familiar	-0.12	-0.01	-0.01	-0.08	-0.02	-0.10	-0.13
Familiar	0.11	0.02	0.02	0.03	0.07	0.07	0.14

ANOVA THETA SCORE DIFFERENCE

Effect Sizes for Device by Device Familiarity Contrasts: PC

	Familiar - Not Familiar	XPS: Familiar- Other: Familiar	XPS: Not Familiar - Other: Not Familiar	XPS: Familiar - Other: Not Familiar
XPS	0.13*			
Macbook	0.02	0.07	-0.05	0.07
iPhone	0.02	0.07	-0.06	0.07
iPad	0.06	0.07	-0.02	0.11*
Gal Tab	0.06	0.03	-0.06	0.09
Gal Phone	0.11*	0.03	-0.01	0.14*
Chromebook	0.17*	-0.02	0.01	0.17*

*p<0.05

ANOVA THETA SCORE MEANS

Model 2: Mixed Linear Effects Models with Device Treated as Fixed

	MC Subtest						
Device	XPS	Macbook	iPhone	iPad	Gal Tab	Gal Phone	Chrome book
LSM	-0.23	-0.08	-0.16	-0.21	-0.18	-0.20	-0.16
Not Familiar	-0.36	-0.07	-0.17	-0.24	-0.25	-0.24	-0.23
Familiar	-0.10	-0.10	-0.16	-0.18	-0.10	-0.16	-0.08

ANOVA THETA SCORE DIFFERENCE

Effect Sizes for Device by Device Familiarity Contrasts: MC

Device	Familiar - Not Familiar	XPS: Familiar - Other: Familiar	XPS: Not Familiar - Other: Not Familiar	XPS: Familiar - Other: Not Familiar
XPS	0.18*			
Macbook	-0.02	0.00	-0.17*	-0.02
iPhone	0.01	0.06	-0.11	0.05
iPad	0.04	0.08	-0.07	0.10
Gal Tab	0.10	0.00	-0.07	0.12
Gal Phone	0.06	0.05	-0.08	0.12
Chromebook	0.11	-0.02	-0.09	0.11

*p<0.05

ANOVA RESPONSE TIME DIFFERENCE (SECONDS)

- **Models 1 & 2: Mixed Linear Effects Models with device treated either as random or fixed**
 - Both models produced consistent results within each subtest
 - For most subtests (except PC), there were significant response time differences between devices and, thus, Model 2 was used to interpret additional results for all subtests except PC
 - For PC, Model 1 was used to interpret additional results
- **Practical significance for response time**
 - If there would be a need to increase test-taking time to account for completion times between devices
 - an increase in test-taking time would be offered if a difference of 30 or more seconds existed between device conditions
 - Each subtest's practical significance for response time is scaled to account for the fewer number of items administered during the evaluation

ANOVA RESPONSE TIME DIFFERENCE (SECONDS)

Practical Difference for Response Time, by Subtest

Subtest	CAT Test Length	DE Test Length	Practical Difference = 30 secs * [DE Length / CAT Test Length]
AO	15	10	20 seconds
AR	15	6	12 seconds
GS	15	10	20 seconds
MC	15	12	24 seconds
MK	15	12	24 seconds
PC	10	5	15 seconds
WK	15	10	20 seconds

DE = Device Evaluation

ANOVA RESPONSE TIME DIFFERENCE (SECONDS)

Model 1: Mixed Linear Effects Models with Device Treated as Random

	Subtest
	PC
Significant Interactions	Sample X Test Order***
	Familiar X Test Order** (ni)

p<0.01, *p<0.001, ni = not interpreted

ANOVA RESPONSE TIME (SECONDS) DIFFERENCE

Model 1: Mixed Linear Effects Models with Device Treated as Random

	Subtest	
	PC	% Increase in
Device	Not Significant	Time Spent
Familiar	N.S.	
Not Familiar		
Familiar		
Sample	89 seconds***	44%
Applicants	202	
Recruits	291	
Test Order	60 seconds***	28%
Admin #1	276	
Admin #2	216	

ANOVA RESPONSE TIME (SECONDS) DIFFERENCE

Model 2: Mixed Linear Effects Models with Device Treated as Fixed

		Subtest					
		WK	MK	AR	GS	MC	AO
Significant Interactions	Sample X Familiar*		Sample X Test Order*** (ni)	Sample X Test Order*** (ni)	Sample X Test Order* (ni)	Sample X Test Order*** (ni)	Sample X Test Order*** (ni)
	Familiar X Test Order*			Familiar X Test Order** (ni)			Device X Sample*
				Device X Sample X Familiar X Test Order*			

*p<0.05, **p<0.01, ***p<0.001, ni = not interpreted

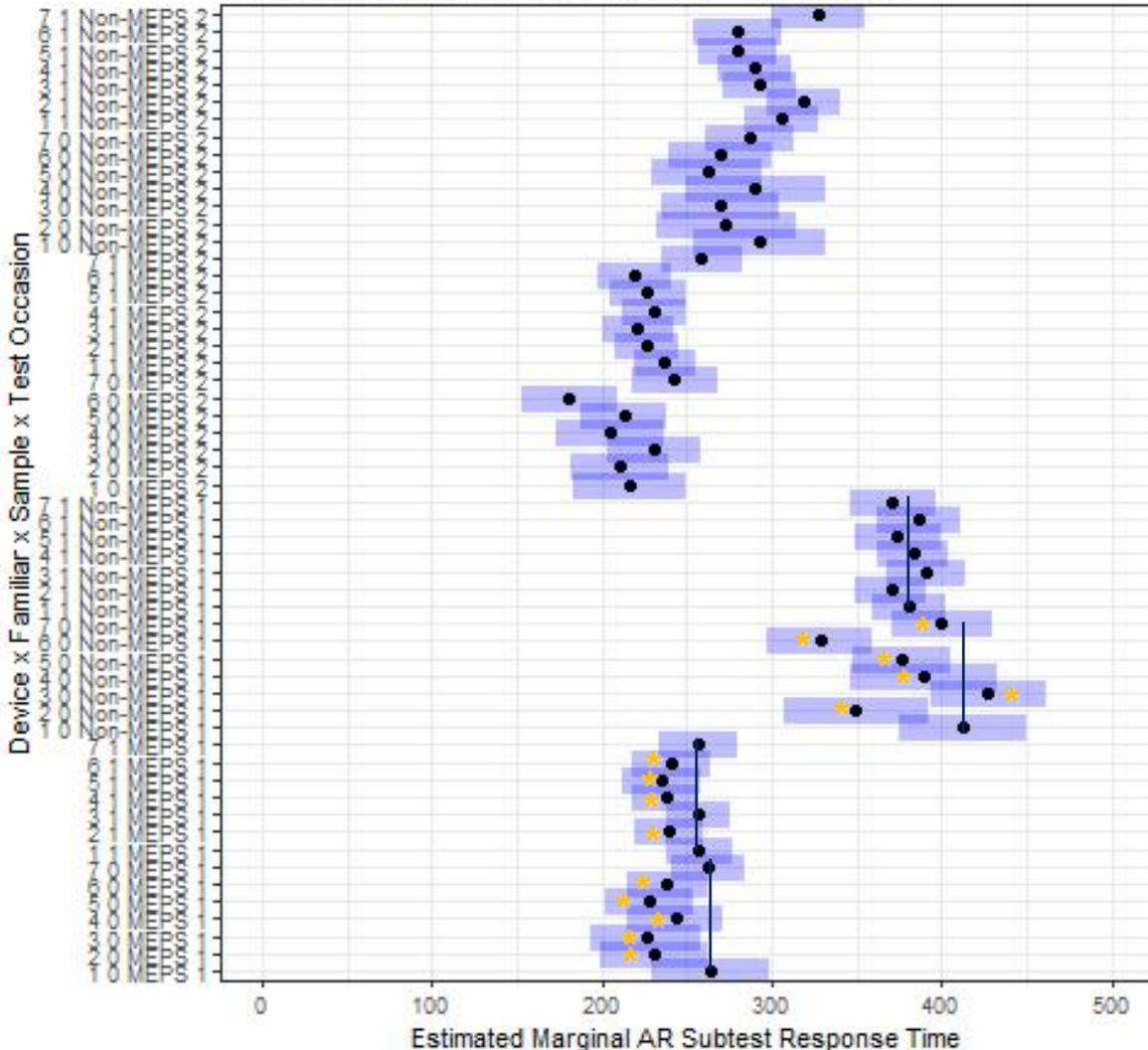
ANOVA RESPONSE TIME (SECONDS) MEANS

Model 2: Mixed Linear Effects Models with Device Treated as Fixed

	Subtest			
	WK	MK	GS	MC
Device	***	**	***	***
XPS	142	387	205	298
MacBook	129	361 (7%)	195	295
iPhone	121 (15%)	365	206	293
iPad	107 (25%)	345 (11%)	181 (12%)	268 (10%)
Galaxy Tab	110 (23%)	354 (9%)	182 (11%)	271 (9%)
Galaxy SP	107 (25%)	359 (7%)	185 (10%)	274
Chromebook	136	382	209	297

Percent decrease in time spent on alternate devices in comparison to XPS is presented in parentheticals for practical differences.

Estimated Marginal AR Subtest Response Time Means
Device by Familiarity Groups by Sample by Test Occasion



Percent decrease in time spent on alternate devices in comparison to XPS is presented in the % column.

Recruits, UnFam, Device #1, XPS (1; n=49)

ID	Device	SECs	%	N
2	MacB	62.20	15	37
3	iPhone	-15.48	-4	61
4	iPad	22.26	5	37
5	Gal Tab	36.11	9	83
6	Gal SP	83.70	20	69
7	ChromeB	12.09	3	80

Applicants, Familiar, Device #1, XPS (1; n=197)

ID	Device	SECs	%	N
2	MacB	18.49	7	169
4	iPad	20.17	8	196
5	Gal Tab	22.43	9	136
6	Gal SP	17.22	7	130

Applicants, UnFam, Device #1, XPS (1; n=58)

ID	Device	SECs	%	N
2	MacB	33.06	13	67
3	iPhone	38.06	14	65
4	iPad	20.87	8	85
5	Gal Tab	35.67	14	103
6	Gal SP	25.36	10	116

ANOVA RESPONSE TIME MEANS (SECONDS)

Model 2: Mixed Linear Effects Models with Device Treated as Fixed

	AO Subtest						
Device	XPS	Macbook	iPhone	iPad	Gal Tab	Gal Phone	Chrome book
LSM	216	213	210	197	217	201	212
Applicants	203	197	195	182	196	181	204
Recruits	229	228	226	212	238	220	220
% Decrease				10%		11%	

Note: Percent decrease in time spent on alternate devices in comparison to XPS is presented in the last row for potentially significant findings.

DISCUSSION

- **Results of value include the following:**
 - The specific device an examinee uses to take the ASVAB does not significantly impact test scores.
 - Examinees perform better on the ASVAB when they are familiar with the device they use.
 - In general, examinees use less time responding to items on alternative devices in comparison to the XPS.*
- **Overall, based on these findings, ASVAB subtest scores among applicants should be comparable regardless of device used to take the tests so long as the examinee uses a device that is familiar to him/her AND the test delivery application is designed to be responsive to a variety of device types.**

*Note: Previous studies have shown that examinees are provided sufficient time for responding to test items on currently allowed administration devices such as the XPS.

RECOMMENDATIONS

- Design a test delivery application responsive to a variety of device types for ASVAB administration
- Allow examinees to choose a device they are familiar with to take the ASVAB
- Develop a test monitoring plan that tracks operational performance differences (scores & response time) between device types
- Develop a data collection tool that reports device features (e.g., screen size, browser type and version, device type, etc.) for post-test monitoring and analysis
- Develop and implement a post-test questionnaire intended to measure barriers to optimal performance
- Operational implementation decisions (slide 35) must be made prior to moving forward with device expansion

REMAINING ANALYSES

- Does device differentially impact item difficulty?
 - Conduct multiple DIF tests for uniform and non-uniform DIF
 - Groups: 7 device conditions
 - Note any items flagged for DIF
- Are there item features (e.g., inclusion of graphic) that interact with the device that increase the probability that item difficulty is differentially impacted?
 - Of the items noted for DIF, explore whether there are patterns based on item features that may explain the differences detected
- Complete a comprehensive hierarchical Bayesian-based analysis that accounts for all variables, demographics, and item/score level differences.
 - To be used for generating the final report of analyses

OPERATIONAL IMPLEMENTATION CONSIDERATIONS

Who should take the ASVAB on which mobile device and for what purpose?

Depends in large part on outcomes of Device Evaluation

- **Who?**

- Applicants testing at home?
- Applicants testing at MEPS/METs?
- Students testing in CEP/schools?

- **Which Mobile Devices?**

- Test-taker owned & maintained?
- DoD owned & maintained?
- School owned & maintained?

- **What Purpose?**

- Unproctored APT—not score of record
- Unproctored PiCAT— verify for enlistment
- Proctored at MEPS/METs—score of record
- Proctored at high schools—score of record

Considerations: Compromise from test-taker-owned device via screenshots; maintenance costs of DoD-owned devices; score effects associated with testing on unfamiliar devices, . . .



