Big Data, Big Analysis:
A Collaborative Modeling Framework for Multi-study Replication

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Convention of Canadian Psychological Association | Victoria, BC | June 10, 2016

- The IALSA network (NIH/NIA 1P01AG043362) is comprised of over 100 longitudinal studies on aging, health and dementia.
  - Mix of samples aged from birth to 100 years
  - Assessed from 1921 to the present.
  - Monitoring each individual for 4 to 48 years
  - Time between assessments 6 months to 17 years

- Focus on the reproducibility of results (i.e., direction and pattern of effects) across populations, historical periods, measurements, designs, and statistical models.

- Research aim: *To maintain and enhance cognitive and physical health and well-being throughout the lifespan*

IALSA Approach: Coordinated Analysis with Replication (CAR)

- Finds common/similar measures among studies (maelstrom-research.org)
- Fits same models to many longitudinal studies
- Meta-analyzes model solutions
- Aim: *Maximize value from each study while providing comparable results*
- Expect similar conclusions regardless of the exact variables used.
- Evaluation of sensitivity to statistical model
- Meta-Analysis / Meta-Regression

Hofer, S. M., & **Piccinin**, A. M. (2009). Integrative data analysis through coordination of measurement and analysis protocol across independent longitudinal studies. *Psychological Methods, 14(2), 150*.

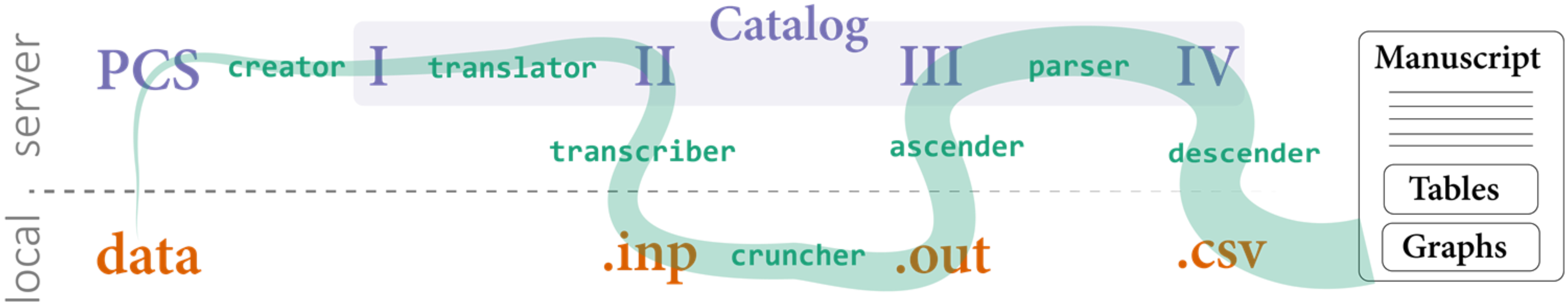
IALSA Portland Workshop *Feb 23-25, 2015* (*github.com/IALSA/IALSA-2015-Portland*)

- Primary aim: To examine the associations between changes in
  - **physical functioning** (e.g., grip strength, pulmonary function) and
  - **cognitive functioning** (e.g., memory, reasoning)
  - in multiple-study comparative framework.
- Research foci: To examine concurrent decline between
  - Pulmonary function – Cognition
  - Grip Strength – Cognition
  - Gait – Cognition
  - Cognition: Within and across cognitive domains
  - Physical functioning: Across pulmonary, grip, gait
- Bivariate linear growth curve models
- Adjustment for age, sex, education, height, health behaviors and outcomes

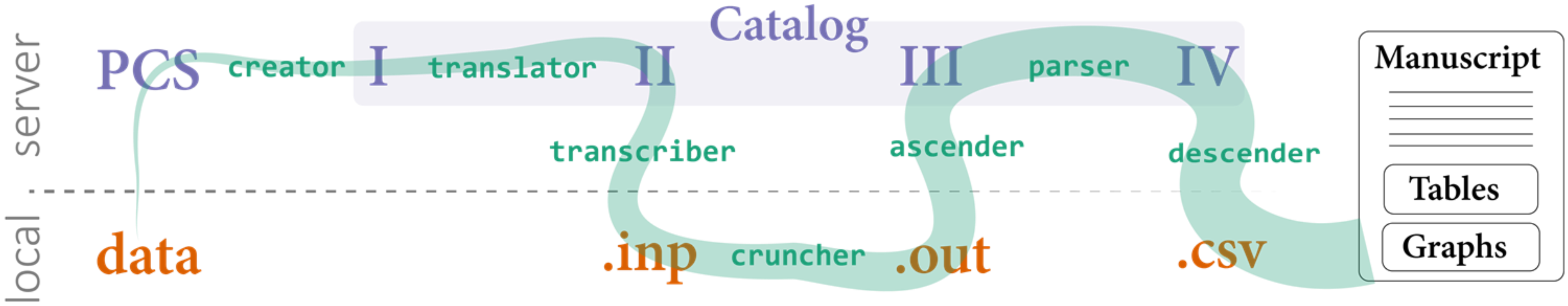
IALSA Portland Workshop *Feb 23-25, 2015* *(github.com/IALSA/IALSA-2015-Portland)*

Study		Driver
Einstein Aging Study	EAS	Andrea Zammit
English Longitudinal Study of Aging	ELSA	Annie Robitaille
Health and Retirement Study	HRS	Chenkai Wu
Interdisciplinary Longitudinal Study of Aging	ILSE	Philipp Handschuh
Normative Aging Study	NAS	Lewina Lee
Quebec Longitudinal Study on Nutrition and Aging	NuAge	Valerie Jarry
Octogenarian Twins	OCTO	Marcus Praetorius
Rush Memory and Aging Project	MAP	Cassandra Brown
Swedish Adoption Twin Study of Aging	SATSA	Deborah Finkel

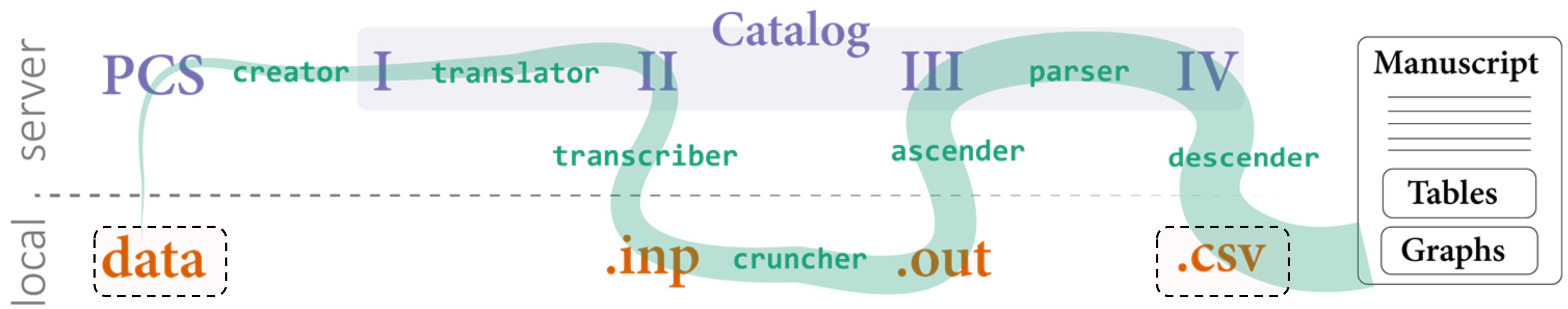

Portland, OR
Feb 23-25, 2015



This is the
WORKFLOW MAP
of the coordinated analysis.



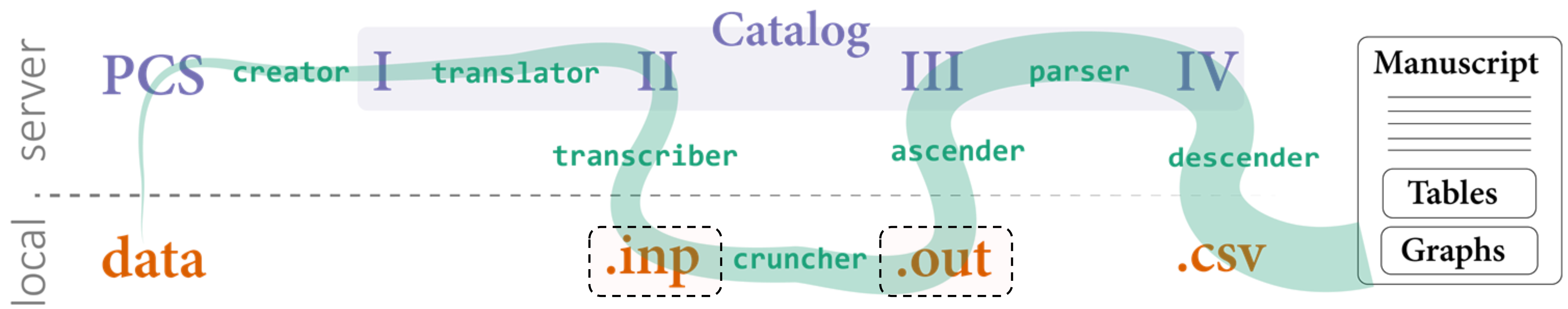
Next,
we will show you
what each element and process
IS and DOES.



These are
language-agnostic, tabulated DATA FILES.
They can be used by any software (R, SAS, STATA, M*plus*, etc)

	A	B	C	D	E	F	H	I	J	Q	R	S	T	U
1	study_name	model_number	subgroup	model_type	subject_count	wave_count	LL	aic	bic	ab_TAU_00_est	ab_TAU_00_se	ab_TAU_00_wald	ab_TAU_00_pval	ab_TAU
2	eas	b1	female	ae	580	8	-12370.4	24790.79	24899.86	-214.803	119.207	-1.802	0.072	-1.4
3	eas	b1	female	ae	593	8	-8766.76	17583.53	17693.16	24.846	13.797	1.801	0.072	0.6
4	eas	b1	female	ae	572	8	-8975.66	18001.32	18110.05	69.278	19.852	3.49	0	1.0
5	eas	b1	female	ae	524	7	-7043.93	14137.86	14244.4	5.151	9.445	0.545	0.586	-0.2
6	eas	b1	female	ae	594	8	-9357.93	18765.87	18875.54	55.35	19.105	2.897	0.004	0.8
7	eas	b1	female	ae	594	8	-6681.55	13413.11	13522.78	5.336	4.51	1.183	0.237	0.1
8	eas	b1	female	ae	595	8	-7094.86	14239.72	14349.44	17.044	5.765	2.956	0.003	0.3
9	eas	b1	female	ae	554	8	-8065.42	16180.84	16288.77	8.647	9.337	0.926	0.354	0.1
10	eas	b1	female	ae	383	8	-3871.71	7793.415	7892.116	10.378	5.741	1.808	0.071	-0.0
11	eas	b1	female	ae	563	8	-8499.24	17048.48	17156.81	31.673	13.058	2.426	0.015	0.4
12	eas	b1	female	ae	592	8	-9307.2	18664.39	18773.98	69.62	20.65	3.371	0.001	1.4
13	eas	b1	female	aeh	150	8	-4939.77	9937.539	10024.85	-219.554	185.685	-1.182	0.237	-1.1
14	eas	b1	female	aeh	150	8	-3582.45	7222.909	7310.217	16.88	20.942	0.806	0.42	0.8
15	eas	b1	female	aeh	150	8	-3709.14	7476.282	7563.591	81.433	32.4	2.513	0.012	0.8
16	eas	b1	female	aeh	130	7	-2632.36	5322.718	5405.877	15.274	13.399	1.14	0.254	-0.4
17	eas	b1	female	aeh	150	8	-3714.27	7486.538	7573.847	60.856	26.394	2.306	0.021	1.
18	eas	b1	female	aeh	150	8	-2825.3	5708.606	5795.914	9.225	7.158	1.289	0.197	0.2
19	eas	b1	female	aeh	150	8	-2910.72	5879.44	5966.749	14.142	7.545	1.874	0.061	0.3
20	eas	b1	female	aeh	150	8	-3450.76	6959.528	7046.837	10.8	13.947	0.774	0.439	0.2

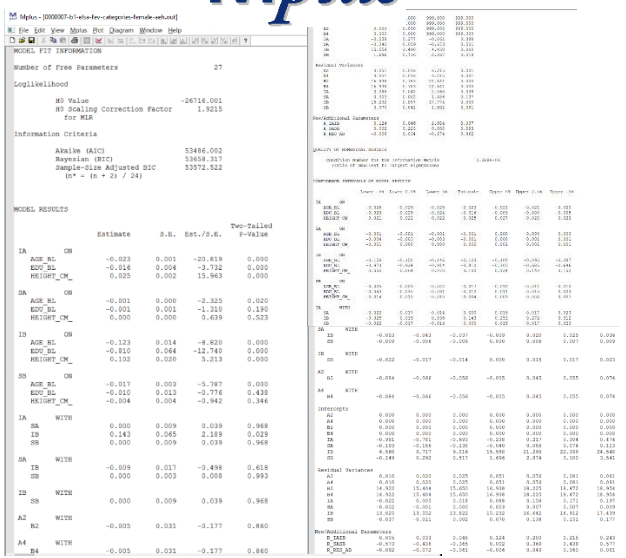
	id	year_bl	age_bl	year_born	male_bl	edu_bl	height_cm_bl	diabetes_bl	cardio_bl	smoke_bl	age_t1	age_t2	age_t3	age_t4	age_t5	age_t6	animals_t1	animals_t2	animals_t3	animals_t4	animals_t5	anima
1	103712	2002	55	1947	0	4	172.20	1	0	0	55	57	59	61	63	65	18	24	15	16	23	NA
2	103713	2002	71	1931	1	3	NA	0	0	0	71	73	75	NA	NA	NA	10	9	8	NA	NA	NA
3	103714	2002	51	1950	0	4	169.50	0	0	0	51	53	55	57	59	61	33	27	19	28	31	NA

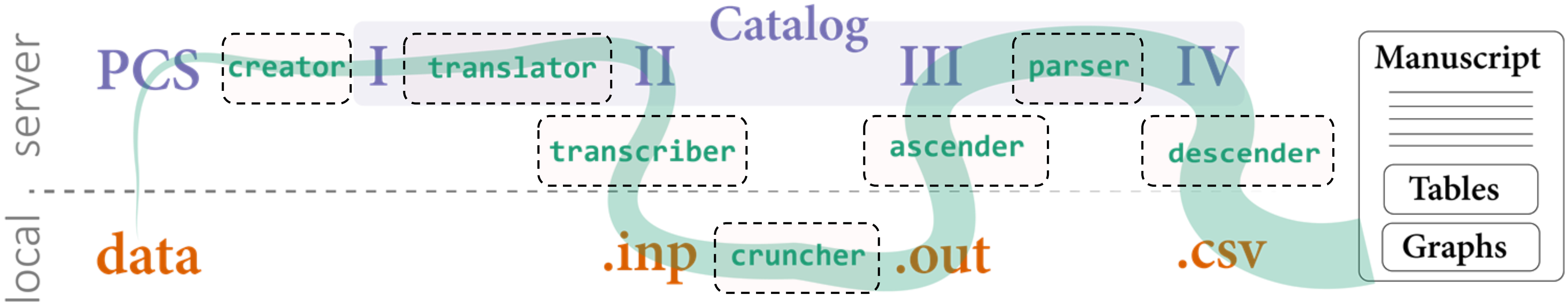


Mplus

These are
input and output files
consumed and produced by M*plus*.