BACKUP SLIDES

ACRONYMS & CODES

- **DE = Device Evaluation**
- **ni = not interpreted**
- **Device**
 - 1 = XPS = Dell XPS 13 (the device that serves as the control condition)
 - 2 = MacBook = Apple MacBook Pro
 - 3 = iPhone = Apple iPhone XS
 - 4 = iPad = Apple iPad Pro
 - 5 = Gal Tab = Samsung Galaxy Tab A
 - 6 = Gal SP = Samsung Galaxy S9+
 - 7 = Chromebook = Dell Chromebook 3380
- **Device Familiarity**
 - 0 = UnFam = Not Familiar
 - 1 = Familiar

ACRONYMS & CODES

- **Sample**

- Non-MEPS = Recruits
- MEPS = Applicants

- **Test Order**

- 1 = Adm1 = Administration #1
- 2 = Adm2 = Administration #2

- **MOT = Motivation**

- **Subtests**

- GS = General Science
- AR = Arithmetic Reasoning
- WK = Word Knowledge
- PC = Paragraph Comprehension
- MK = Mathematical Knowledge
- MC = Mechanical Comprehension
- AO = Assembling Objects

PARTICIPANT DEVICE FAMILIARITY

Which electronic devices are you comfortable using? Please select all that apply.

- Dell XPS Laptop
- Apple MacBook Pro Laptop
- Apple iPhone
- Apple iPad Pro
- Samsung Galaxy Tablet
- Samsung Galaxy Smartphone
- Dell Chromebook Laptop

PARTICIPANT MOTIVATION

Tell us your level of motivation to answer questions correctly while taking this test. Select the statement you agree with most. Your honest responses will not be used for any purpose other than to help ensure the reliability of our evaluation findings.

- 1. I answered all questions to the best of my ability.**
- 2. I answered most questions to the best of my ability.**
- 3. I answered a few of the questions to the best of my ability.**
- 4. I did not answer questions to the best of my ability.**

- **Correlation btw Motivation (1-4) and Device Familiarity (0,1)**
 - Administration #1: -0.07
 - Administration #2: -0.09

PARTICIPANT MOTIVATION

AVERAGE DIFFERENCES BETWEEN THETA SCORE ON RECORD AND DEVICE EVALUATION THETA SCORE, BY LEVEL OF MOTIVATION (MOT)

Administration #1				
Test	MOT =1	MOT =2	MOT =3	MOT =4
GS	0.11	0.12	0.28	0.82
AR	0.26	0.37	0.74	1.21
WK	-0.10	-0.11	0.05	0.79
PC	0.21	0.34	0.66	1.17
MK	0.02	0.13	0.32	0.66
MC	0.11	0.16	0.53	1.03
AO	-0.08	0.14	0.64	1.34

Administration #2				
Test	MOT =1	MOT =2	MOT =3	MOT =4
GS	0.11	0.09	0.18	0.72
AR	0.30	0.38	0.73	1.11
WK	-0.10	-0.07	0.01	0.64
PC	0.26	0.39	0.74	1.17
MK	0.07	0.20	0.48	0.77
MC	0.10	0.17	0.62	1.15
AO	0.00	0.26	0.76	1.40

PARTICIPANT MOTIVATION

CHI-SQUARE FREQUENCY COUNT DIFFERENCES BETWEEN DEVICE FAMILIARITY GROUPS WITHIN MOTIVATION GROUP, BY SUBGROUP: SEX

Observed				Expected				χ^2
Group	Female	Male	TOTAL	Group	Female	Male	TOTAL	(p-value)
Motivation: 1&2	1408	5187	6595	Motivation: 1&2	1408	5187	6595	2.98 (.08)
Familiar = 0	510	1751	2261	Familiar = 0	482.71	1778.29	2261	
Familiar = 1	898	3436	4334	Familiar = 1	925.29	3408.71	4334	
Motivation: 3&4	205	598	803	Motivation: 3&4	205	598	803	1.88 (.17)
Familiar = 0	98	253	351	Familiar = 0	89.608	261.392	351	
Familiar = 1	107	345	452	Familiar = 1	115.39	336.608	452	
TOTAL	1613	5785	7398	TOTAL	1613	5785	7398	

PARTICIPANT MOTIVATION

CHI-SQUARE FREQUENCY COUNT DIFFERENCES BETWEEN DEVICE FAMILIARITY GROUPS WITHIN MOTIVATION GROUP, BY SUBGROUP: ETHNICITY

Observed				Expected				χ^2 (p-value)
Group	Hispanic	Not Hispanic	TOTAL	Group	Hispanic	Not Hispanic	TOTAL	
Motivation: 1&2	1144	5443	6587	Motivation: 1&2	1144	5443	6587	0.22 (.64)
Familiar = 0	385	1871	2256	Familiar = 0	391.81	1864.19	2256	
Familiar = 1	759	3572	4331	Familiar = 1	752.19	3578.81	4331	
Motivation: 3&4	121	681	802	Motivation: 3&4	121	681	802	1.52 (.22)
Familiar = 0	59	291	350	Familiar = 0	52.805	297.195	350	
Familiar = 1	62	390	452	Familiar = 1	68.195	383.805	452	
TOTAL	1265	6124	7389	TOTAL	1265	6124	7389	

PARTICIPANT MOTIVATION

CHI-SQUARE FREQUENCY COUNT DIFFERENCES BETWEEN DEVICE FAMILIARITY GROUPS WITHIN MOTIVATION GROUP, BY SUBGROUP: RACE (A=ASIAN, B=BLACK, W=WHITE)

Observed				
Group	A	B	W	TOTAL
Motivation: 1&2	273	1351	4656	6280
Familiar = 0	103	549	1502	2154
Familiar = 1	170	802	3154	4126
Motivation: 3&4	34	254	475	763
Familiar = 0	15	113	206	334
Familiar = 1	19	141	269	429
TOTAL	307	1605	5131	7043

Expected					χ^2
Group	A	B	W	TOTAL	(p-value)
Motivation: 1&2	273	1351	4656	6280	34.1 (.01)
Familiar = 0	94	463	1597	2154	
Familiar = 1	179	888	3059	4126	
Motivation: 3&4	34	254	475	763	0.09 (.96)
Familiar = 0	15	111	208	334	
Familiar = 1	19	143	267	429	
TOTAL	307	1605	5131	7043	

PARTICIPANT MOTIVATION

CHI-SQUARE FREQUENCY COUNT DIFFERENCES BETWEEN DEVICE FAMILIARITY GROUPS WITHIN MOTIVATION GROUP, BY SUBGROUP: SES

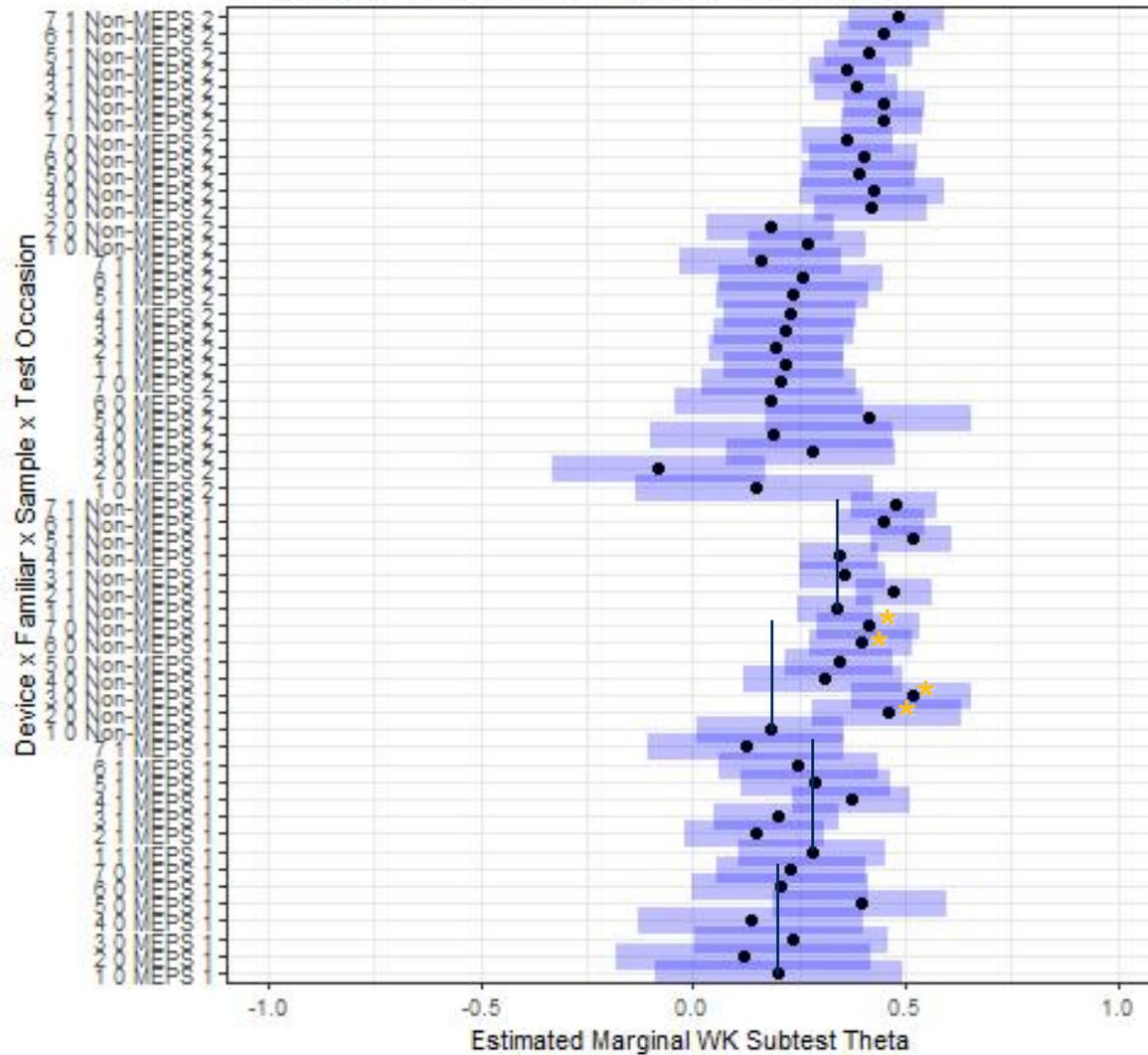
Observed				Expected				χ^2
Group	Low	High	TOTAL	Group	Low	High	TOTAL	(p-value)
Motivation: 1&2	6634	2215	8849	Motivation: 1&2	6634	2215	8849	6.48 (.01)
Familiar = 0	2314	707	3021	Familiar = 0	2264.8	756.189	3021	
Familiar = 1	4320	1508	5828	Familiar = 1	4369.2	1458.81	5828	
Motivation: 3&4	871	298	1169	Motivation: 3&4	871	298	1169	4.72 (.03)
Familiar = 0	414	120	534	Familiar = 0	397.87	136.127	534	
Familiar = 1	457	178	635	Familiar = 1	473.13	161.873	635	
TOTAL	7505	2513	10018	TOTAL	7505	2513	10018	

PARTICIPANT MOTIVATION

CORRELATIONS WITH ASVAB SCORES OF RECORD

	Before Motivation Data Cleaning (N=10,303)						After Cleaning (N=8,517)			
Subtest	Motivation-Adm1	Motivation-Adm2	DE Adm1	DE Adm2	AFQT Adm1	AFQT Adm2	DE Adm1	DE Adm2	AFQT Adm1	AFQT Adm2
GS	.12	.10	.64	.64	.56	.56	.66	.65	.58	.56
AR	.29	.26	.56	.55	.53	.52	.63	.62	.56	.54
WK	.11	.13	.65	.63	.56	.58	.67	.66	.57	.59
PC	.21	.23	.42	.43	.50	.49	.45	.47	.51	.52
MK	.14	.20	.68	.64	.59	.60	.70	.67	.60	.61
MC	.18	.27	.56	.58	.42	.44	.58	.62	.43	.45
AO	.33	.34	.43	.42	.35	.31	.46	.47	.36	.32
AFQT	-.07	-.09								