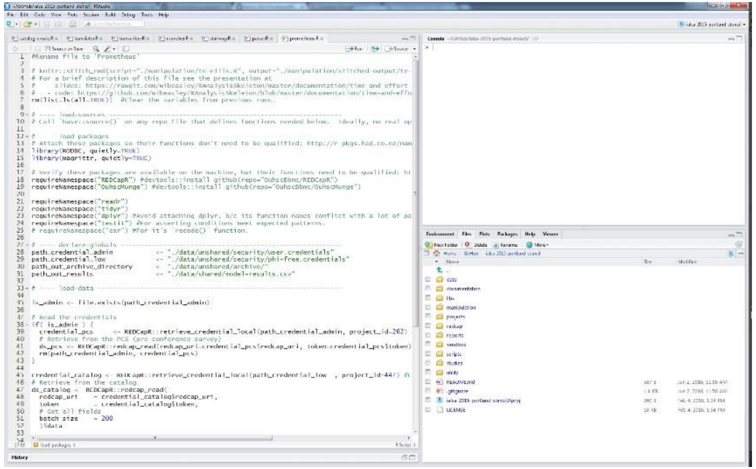
Mplus

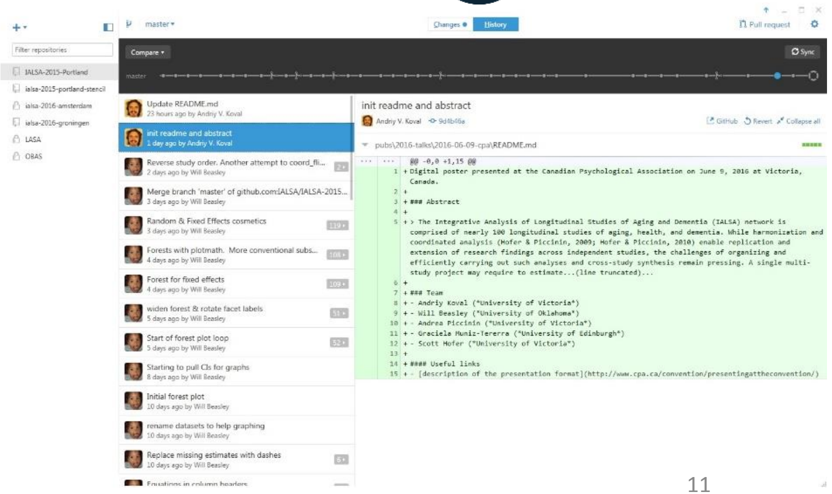


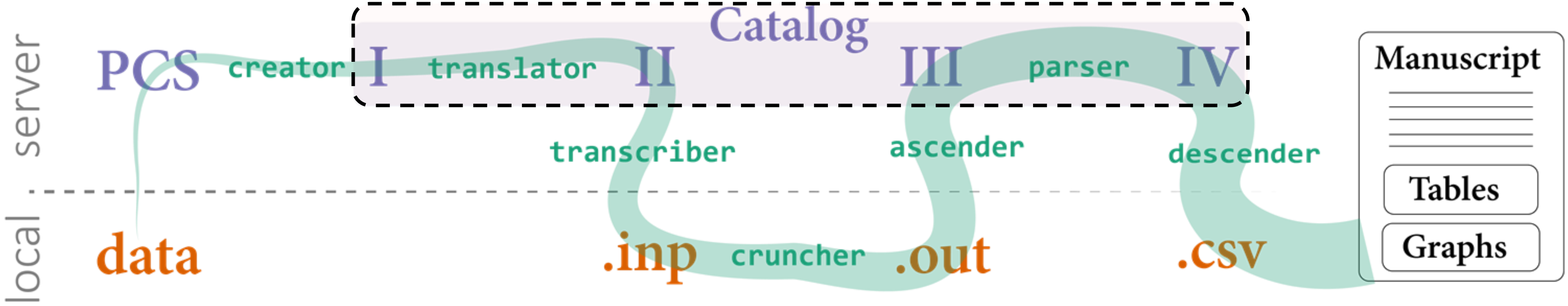


These are **R** SCRIPTS

Run in **RStudio** and coordinated in **GitHub**



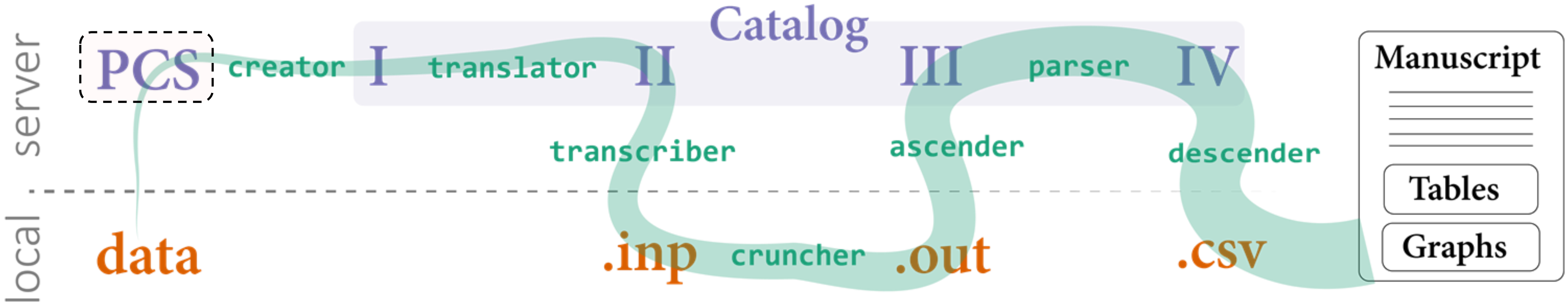




This is a
DATASET
each row = one model per study
It is stored on a REDCap server.

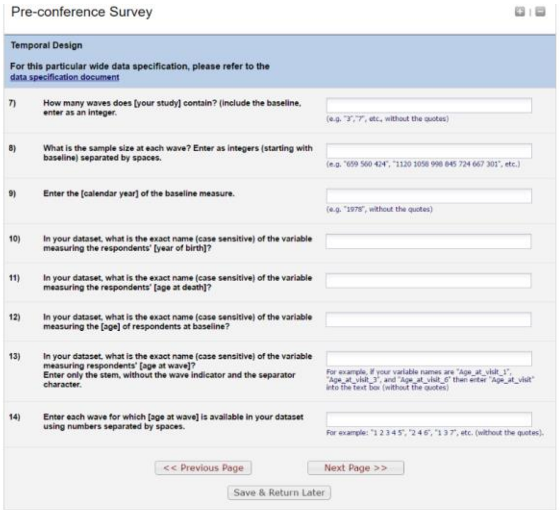
REDCap
Research Electronic Data Capture

Harris, PA, **Taylor**, R, **Thielke**, R, **Payne**, R, **Gonzalez**, N, Conde, JG (2009). Research electronic data capture (REDCap) - A metadata-driven methodology and workflow process for providing translational research informatics support, *J Biomed Inform, 42*(2), 377-81.



Drivers enter their study's
METADATA
into this REDCap survey.

REDCap
Research Electronic Data Capture



Pre-conference Survey

Temporal Design

For this particular wide data specification, please refer to the data specification document

7)	How many waves does [your study] contain? (include the baseline, enter as an integer.	(e.g. "3","7", etc., without the quotes)
8)	What is the sample size at each wave? Enter as integers (starting with baseline) separated by spaces.	(e.g. "659 560 424", "1120 1058 998 845 724 667 301", etc.)
9)	Enter the [calendar year] of the baseline measure.	(e.g. "1978", without the quotes)
10)	In your dataset, what is the exact name (case sensitive) of the variable measuring the respondents' [year of birth]?	
11)	In your dataset, what is the exact name (case sensitive) of the variable measuring the respondents' [age at death]?	
12)	In your dataset, what is the exact name (case sensitive) of the variable measuring the [age] of respondents at baseline?	
13)	In your dataset, what is the exact name (case sensitive) of the variable measuring respondents' [age at wave]? Enter only the stem, without the wave indicator and the separator character.	For example, if your variable names are "Age_at_visit_1", "Age_at_visit_3", and "Age_at_visit_6" then enter "Age_at_visit" into the text box (without the quotes)
14)	Enter each wave for which [age at wave] is available in your dataset using numbers separated by spaces.	For example: "1 2 3 4 5", "2 4 6", "1 3 7", etc. (without the quotes).

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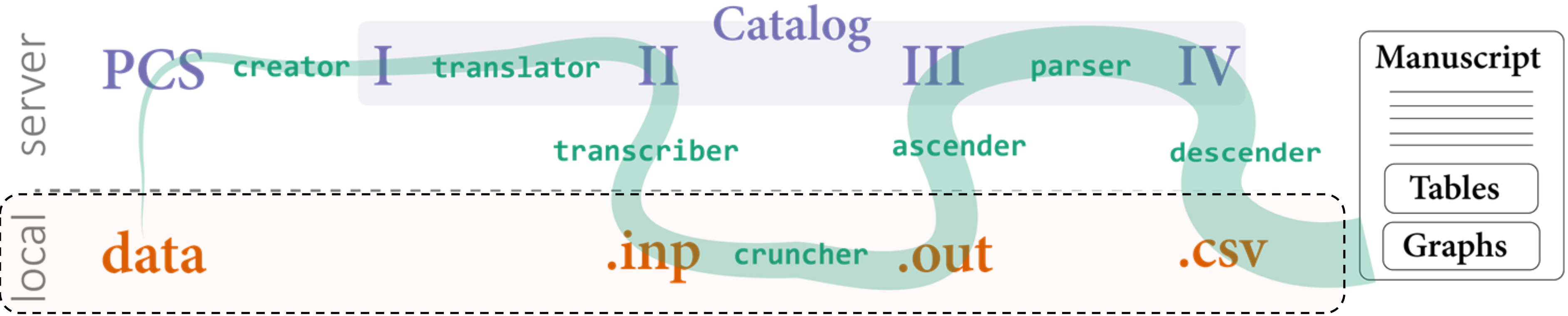
Save & Return Later

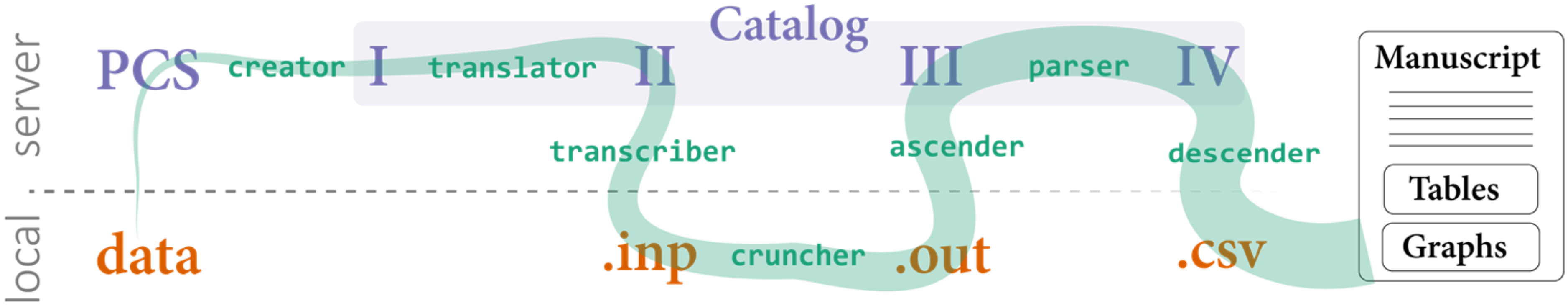
Harris, PA, **Taylor**, R, **Thielke**, R, **Payne**, R, **Gonzalez**, N, Conde, JG (2009). Research electronic data capture (REDCap) - A metadata-driven methodology and workflow process for providing translational research informatics support, *J Biomed Inform, 42*(2), 377-81.



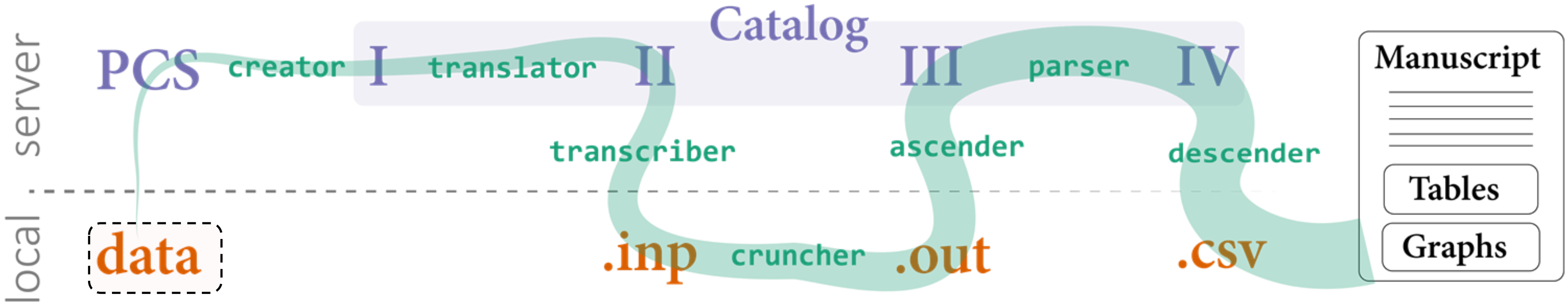
This is PRIVATE space on local machines.
Sensitive information ALWAYS under control of the driver.
Raw data is not shared with anyone at any point.

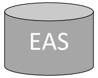
-> greater security

-> less IRB paperwork



Now we will walk you through
Coordinated Analysis with Replication
from raw data files to tables and graphs in manuscripts.





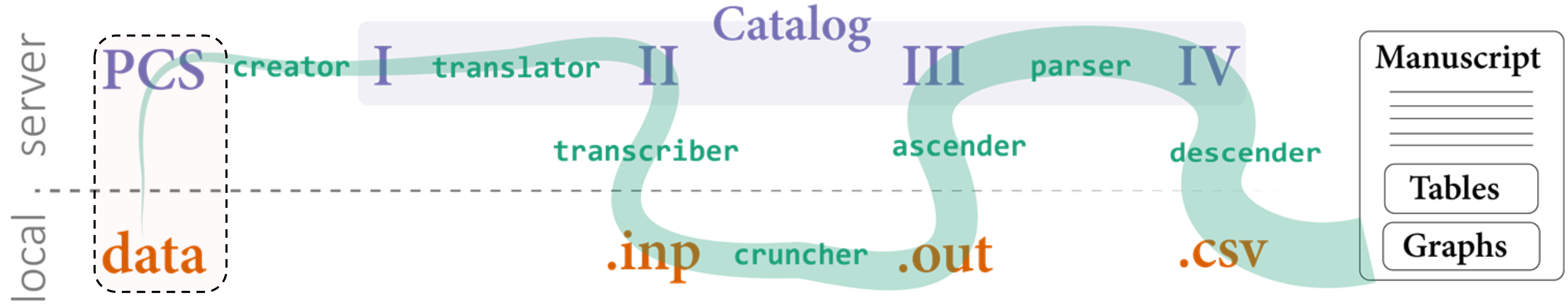
DRIVERS
provide expertise on their longitudinal studies,
bring groomed dataset to CAR, and
need only basic knowledge of R

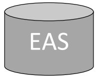
Wide

	id	year_bl	age_bl	year_born	male_bl	edu_bl	height_cm_bl	diabetes_bl	cardio_bl	smoke_bl	age_t1	age_t2	age_t3	age_t4	age_t5	age_t6	animals_t1	animals_t2	animals_t3	animals_t4	animals_t5	anima
1	103712	2002	55	1947	0	4	172.20	1	0	0	55	57	59	61	63	65	18	24	15	16	23	NA
2	103713	2002	71	1931	1	3	NA	0	0	0	71	73	75	NA	NA	NA	10	9	8	NA	NA	NA
3	103714	2002	51	1950	0	4	169.50	0	0	0	51	53	55	57	59	61	33	27	19	28	31	NA

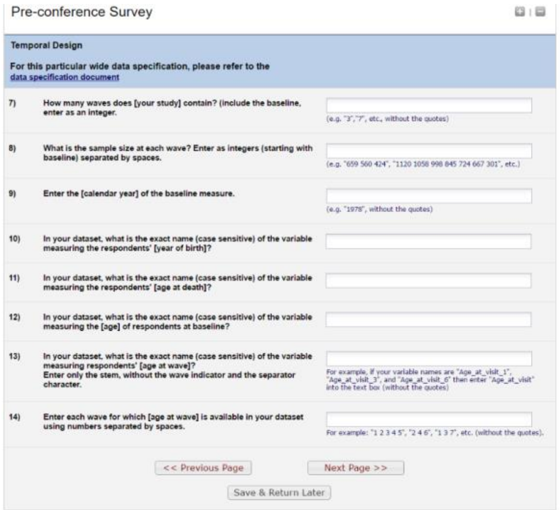
Long

	id	wave	year_born	years_since_bl	year_bl	year	age_bl	age	male_bl	edu_bl	height_cm_bl	diabetes_bl	cardio_bl	smoke_bl	fev	fvc	pef	grip	gait	word_recall_im	word_recall_de	animals
1	103712	1	1947	0	2002	2002	55	55	0	4	172.20	1	0	0	NA	NA	NA	NA	NA	6	6	18
2	103712	2	1947	2	2002	2004	55	57	0	4	172.20	1	0	0	2.99	2.99	4.99	26.833333	NA	6	6	24
3	103712	3	1947	4	2002	2006	55	59	0	4	172.20	1	0	0	NA	NA	NA	NA	NA	10	8	15
4	103712	4	1947	6	2002	2008	55	61	0	4	172.20	1	0	0	2.58	2.58	3.78	21.333333	0.687679112	7	7	16
5	103712	5	1947	8	2002	2010	55	63	0	4	172.20	1	0	0	NA	NA	NA	NA	1.105990767	7	6	23
6	103712	6	1947	10	2002	2012	55	65	0	4	172.20	1	0	0	NA	NA	NA	25.500000	1.019108295	6	6	NA
7	103713	1	1931	0	2002	2002	71	71	1	3	NA	0	0	0	NA	NA	NA	NA	0.108572721	5	1	10
8	103713	2	1931	2	2002	2004	71	73	1	3	NA	0	0	0	NA	NA	3.62	17.166667	0.096793711	3	4	9
9	103713	3	1931	4	2002	2006	71	75	1	3	NA	0	0	0	NA	NA	NA	NA	NA	4	2	8
10	103714	1	1950	0	2002	2002	51	51	0	4	169.50	0	0	0	NA	NA	NA	NA	NA	8	7	33





REDCap interacts with the DRIVER
to obtain relevant description
of the study 's DATASET and characteristics.


Pre-conference Survey

Temporal Design

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10)	In your dataset, what is the exact name (case sensitive) of the variable measuring the respondents' [year of birth]?	
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12)	In your dataset, what is the exact name (case sensitive) of the variable measuring the [age] of respondents at baseline?	
13)	In your dataset, what is the exact name (case sensitive) of the variable measuring respondents' [age at wave]? Enter only the stem, without the wave indicator and the separator character.	For example, if your variable names are "Age_at_visit_1", "Age_at_visit_3", and "Age_at_visit_6" then enter "Age_at_visit" into the text box (without the quotes)
14)	Enter each wave for which [age at wave] is available in your dataset using numbers separated by spaces.	For example: "1 2 3 4 5", "2 4 6", "1 3 7", etc. (without the quotes).