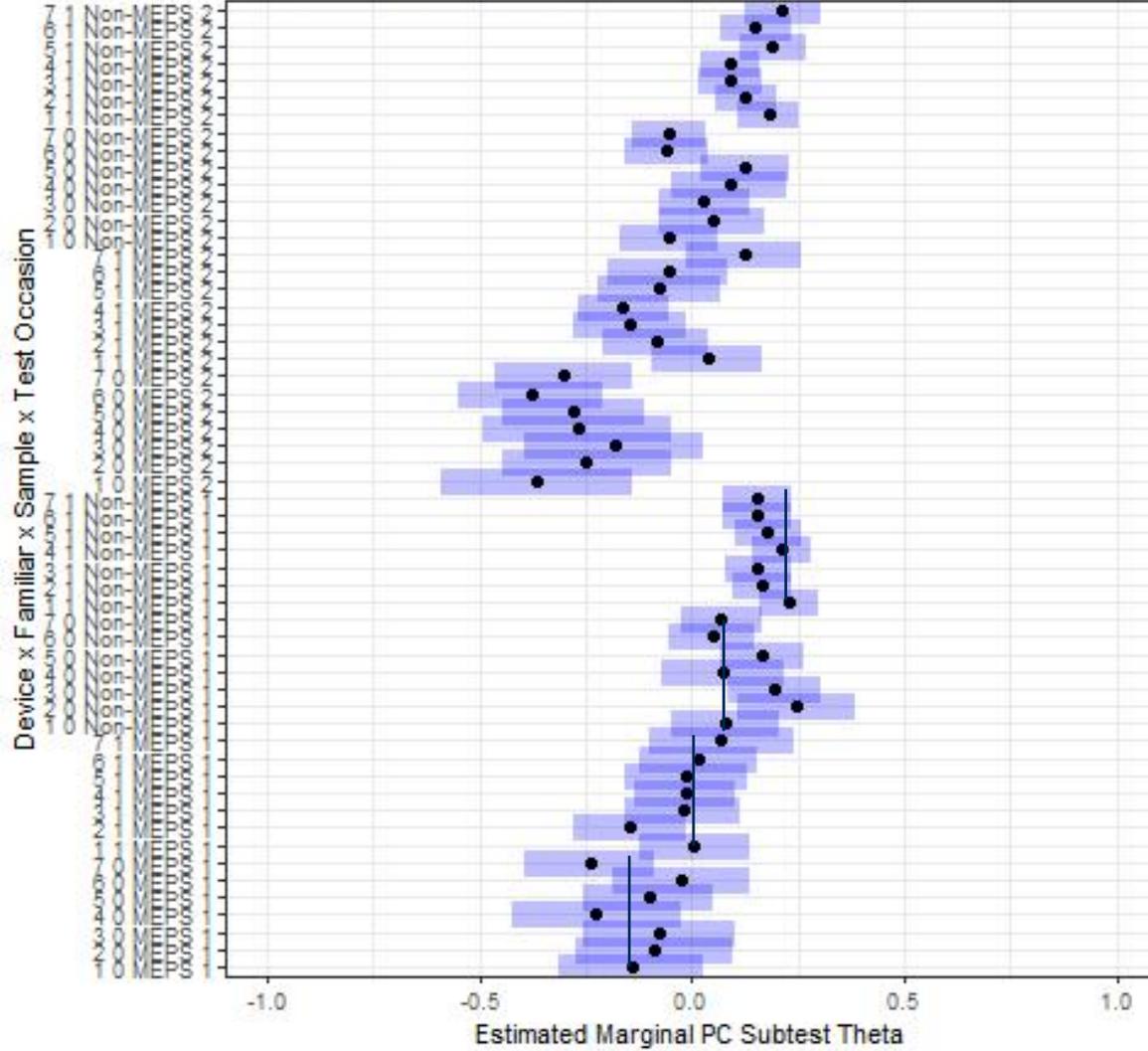
Estimated Marginal WK Subtest Theta Means
 Device by Familiarity Groups by Sample by Test Occasion



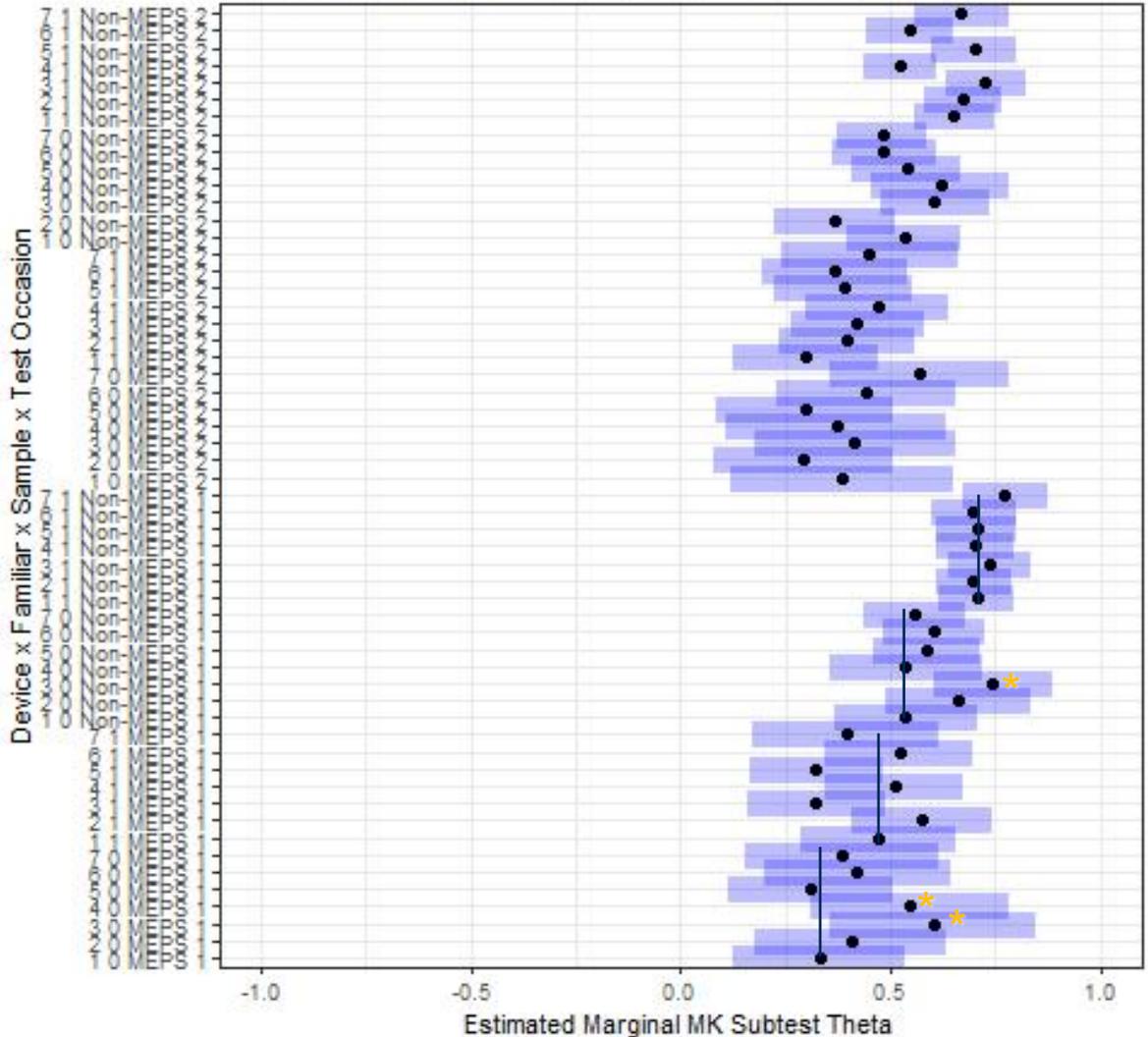
**Recruits, UnFamiliar, Admin #1,
 XPS (1; n=41)**

ID	Device	Theta Dif	N
2	MacBook	-0.274	40
3	iPhone	-0.332	61
6	Gal SP	-0.214	84
7	ChromeB	-0.230	84

Estimated Marginal PC Subtest Theta Means
Device by Familiarity Groups by Sample by Test Occasion



Estimated Marginal MK Subtest Theta Means
 Device by Familiarity Groups by Sample by Test Occasion



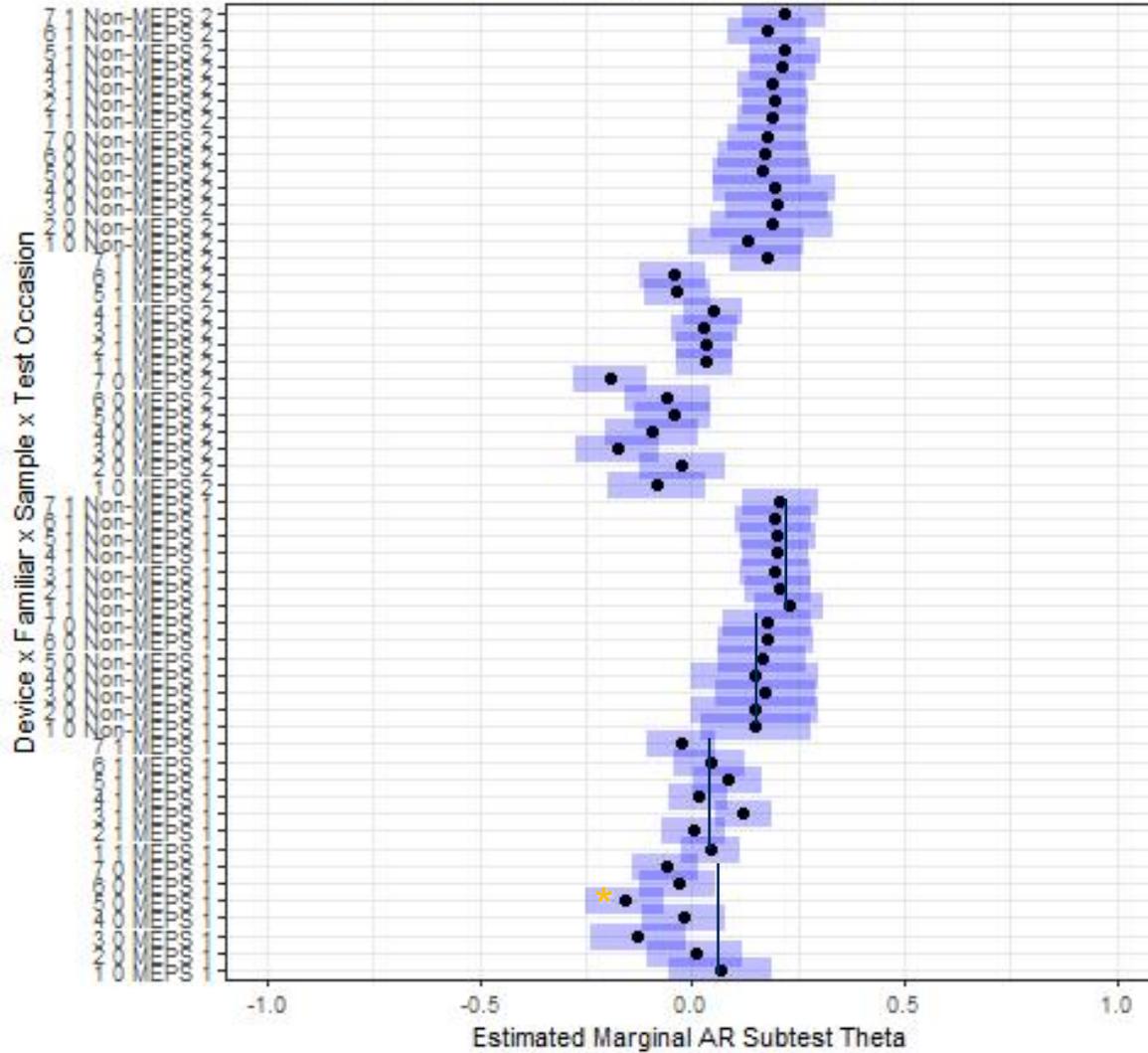
**Recruits, UnFam, Device #1,
 XPS (1; n=41)**

ID	Device	Theta Dif	N
3	iPhone	-0.208	61

**Applicants, UnFam, Device #1,
 XPS (1; n=29)**

ID	Device	Theta Dif	N
3	iPhone	-0.271	20
4	iPad	-0.215	22

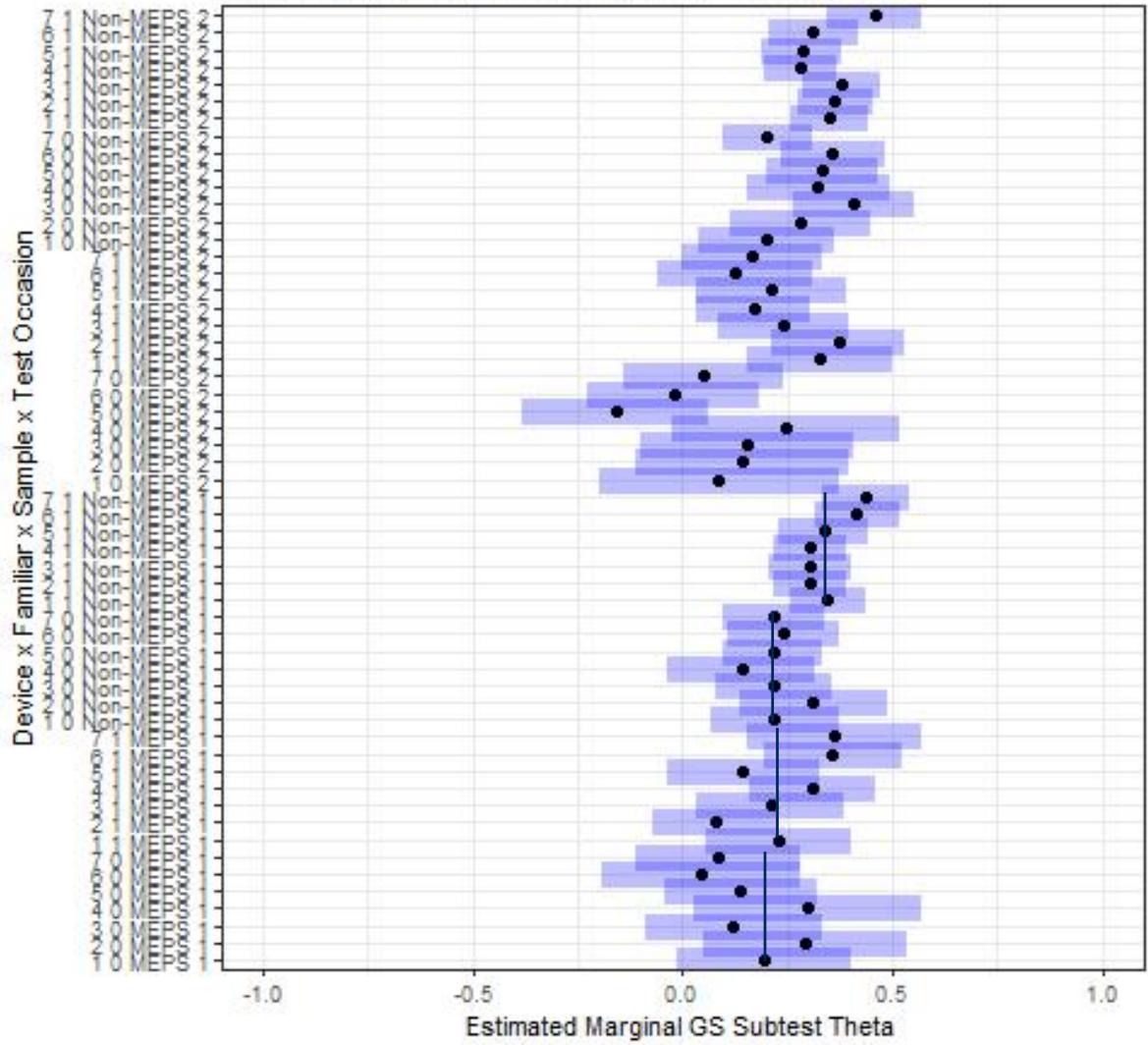
Estimated Marginal AR Subtest Theta Means
 Device by Familiarity Groups by Sample by Test Occasion



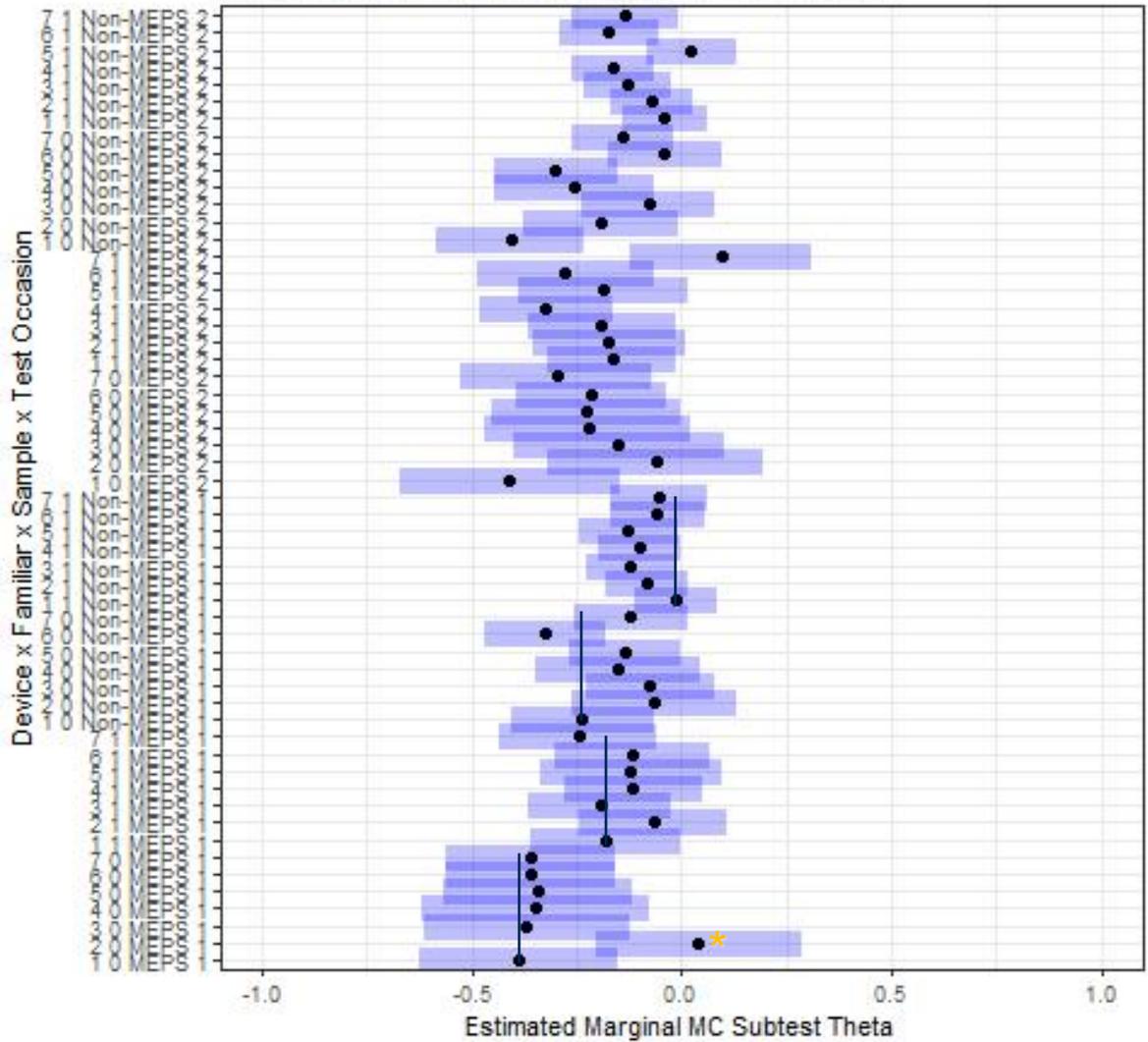
Applicants, UnFamiliar, Admin #1, XPS (1; n=58)

ID	Device	Theta Dif	N
5	Gal Tab	0.221	103

Estimated Marginal GS Subtest Theta Means
Device by Familiarity Groups by Sample by Test Occasion



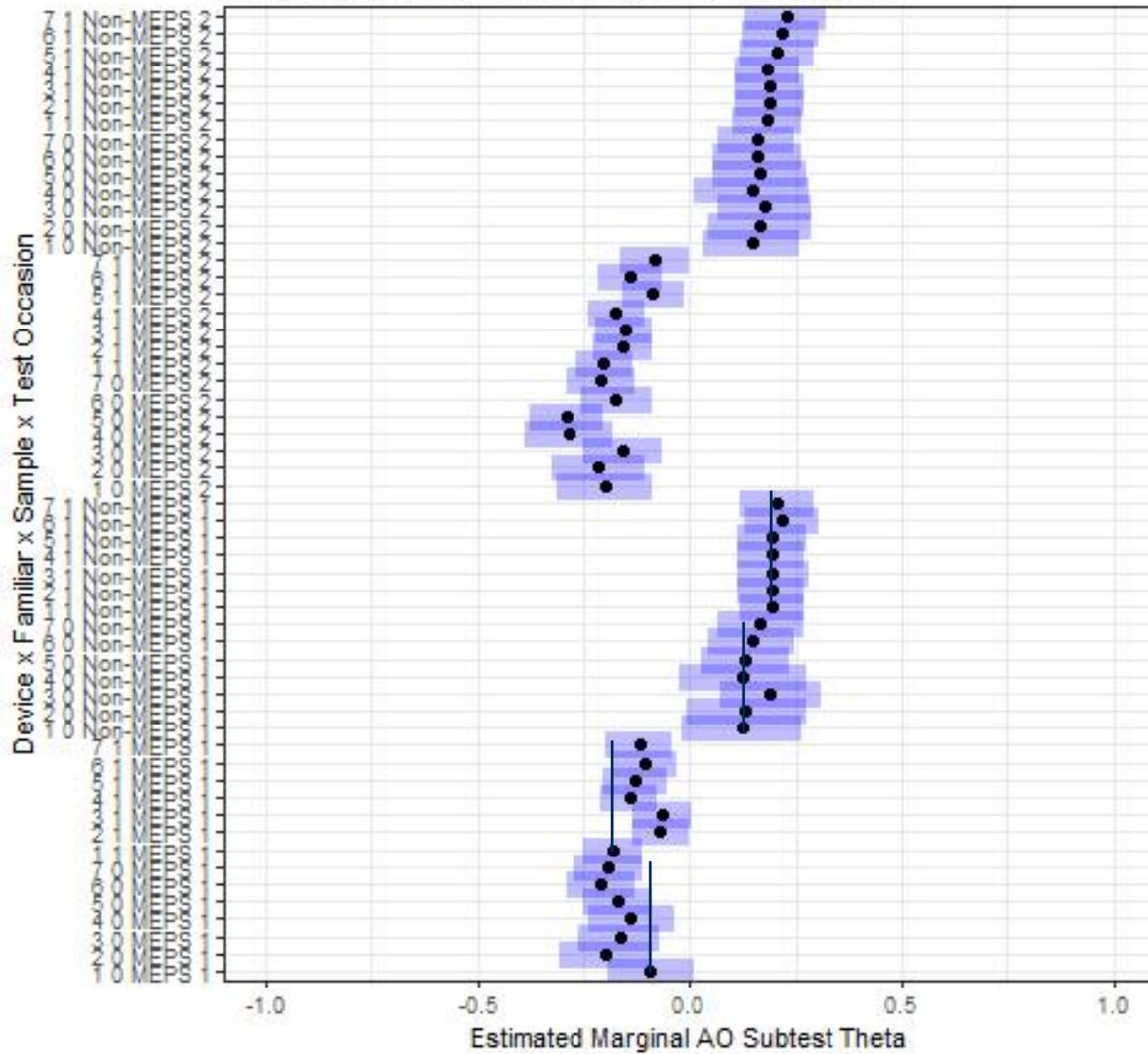
Estimated Marginal MC Subtest Theta Means
 Device by Familiarity Groups by Sample by Test Occasion



**Applicants, UnFamiliar,
 Admin #1, XPS (1; n=26)**

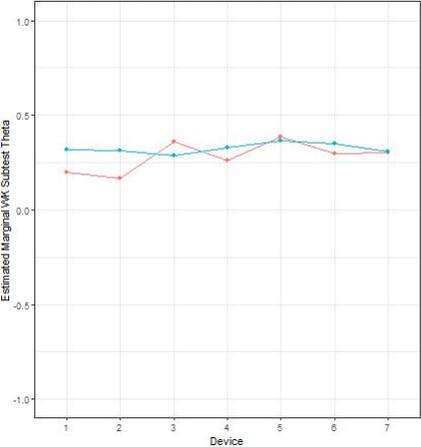
ID	Device	Theta Dif	N
2	MacB	-0.428	24

Estimated Marginal AO Subtest Theta Means
 Device by Familiarity Groups by Sample by Test Occasion

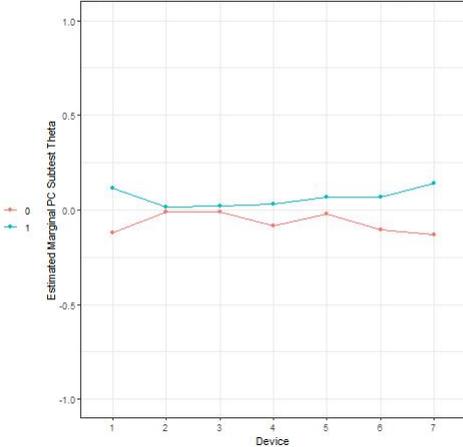


ESTIMATED MARGINAL THETA MEANS

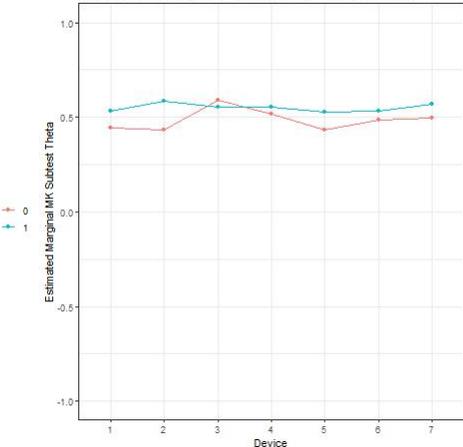
WK Estimated Marginal Theta Means by Device Familiarity



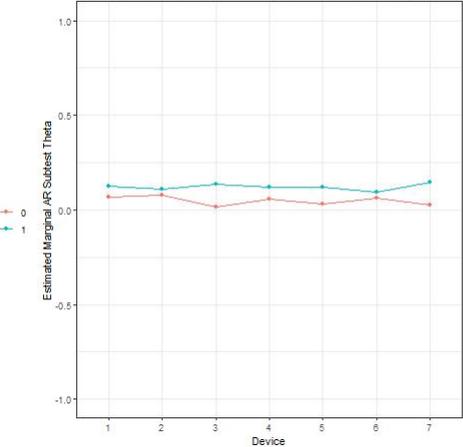
PC Estimated Marginal Theta Means by Device Familiarity



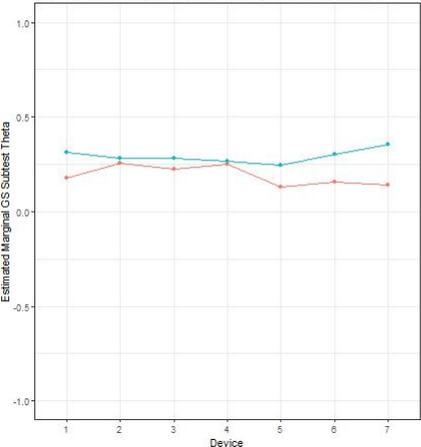
MK Estimated Marginal Theta Means by Device Familiarity