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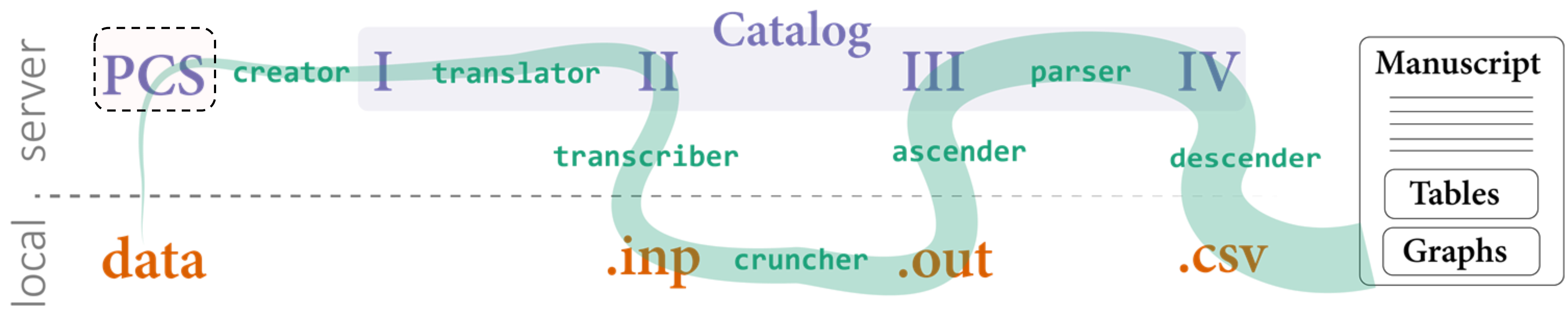
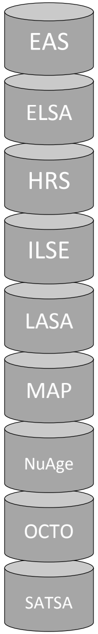
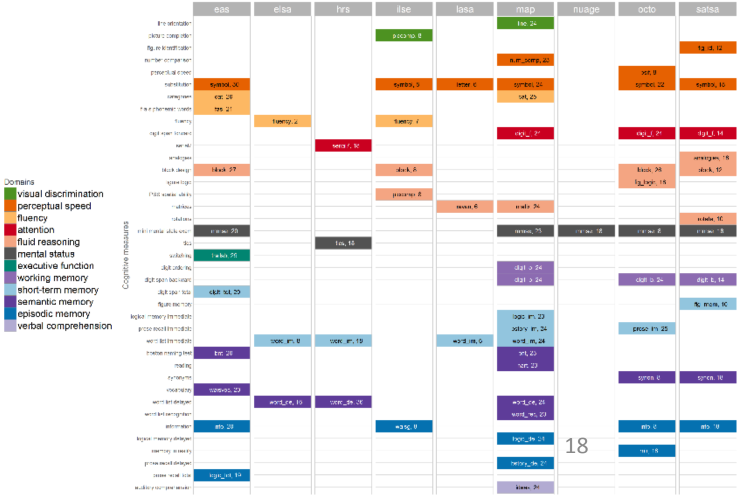
Image credit: https://support.novell.com/techcenter/articles/ana19920502.html

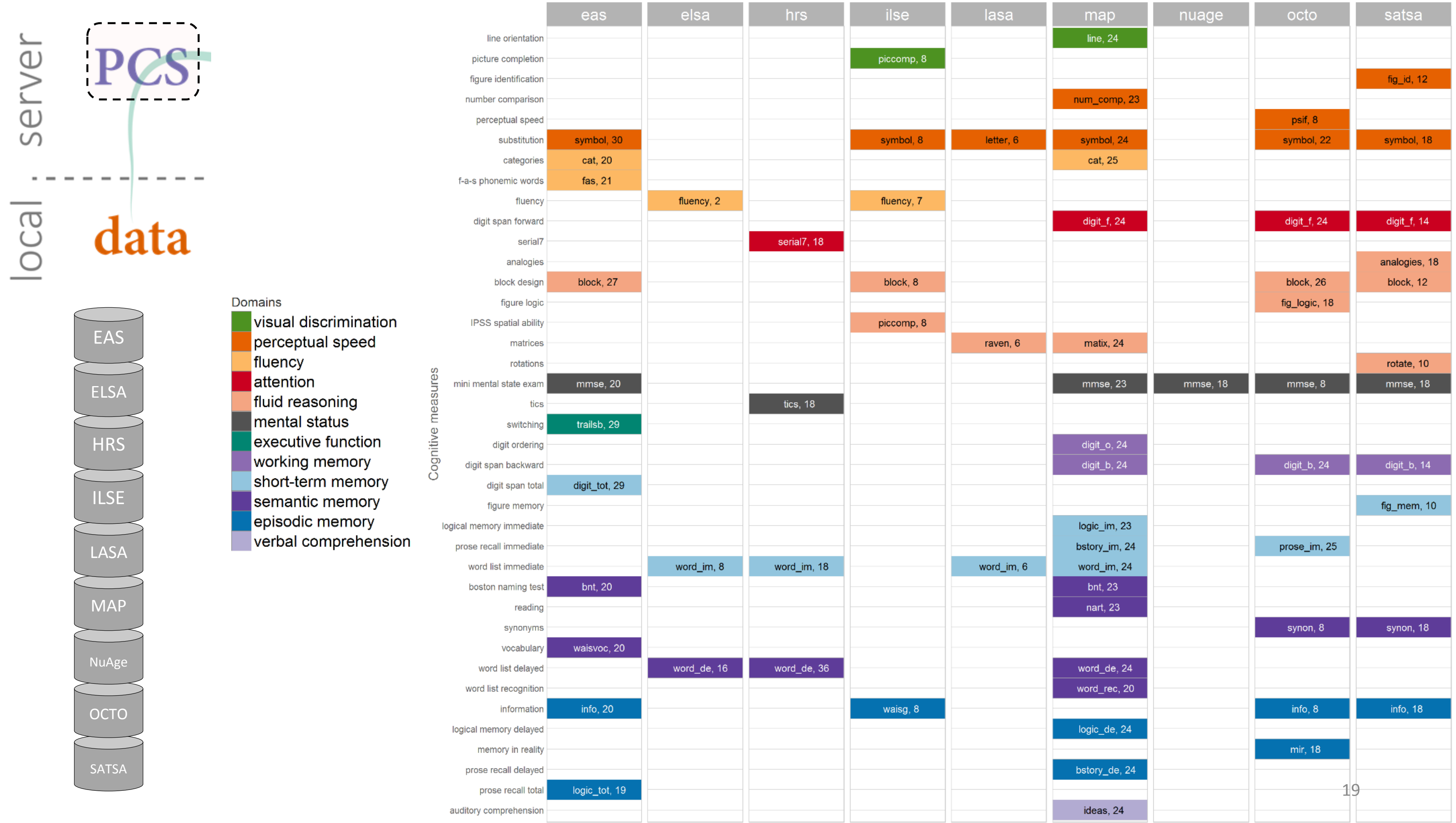
	id	year_bl	age_bl	year_born	male_bl	edu_bl	height_cm_bl	diabetes_bl	cardio_bl	smoke_bl	age_t1	age_t2	age_t3	age_t4	age_t5	age_t6	animals_t1	animals_t2	animals_t3	animals_t4	animals_t5	anima
1	103712	2002	55	1947	0	4	172.20	1	0	0	55	57	59	61	63	65	18	24	15	16	23	NA
2	103713	2002	71	1931	1	3	NA	0	0	0	71	73	75	NA	NA	NA	10	9	8	NA	NA	NA
3	103714	2002	51	1950	0	4	169.50	0	0	0	51	53	55	57	59	61	33	27	19	28	31	NA

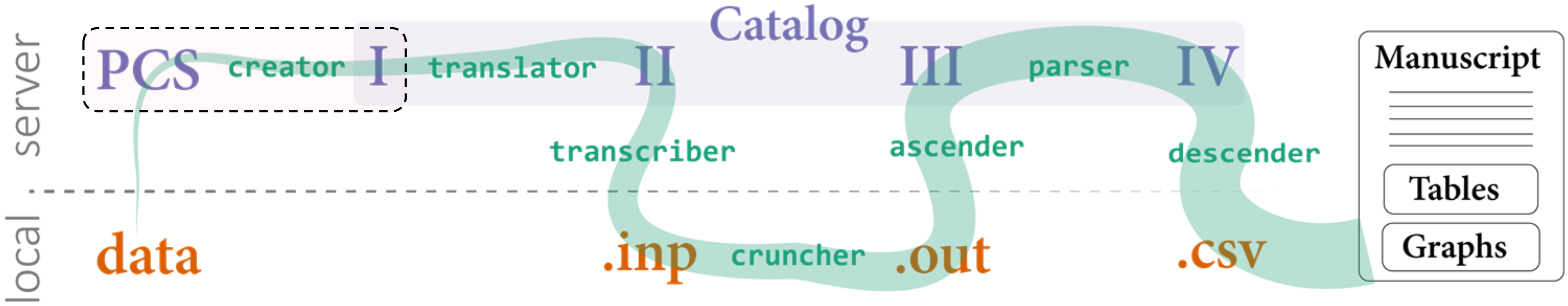




When all drivers fill in the Pre-Conference Survey
we can see which studies have similar
COGNITIVE MEASURES