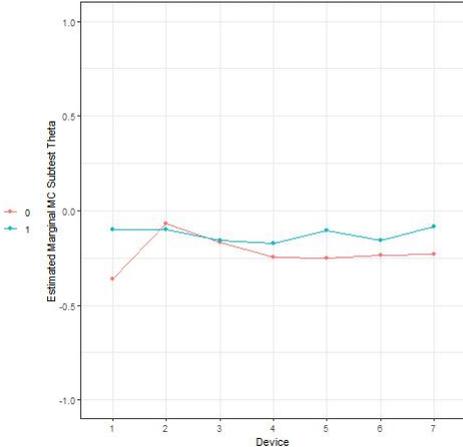
AR Estimated Marginal Theta Means by Device Familiarity



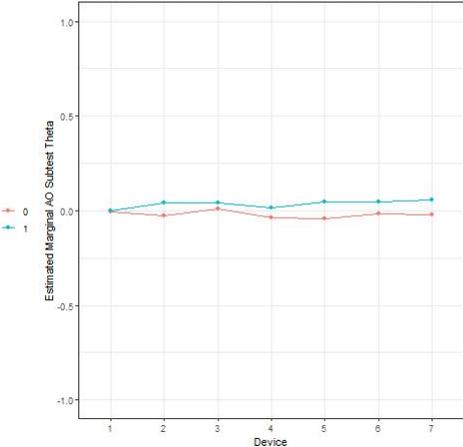
GS Estimated Marginal Theta Means by Device Familiarity



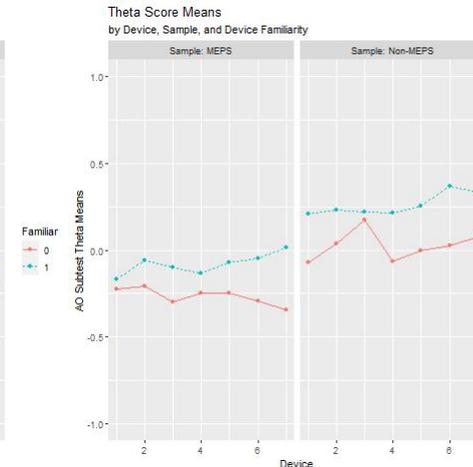
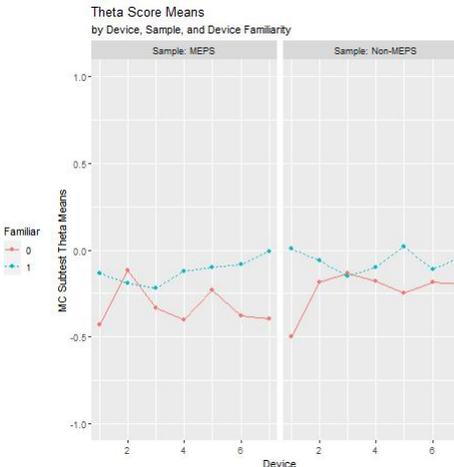
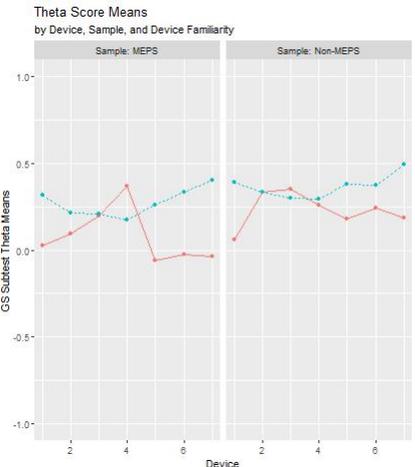
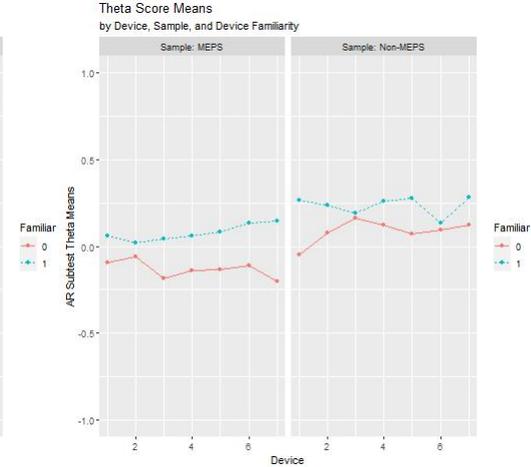
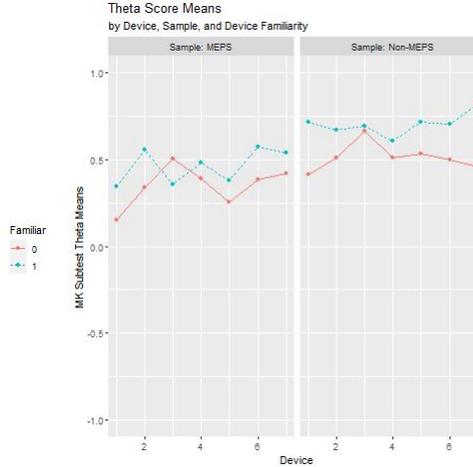
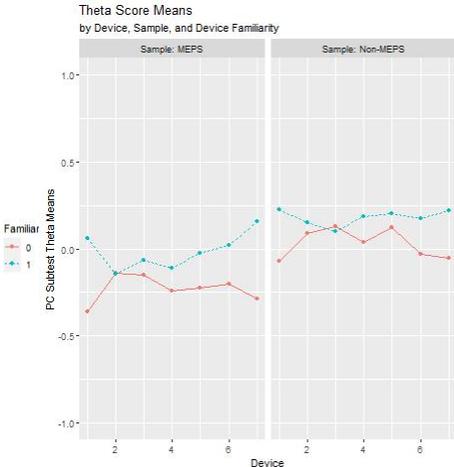
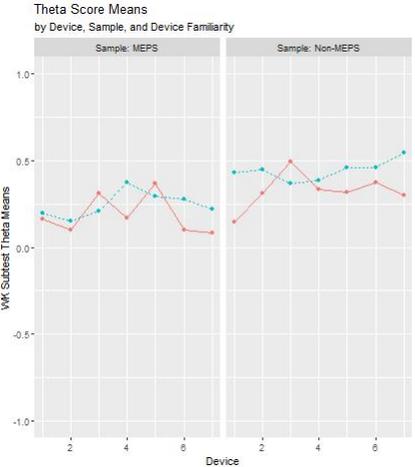
MC Estimated Marginal Theta Means by Device Familiarity



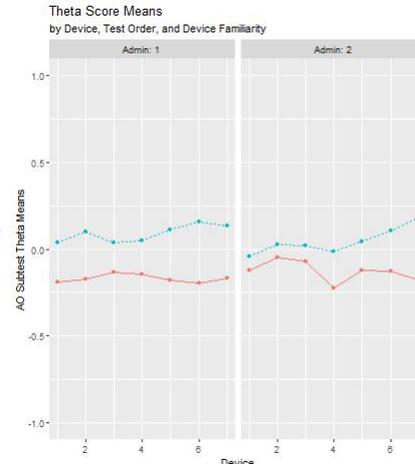
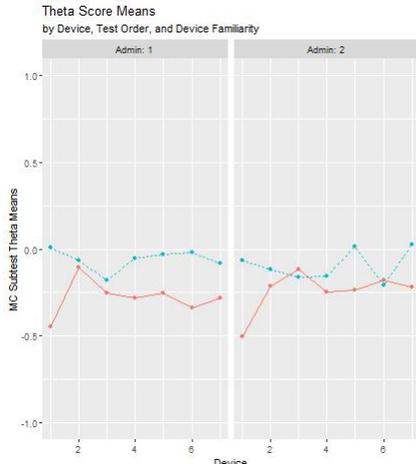
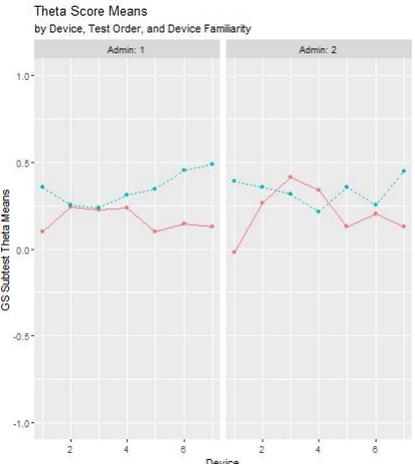
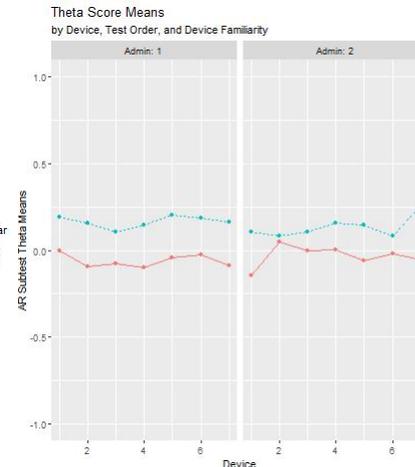
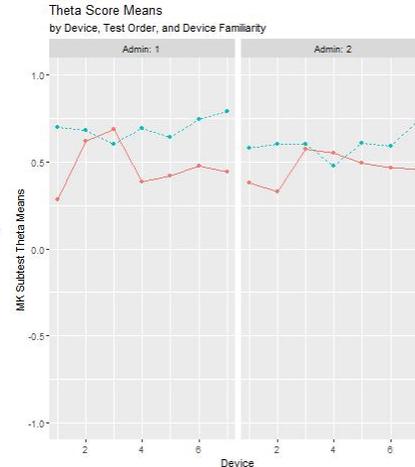
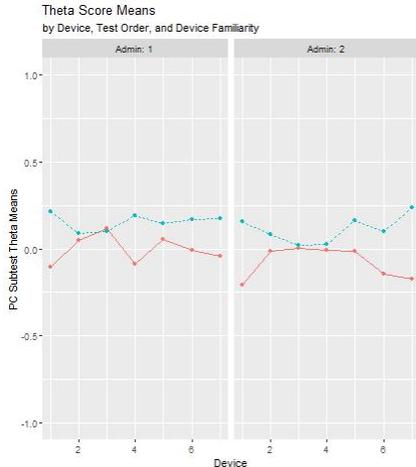
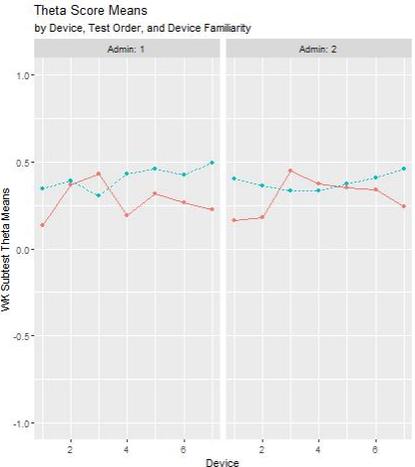
AO Estimated Marginal Theta Means by Device Familiarity



ESTIMATED MARGINAL THETA MEANS



ESTIMATED MARGINAL THETA MEANS



Recruits, Fam, Device #1, XPS (1; n=165)

ID	Device	SECs	N
4	iPad	25.56	157
5	Gal Tab	24.08	140
6	Gal SP	28.48	123

Recruits, UnFam, Device #1, XPS (1; n=41)

ID	Device	SECs	N
2	MacB	53.70	40
3	iPhone	57.47	61
4	iPad	46.33	36
5	Gal Tab	71.71	76
6	Gal SP	56.90	84
7	ChromeB	29.86	84