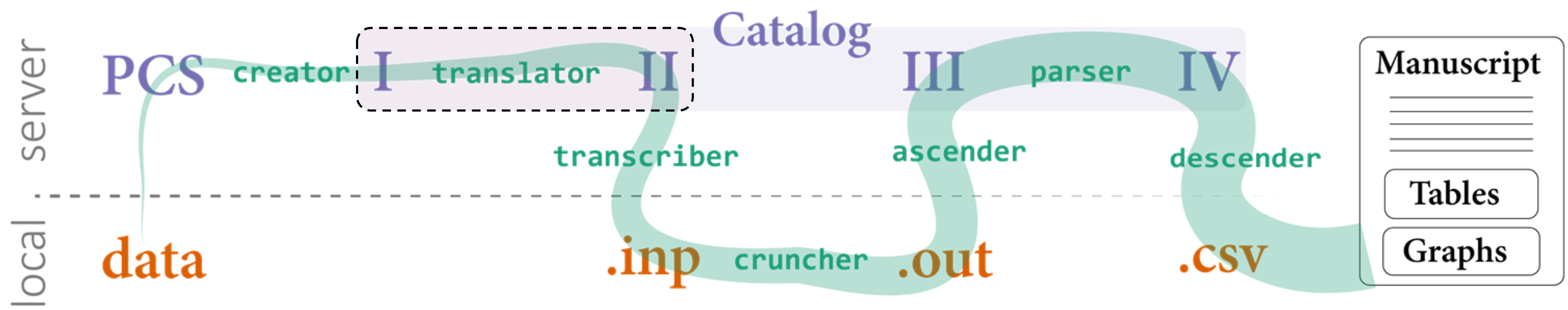



PCS
server
local
data
EAS
ELSA
HRS
ILSE
LASA
MAP
NuAge
OCTO
SATSA
Domains
visual discrimination
perceptual speed
fluency
attention
fluid reasoning
mental status
executive function
working memory
short-term memory
semantic memory
episodic memory
verbal comprehension
Cognitive measures
eas
elsa
hrs
ilse
lasa
map
nuage
octo
satsa
line orientation: line, 24 (map)
picture completion: piccomp, 8 (ilse)
figure identification: fig_id, 12 (satsa)
number comparison: num_comp, 23 (map)
perceptual speed: psif, 8 (octo)
substitution: symbol, 30 (eas); symbol, 8 (ilse); letter, 6 (lasa); symbol, 24 (map); symbol, 22 (octo); symbol, 18 (satsa)
categories: cat, 20 (eas); cat, 25 (map)
f-a-s phonemic words: fas, 21 (eas)
fluency: fluency, 2 (elsa); fluency, 7 (ilse)
digit span forward: digit_f, 24 (map); digit_f, 24 (octo); digit_f, 14 (satsa)
serial7: serial7, 18 (hrs)
analogies: analogies, 18 (satsa)
block design: block, 27 (eas); block, 8 (ilse); block, 26 (octo); block, 12 (satsa)
figure logic: fig_logic, 18 (octo)
IPSS spatial ability: piccomp, 8 (ilse)
matrices: raven, 6 (lasa); matix, 24 (map)
rotations: rotate, 10 (satsa)
mini mental state exam: mmse, 20 (eas); mmse, 23 (map); mmse, 18 (nuage); mmse, 8 (octo); mmse, 18 (satsa)
tics: tics, 18 (hrs)
switching: trailsb, 29 (eas)
digit ordering: digit_o, 24 (map)
digit span backward: digit_b, 24 (map); digit_b, 24 (octo); digit_b, 14 (satsa)
digit span total: digit_tot, 29 (eas)
figure memory: fig_mem, 10 (satsa)
logical memory immediate: logic_im, 23 (map)
prose recall immediate: bstory_im, 24 (map); prose_im, 25 (octo)
word list immediate: word_im, 8 (elsa); word_im, 18 (hrs); word_im, 6 (lasa); word_im, 24 (map)
boston naming test: bnt, 20 (eas); bnt, 23 (map)
reading: nart, 23 (map)
synonyms: synon, 8 (octo); synon, 18 (satsa)
vocabulary: waisvoc, 20 (eas)
word list delayed: word_de, 16 (elsa); word_de, 36 (hrs); word_de, 24 (map)
word list recognition: word_rec, 20 (map)
information: info, 20 (eas); waisg, 8 (ilse); info, 8 (octo); info, 18 (satsa)
logical memory delayed: logic_de, 24 (map)
memory in reality: mir, 18 (octo)
prose recall delayed: bstory_de, 24 (map)
prose recall total: logic_tot, 19 (eas)
auditory comprehension: ideas, 24 (map)



Script run on server.
After drivers enter responses into PCS,
the CREATOR populates/writes
PART I of the Catalog.

1	eas	gait	block	female	a
2	eas	gait	block	female	ae
3	eas	gait	block	female	aeh
4	eas	gait	block	female	aehplus
5	eas	gait	block	female	full
6	eas	gait	block	male	a
7	eas	gait	block	male	ae
8	eas	gait	block	male	aeh
9	eas	gait	block	male	aehplus
10	eas	gait	block	male	full
11	eas	gait	bnt	female	a
12	eas	gait	bnt	female	ae
13	eas	gait	bnt	female	aeh
14	eas	gait	bnt	female	aehplus
15	eas	gait	bnt	female	full



Script run on server.
Using dataset descriptions, the
TRANSLATOR encodes STATISTICAL MODELS
Into M*plus* estimation language

1	eas	gait	block	female	a
2	eas	gait	block	female	ae
3	eas	gait	block	female	aeh
4	eas	gait	block	female	aehplus
5	eas	gait	block	female	full
6	eas	gait	block	male	a
7	eas	gait	block	male	ae
8	eas	gait	block	male	aeh
9	eas	gait	block	male	aehplus
10	eas	gait	block	male	full
11	eas	gait	bnt	female	a
12	eas	gait	bnt	female	ae
13	eas	gait	bnt	female	aeh
14	eas	gait	bnt	female	aehplus
15	eas	gait	bnt	female	full

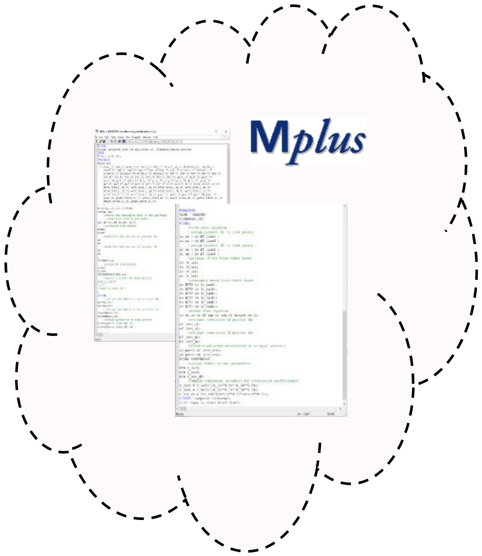
$$_{o=\text{Physical}}\beta_{0i} = {}_p\gamma_{00} + {}_p\Gamma_{0k}(CovSet) + {}_p u_{0i}$$

$$_{o=\text{Physical}}\beta_{1i} = {}_p\gamma_{10} + {}_p\Gamma_{1k}(CovSet) + {}_p u_{1i}$$

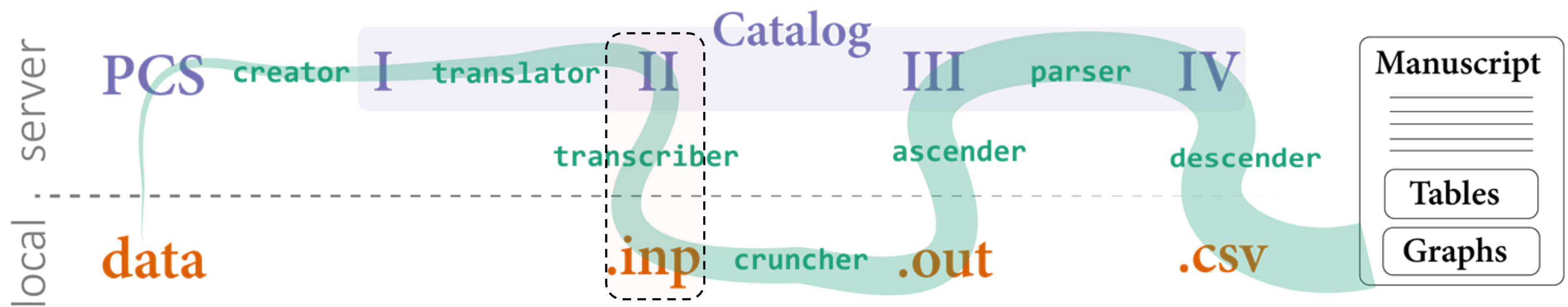
$$_o y_{ti} = {}_o\beta_{0i} + {}_o\beta_{1i}(Time_{ti}) + {}_o\varepsilon_{ti}$$

$$_{o=\text{Cognitive}}\beta_{1i} = {}_c\gamma_{10} + {}_c\Gamma_{1k}(CovSet) + {}_c u_{1i}$$

$$_{o=\text{Cognitive}}\beta_{0i} = {}_c\gamma_{00} + {}_c\Gamma_{0k}(CovSet) + {}_c u_{0i}$$