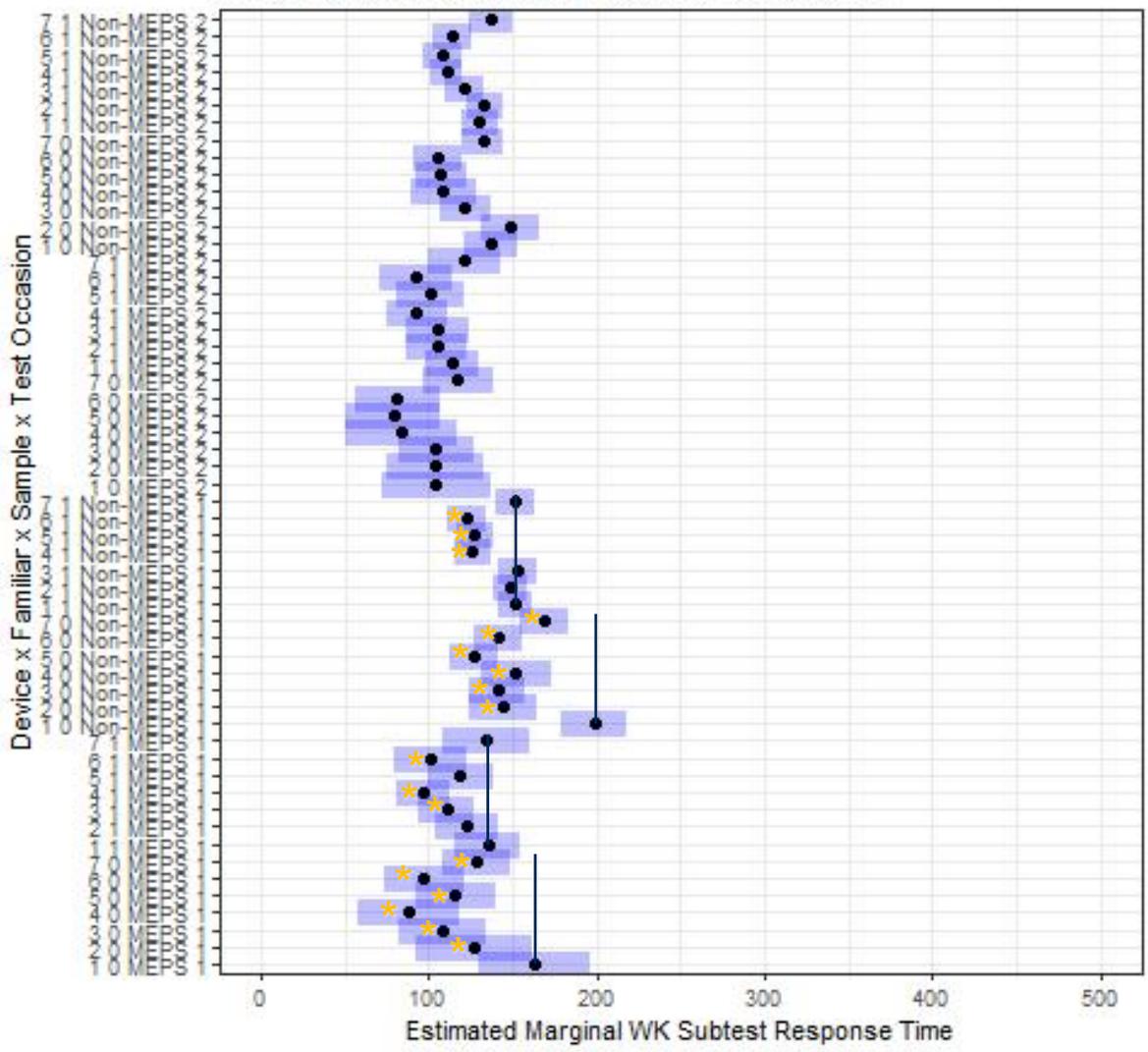
Applicants, Familiar, Device #1, XPS (1; n=44)

ID	Device	SECs	N
3	iPhone	24.32	61
4	iPad	38.97	67
6	Gal SP	34.08	42

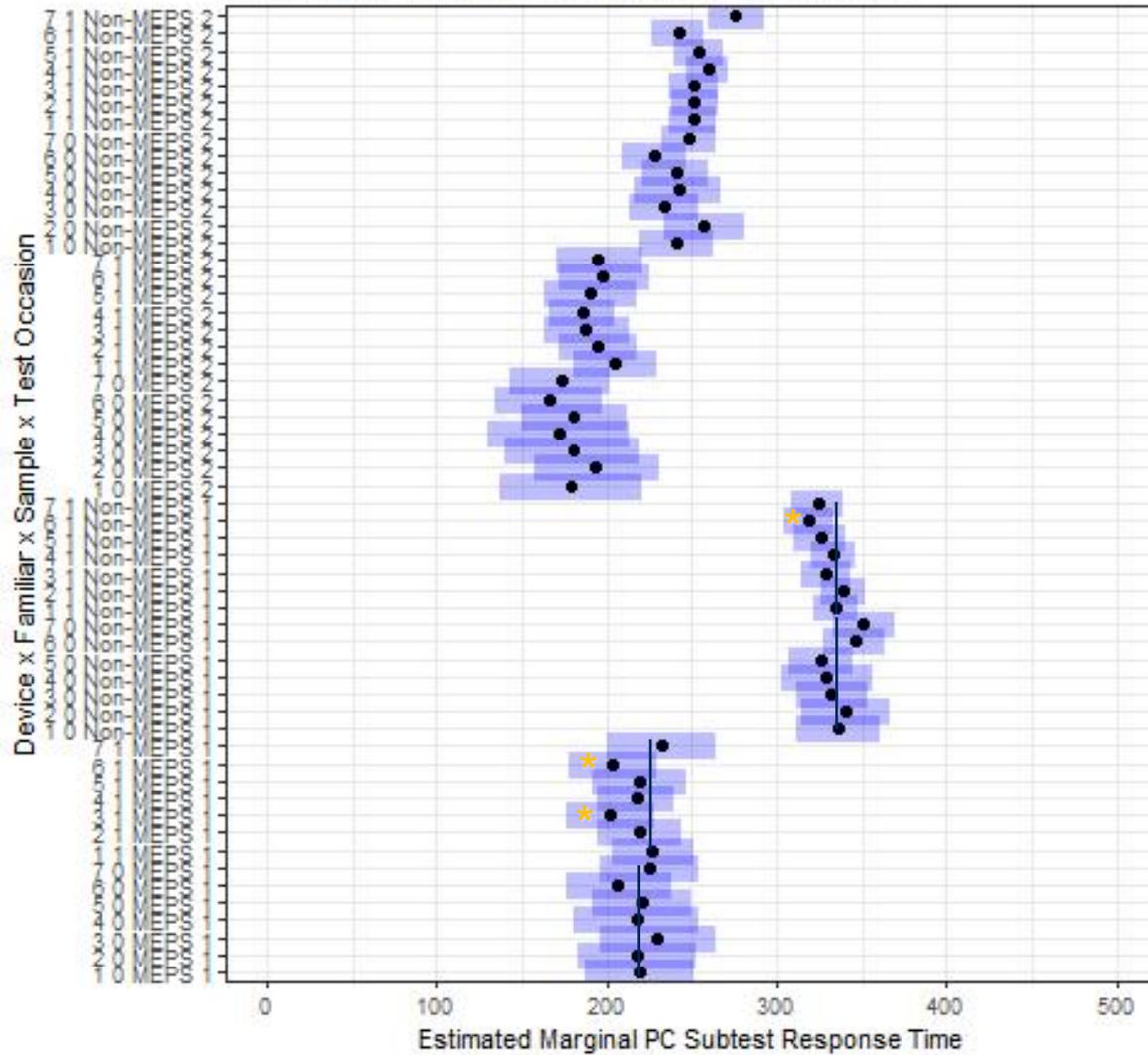
Applicants, UnFam, Device #1, XPS (1; n=15)

ID	Device	SECs	N
2	MacB	36.31	14
3	iPhone	54.93	24
4	iPad	75.22	18
5	Gal Tab	47.11	30
6	Gal SP	65.61	30
7	ChromeB	35.22	41

Estimated Marginal WK Subtest Response Time Means
Device by Familiarity Groups by Sample by Test Occasion



Estimated Marginal PC Subtest Response Time Means
 Device by Familiarity Groups by Sample by Test Occasion



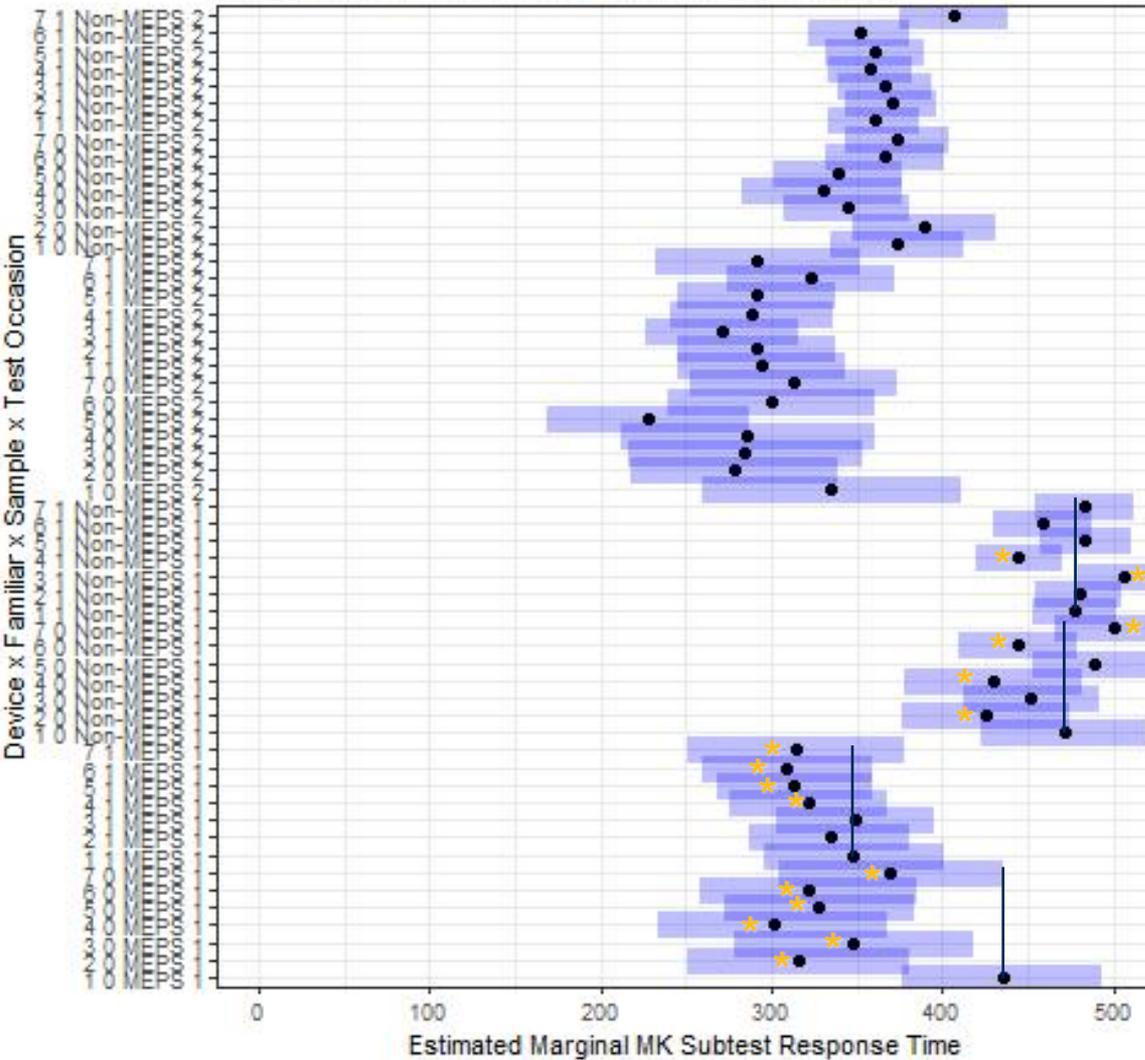
Recruits, Familiar, Device #1,
 XPS (1; n=315)

ID	Device	SECs	N
6	Gal SP	15.51	238

Applicants, Familiar, Device
 #1, XPS (1; n=91)

ID	Device	SECs	N
3	iPhone	25.16	83
6	Gal SP	23.57	80

Estimated Marginal MK Subtest Response Time Means
Device by Familiarity Groups by Sample by Test Occasion



Recruits, Fam, Device #1, XPS (1; n=165)

ID	Device	SECs	N
3	iPhone	-29.10	127
4	iPad	32.22	157

Recruits, UnFam, Device #1, XPS (1; n=41)

ID	Device	SECs	N
2	MacB	42.17	40
4	iPad	50.79	36
6	Gal SP	23.26	84
7	ChromeB	-29.19	84