	Fixed Effects				Random Effects				Residuals	
Physical Intercept	$_p\gamma_{00}$	$_p\gamma_{01}$	$_p\gamma_{02}$ ⋯	$_p\gamma_{0k}$	$_{pp}\tau_{00}$	$_{pp}\tau_{01}$	$_{pc}\tau_{01}$	$_{pc}\tau_{00}$	$_p\sigma^2$	$_{pc}\sigma^2$
Physical Slope	$_p\gamma_{10}$	$_p\gamma_{11}$	$_p\gamma_{12}$ ⋯	$_p\gamma_{1k}$		$_{pp}\tau_{11}$	$_{pc}\tau_{11}$	$_{pc}\tau_{10}$		
Cognitive Slope	$_c\gamma_{10}$	$_c\gamma_{11}$	$_c\gamma_{12}$ ⋯	$_c\gamma_{1k}$			$_{cc}\tau_{11}$	$_{cc}\tau_{10}$		$_c\sigma^2$
Cognitive Intercept	$_c\gamma_{00}$	$_c\gamma_{01}$	$_c\gamma_{02}$ ⋯	$_c\gamma_{0k}$				$_{cc}\tau_{00}$		



Script run on driver's local machine.
TRANSCRIBER takes model syntax from Part II,
and saves it as an `.inp` file on the driver's local machine

ock	female	a
ock	female	ae
ock	female	aeh
ock	female	aehplus
ock	female	full
ock	male	a
ock	male	ae
ock	male	aeh
ock	male	aehplus
ock	male	full
t	female	a
t	female	ae
t	female	aeh
t	female	aehplus
t	female	full

$$ {}_{o=\text{Physical}}\beta_{0i} = {}_p\gamma_{00} + {}_p\Gamma_{0k}(CovSet) + {}_p u_{0i} $$

$$ {}_{o=\text{Physical}}\beta_{1i} = {}_p\gamma_{10} + {}_p\Gamma_{1k}(CovSet) + {}_p u_{1i} $$

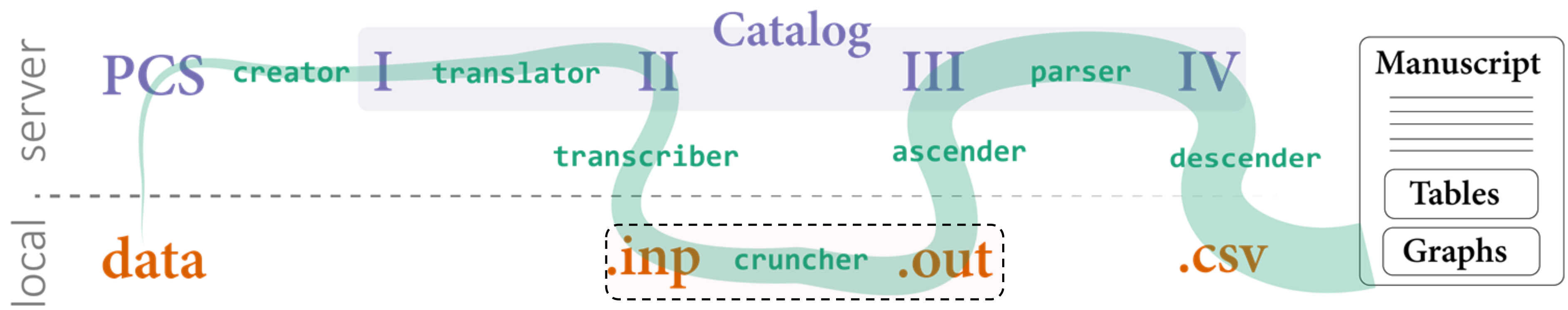
$$ {}_o y_{ti} = {}_o\beta_{0i} + {}_o\beta_{1i}(Time_{ti}) + {}_o\varepsilon_{ti} $$

$$ {}_{o=\text{Cognitive}}\beta_{1i} = {}_c\gamma_{10} + {}_c\Gamma_{1k}(CovSet) + {}_c u_{1i} $$

$$ {}_{o=\text{Cognitive}}\beta_{0i} = {}_c\gamma_{00} + {}_c\Gamma_{0k}(CovSet) + {}_c u_{0i} $$

	Fixed Effects			Random Effects				Residuals	
Physical Intercept	${}_p\gamma_{00}$	${}_p\gamma_{01}$	${}_p\gamma_{02} \cdots {}_p\gamma_{0k}$	${}_{pp}\tau_{00}$	${}_{pp}\tau_{01}$	${}_{pc}\tau_{01}$	${}_{pc}\tau_{00}$	${}_p\sigma^2$	${}_{pc}\sigma^2$
Physical Slope	${}_p\gamma_{10}$	${}_p\gamma_{11}$	${}_p\gamma_{12} \cdots {}_p\gamma_{1k}$		${}_{pp}\tau_{11}$	${}_{pc}\tau_{11}$	${}_{pc}\tau_{10}$		
Cognitive Slope	${}_c\gamma_{10}$	${}_c\gamma_{11}$	${}_c\gamma_{12} \cdots {}_c\gamma_{1k}$			${}_{cc}\tau_{11}$	${}_{cc}\tau_{10}$		${}_c\sigma^2$
Cognitive Intercept	${}_c\gamma_{00}$	${}_c\gamma_{01}$	${}_c\gamma_{02} \cdots {}_c\gamma_{0k}$				${}_{cc}\tau_{00}$		

Mplus



Script run on driver's local machine.

Calls a local installation of M*plus*,

which uses the local `.dat` and `.inp` files.

Returns an `.out` file containing the MODEL SOLUTION

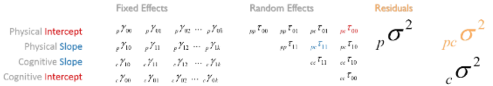
$$_{o=\text{Physical}}\beta_{0i} = {}_p\gamma_{00} + {}_p\Gamma_{0k}(CovSet) + {}_pu_{0i}$$

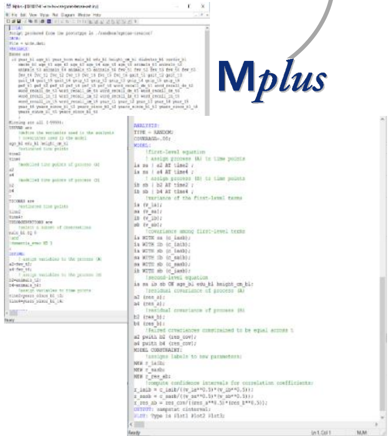
$$_{o=\text{Physical}}\beta_{1i} = {}_p\gamma_{10} + {}_p\Gamma_{1k}(CovSet) + {}_pu_{1i}$$

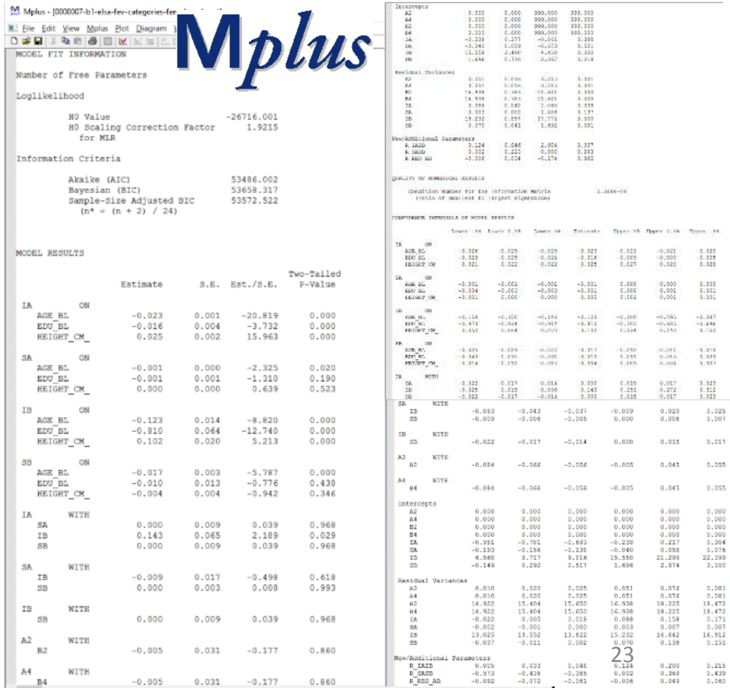
$$_oy_{ti} = {}_o\beta_{0i} + {}_o\beta_{1i}(Time_{ti}) + {}_o\varepsilon_{ti}$$

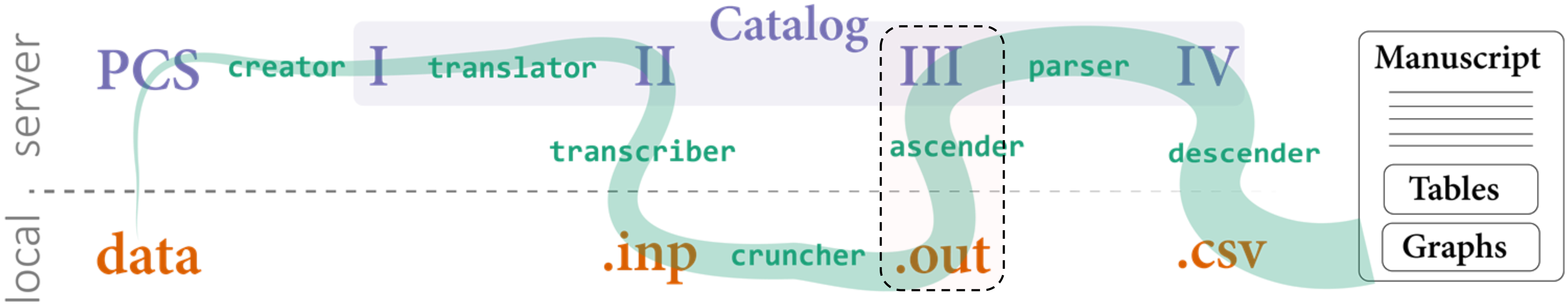
$$_{o=\text{Cognitive}}\beta_{1i} = {}_c\gamma_{10} + {}_c\Gamma_{1k}(CovSet) + {}_cu_{1i}$$

$$_{o=\text{Cognitive}}\beta_{0i} = {}_c\gamma_{00} + {}_c\Gamma_{0k}(CovSet) + {}_cu_{0i}$$