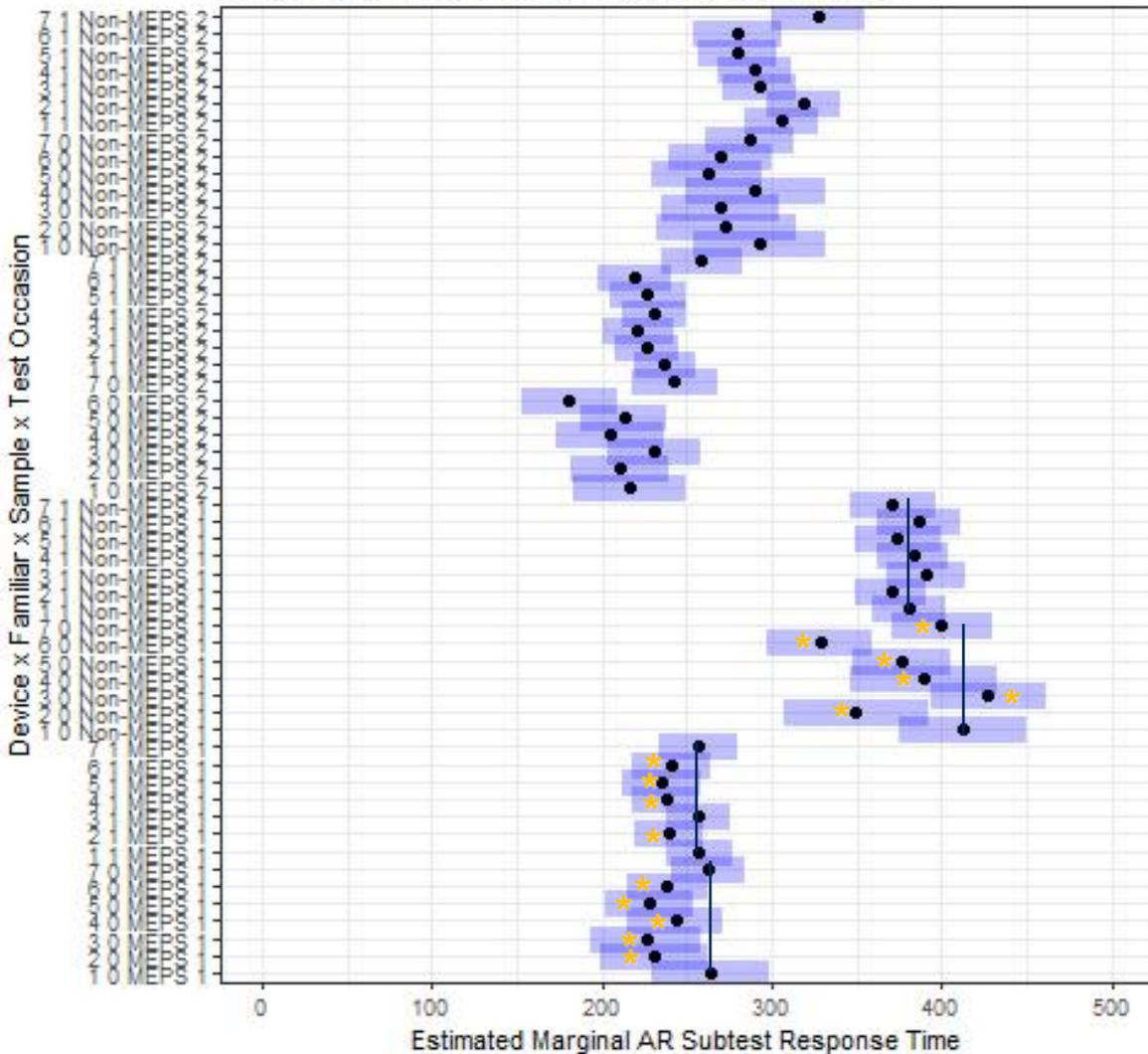
Applicants, Familiar, Device #1, XPS (1; n=36)

ID	Device	SECs	N
4	iPad	26.17	48
5	Gal Tab	34.75	50
6	Gal SP	39.57	41
7	ChromeB	33.62	24

Applicants, UnFam, Device #1, XPS (1; n=29)

ID	Device	SECs	N
2	MacB	119.96	23
3	iPhone	91.19	20
4	iPad	134.78	22
5	Gal Tab	107.77	32
6	Gal SP	113.46	25
7	ChromeB	54.97	23

Estimated Marginal AR Subtest Response Time Means
Device by Familiarity Groups by Sample by Test Occasion



Recruits, UnFam, Device #1, XPS (1; n=49)

ID	Device	SECs	N
2	MacB	62.20	37
3	iPhone	-15.48	61
4	iPad	22.26	37
5	Gal Tab	36.11	83
6	Gal SP	83.70	69
7	ChromeB	12.09	80

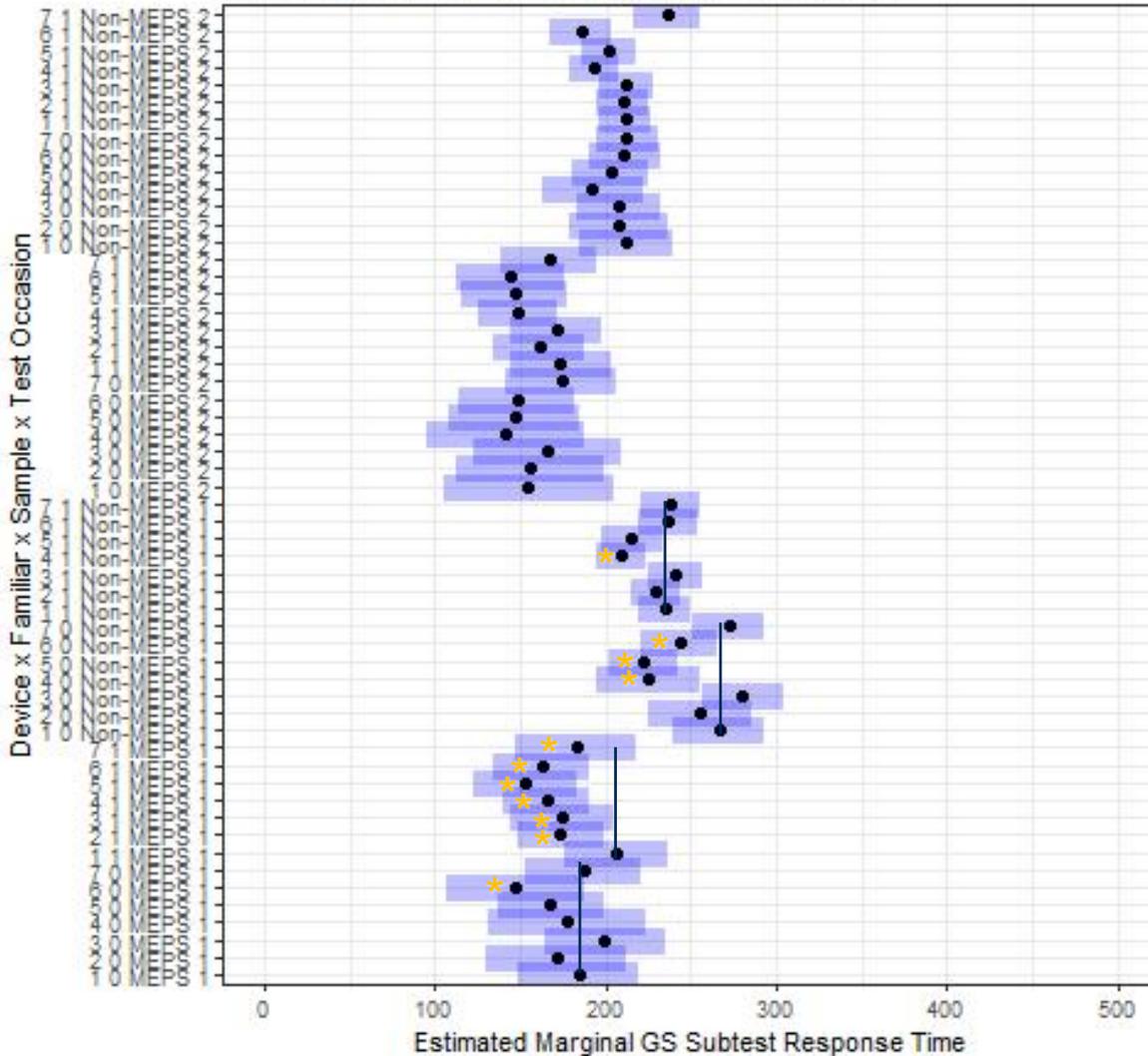
Applicants, Familiar, Device #1, XPS (1; n=197)

ID	Device	SECs	N
2	MacB	18.49	169
4	iPad	20.17	196
5	Gal Tab	22.43	136
6	Gal SP	17.22	130

Applicants, UnFam, Device #1, XPS (1; n=58)

ID	Device	SECs	N
2	MacB	33.06	67
3	iPhone	38.06	65
4	iPad	20.87	85
5	Gal Tab	35.67	103
6	Gal SP	25.36	116

Estimated Marginal GS Subtest Response Time Means
Device by Familiarity Groups by Sample by Test Occasion



Recruits, Fam, Device #1, XPS (1; n=150)

ID	Device	SECs	N
4	iPad	25.40	161

Recruits, UnFam, Device #1, XPS (1; n=49)

ID	Device	SECs	N
4	iPad	40.99	37
5	Gal Tab	44.00	83
6	Gal SP	22.90	69

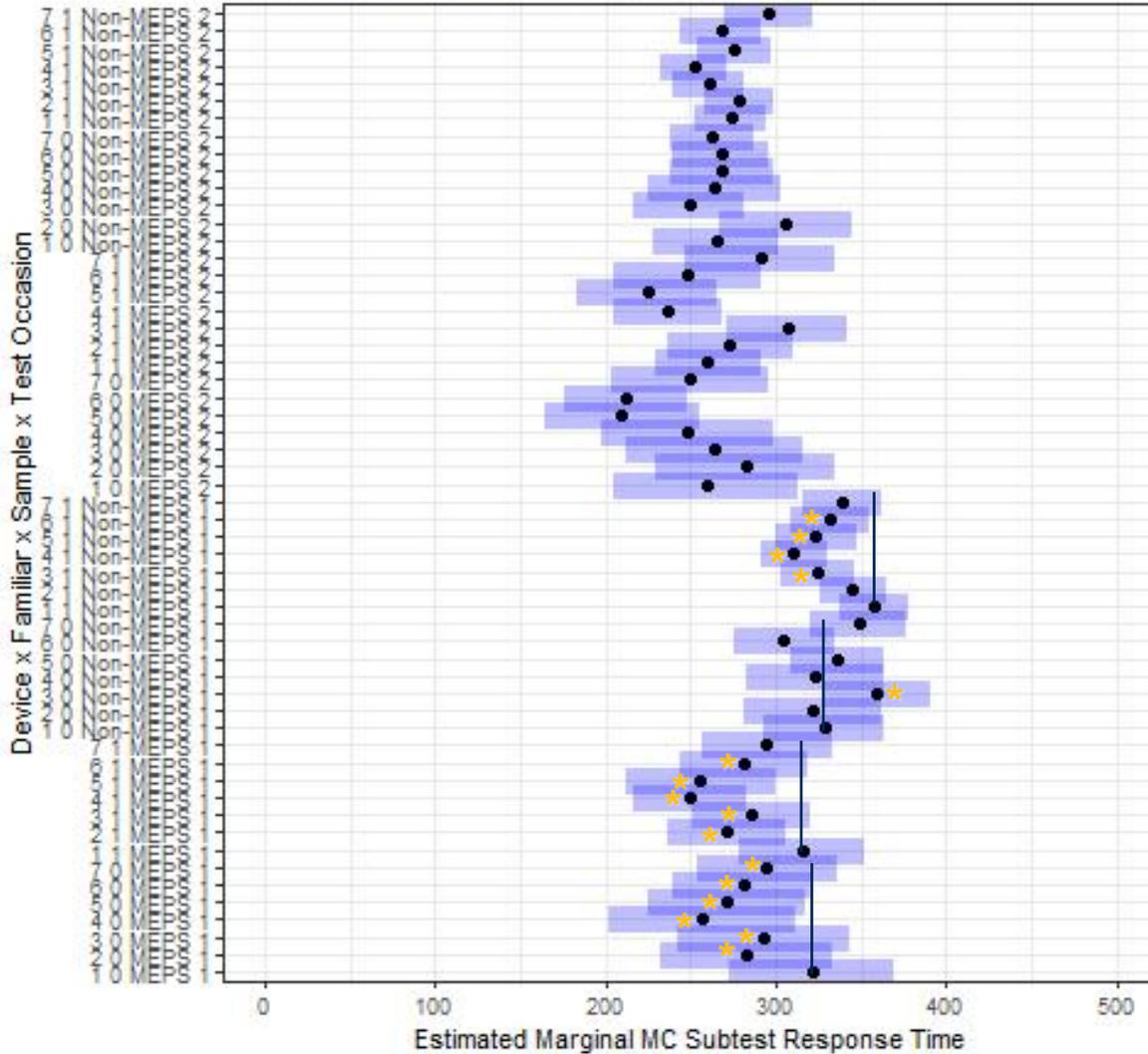
Applicants, Familiar, Admin #1, XPS (1; n=39)

ID	Device	SECs	N
2	MacB	32.92	55
3	iPhone	32.09	38
4	iPad	40.42	54
5	Gal Tab	53.46	37
6	Gal SP	43.80	44
7	ChromeB	23.69	27

Applicants, UnFam, Device #1, XPS (1; n=27)

ID	Device	SECs	N
6	Gal SP	37.05	21

Estimated Marginal MC Subtest Response Time Means
Device by Familiarity Groups by Sample by Test Occasion



Recruits, Fam, Device #1, XPS (1; n=150)

ID	Device	SECs	N
3	iPhone	33.40	131
4	iPad	47.59	161
5	Gal Tab	34.66	107
6	Gal SP	27.10	115

Recruits, UnFam, Device #1, XPS (1; n=49)

ID	Device	SECs	N
3	iPhone	-30.47	61

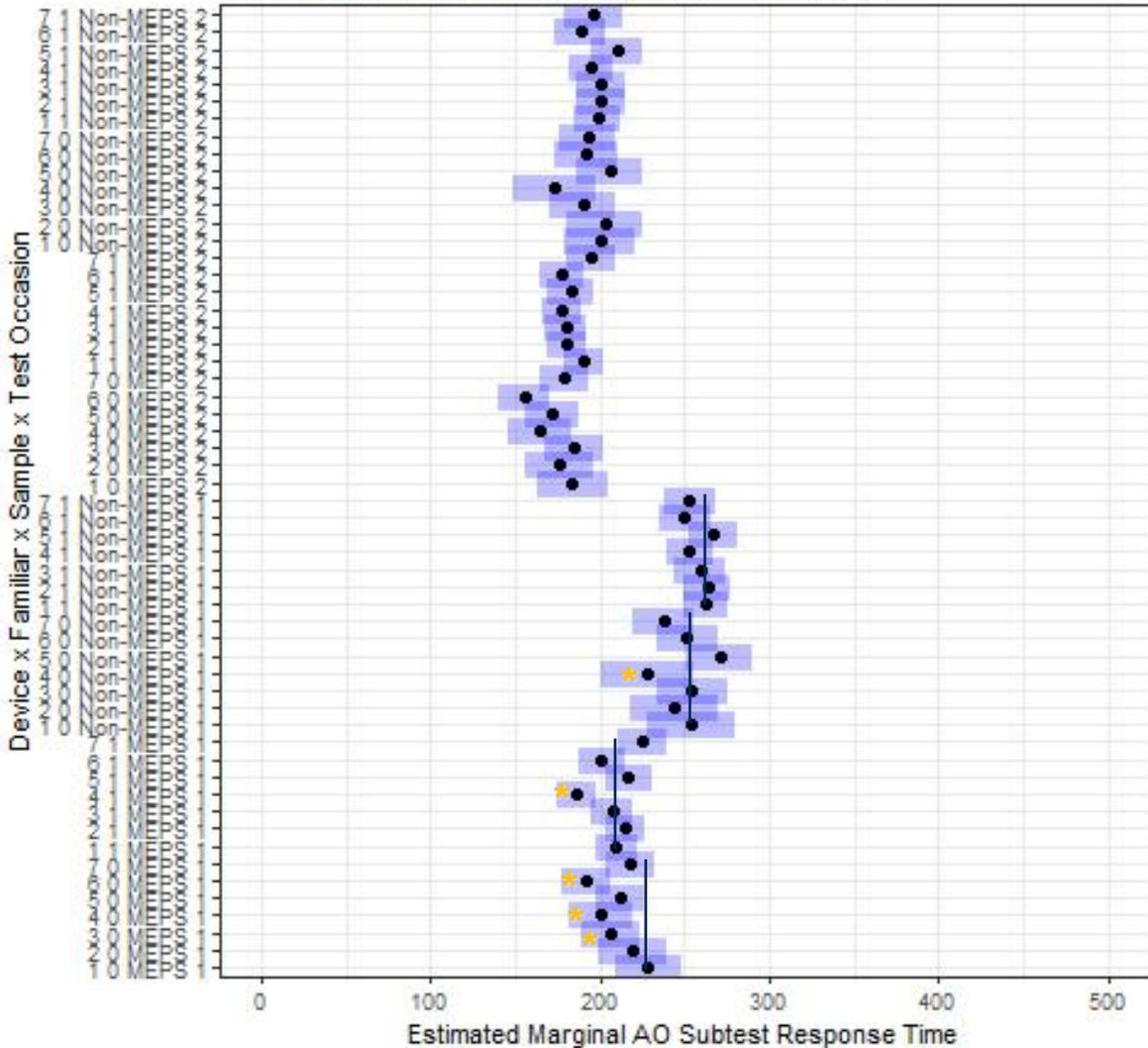
Applicants, Familiar, Device #1, XPS (1; n=47)

ID	Device	SECs	N
2	MacB	44.00	50
3	iPhone	29.55	52
4	iPad	65.61	57
5	Gal Tab	59.52	31
6	Gal SP	34.07	44

Applicants, UnFam, Device #1, XPS (1; n=26)

ID	Device	SECs	N
2	MacB	38.95	24
3	iPhone	29.19	24
4	iPad	64.92	20
5	Gal Tab	49.93	29
6	Gal SP	40.47	36
7	ChromeB	26.72	36

Estimated Marginal AO Subtest Response Time Means
 Device by Familiarity Groups by Sample by Test Occasion



Recruits, Unfamiliar, Device #1,
 XPS (1; n=41)

ID	Device	SECs	N
4	iPad	26.23	36

Applicants, Familiar, Device #1,
 XPS (1; n=189)

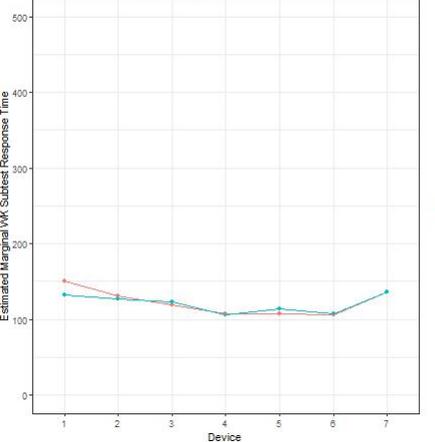
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4	iPad	23.19	214

Applicants, Unfamiliar,
 Device #1, XPS (1; n=76)

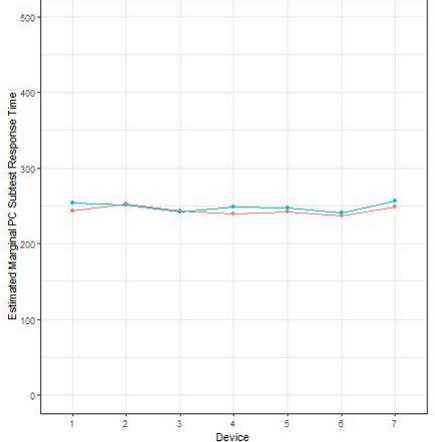
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4	iPad	28.06	79
6	Gal SP	36.54	124

ESTIMATED MARGINAL RESPONSE TIME MEANS

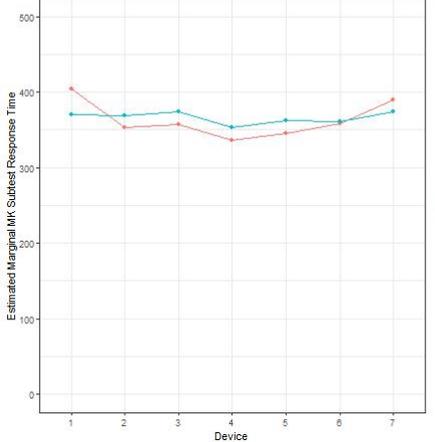
WK Estimated Marginal Response Time Means by Device Familiarity



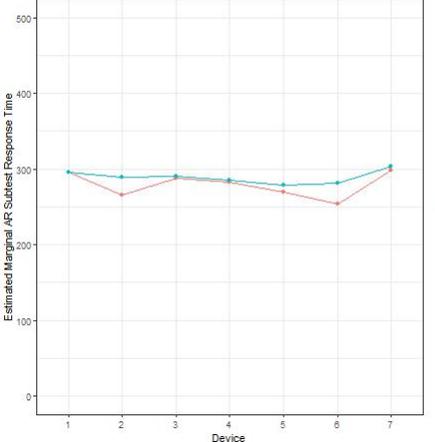
PC Estimated Marginal Response Time Means by Device Familiarity



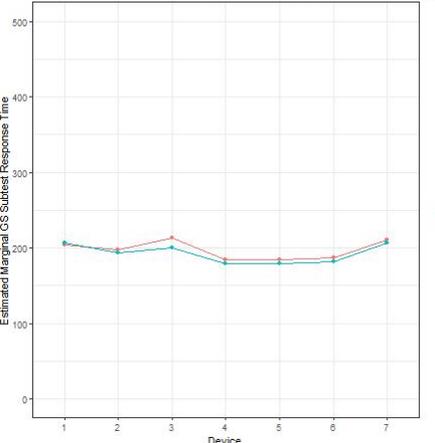
MK Estimated Marginal Response Time Means by Device Familiarity



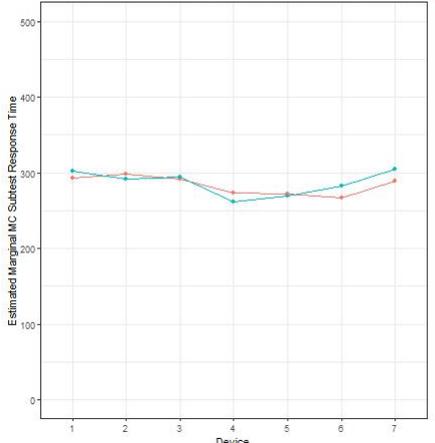
AR Estimated Marginal Response Time Means by Device Familiarity



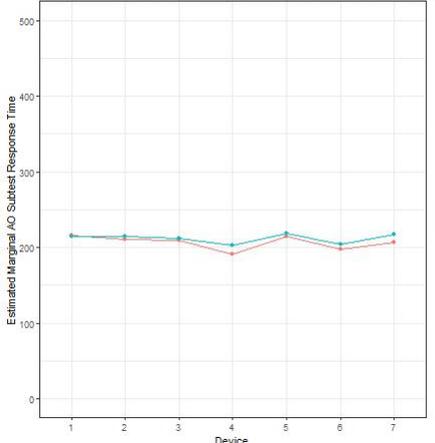
GS Estimated Marginal Response Time Means by Device Familiarity



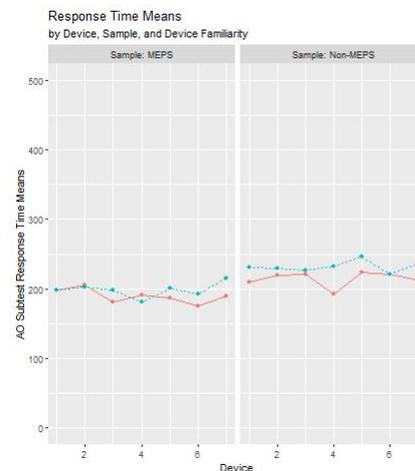
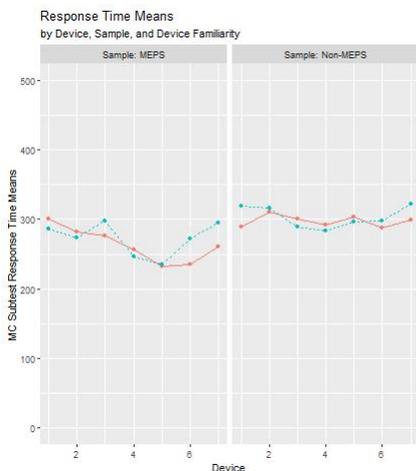
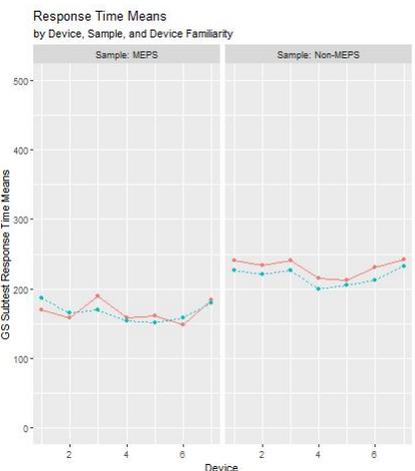
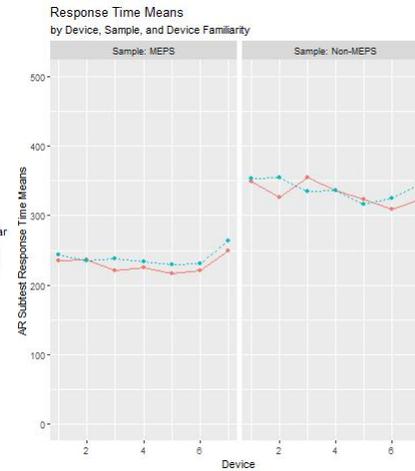
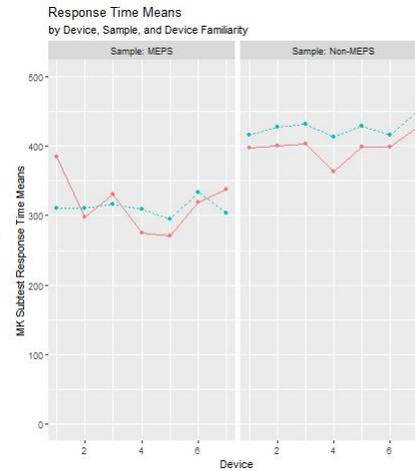
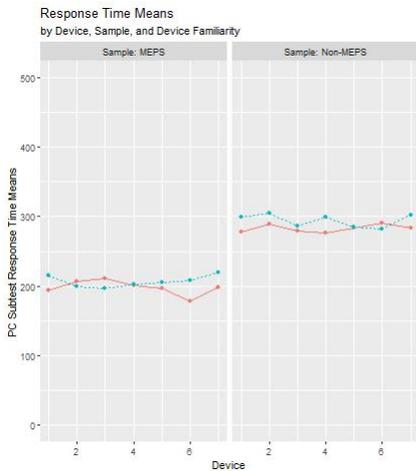
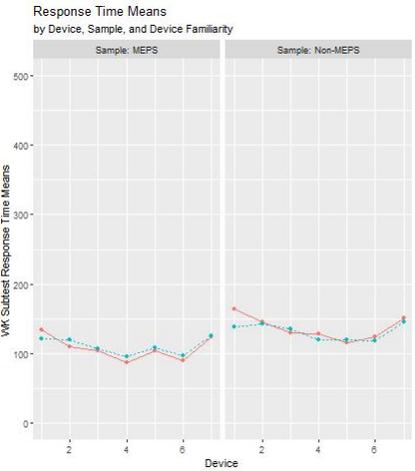
MC Estimated Marginal Response Time Means by Device Familiarity



AO Estimated Marginal Response Time Means by Device Familiarity



ESTIMATED MARGINAL RESPONSE TIME MEANS



ESTIMATED MARGINAL RESPONSE TIME MEANS