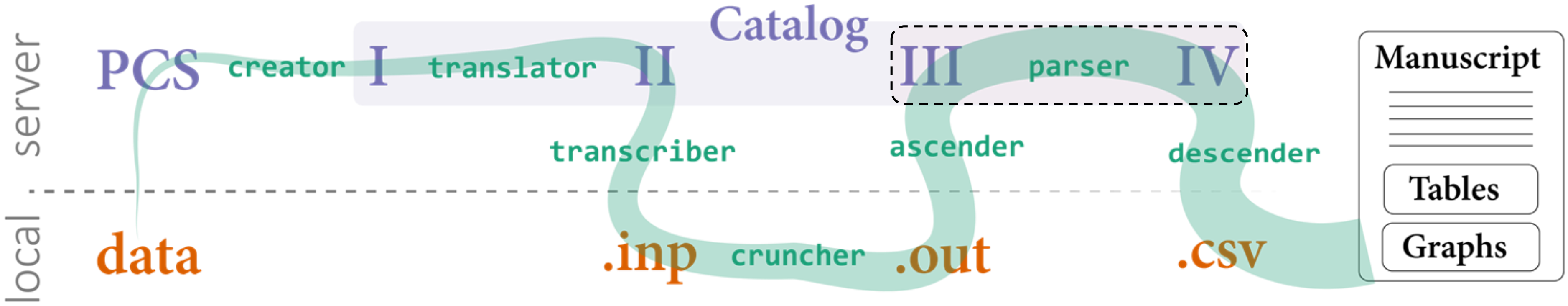








Script run on driver's local machine.
Uploads the contents of the `.out` files
to Part III of the Catalog.



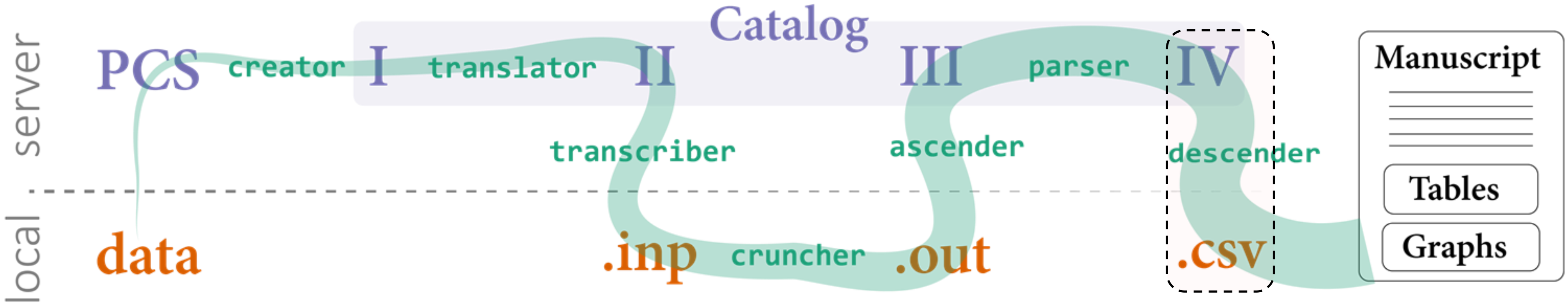
Script run on server.

PARSER extracts elements of model solution from the M*plus* output

(e.g. parameter estimates, fit indices, and the convergence status).

For each model, these values are saved as separate columns in a single row of Part IV.

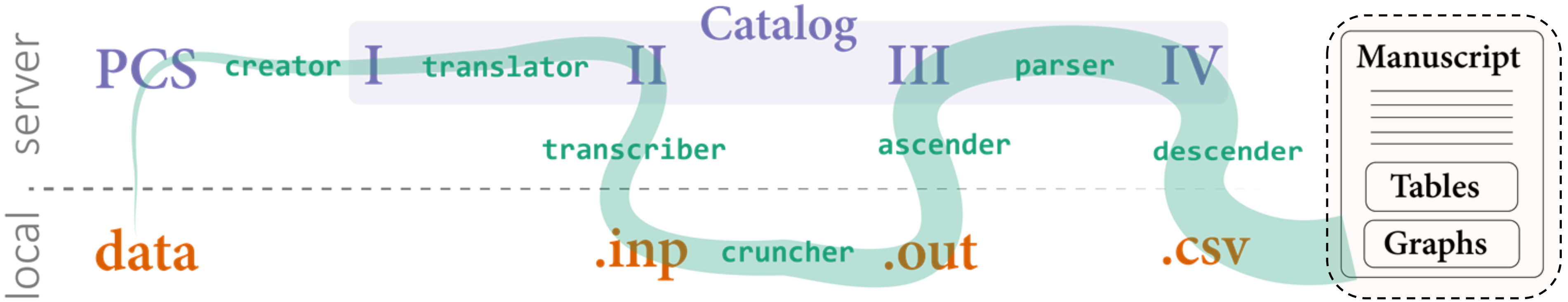
	A	B	C	D	E	F	H	I	J	Q	R	S	T	U	V	W	X	Y	Z	AA
1	study_name	model_number	subgroup	model_type	subject_count	wave_count	LL	aic	bic	ab_TAU_00_est	ab_TAU_00_se	ab_TAU_00_wald	ab_TAU_00_pval	ab_TAU_11_est	ab_TAU_11_se	ab_TAU_11_wald	ab_TAU_11_pval	ab_TAU_01_est	ab_TAU_01_se	ab_TAU_01_wa
2	eas	b1	female	ae	580	8	-12370.4	24790.79	24899.86	-214.803	119.207	-1.802	0.072	-1.426	2.859	-0.499	0.618	-22.556	18.624	-1.2
3	eas	b1	female	ae	593	8	-8766.76	17583.53	17693.16	24.846	13.797	1.801	0.072	0.642	0.347	1.848	0.065	3.495	2.177	1.6
4	eas	b1	female	ae	572	8	-8975.66	18001.32	18110.05	69.278	19.852	3.49	0	1.023	0.37	2.766	0.006	-1.254	2.055	-0.
5	eas	b1	female	ae	524	7	-7043.93	14137.86	14244.4	5.151	9.445	0.545	0.586	-0.282	0.357	-0.79	0.43	2.919	1.916	1.5
6	eas	b1	female	ae	594	8	-9357.93	18765.87	18875.54	55.35	19.105	2.897	0.004	0.815	0.456	1.786	0.074	0.303	2.457	0.1
7	eas	b1	female	ae	594	8	-6681.55	13413.11	13522.78	5.336	4.51	1.183	0.237	0.112	0.109	1.026	0.305	-0.201	0.628	-0.3
8	eas	b1	female	ae	595	8	-7094.86	14239.72	14349.44	17.044	5.765	2.956	0.003	0.322	0.185	1.742	0.081	-1.337	1.027	-1.3
9	eas	b1	female	ae	554	8	-8065.42	16180.84	16288.77	8.647	9.337	0.926	0.354	0.157	0.283	0.553	0.58	2.549	1.865	1.3
10	eas	b1	female	ae	383	8	-3871.71	7793.415	7892.116	10.378	5.741	1.808	0.071	-0.002	0.119	-0.017	0.987	0.215	0.657	0.3
11	eas	b1	female	ae	563	8	-8499.24	17048.48	17156.81	31.673	13.058	2.426	0.015	0.446	0.305	1.462	0.144	-2.218	1.767	-1.2
12	eas	b1	female	ae	592	8	-9307.2	18664.39	18773.98	69.62	20.65	3.371	0.001	1.426	0.639	2.231	0.026	0.118	3.455	0.0
13	eas	b1	female	aeh	150	8	-4939.77	9937.539	10024.85	-219.554	185.685	-1.182	0.237	-1.111	4.85	-0.229	0.819	-10.409	35.697	-0.2
14	eas	b1	female	aeh	150	8	-3582.45	7222.909	7310.217	16.88	20.942	0.806	0.42	0.837	0.945	0.886	0.376	5.52	4.478	1.2
15	eas	b1	female	aeh	150	8	-3709.14	7476.282	7563.591	81.433	32.4	2.513	0.012	0.817	0.561	1.456	0.145	-0.832	3.422	-0.2
16	eas	b1	female	aeh	130	7	-2632.36	5322.718	5405.877	15.274	13.399	1.14	0.254	-0.483	0.706	-0.684	0.494	4.214	3.568	1.1
17	eas	b1	female	aeh	150	8	-3714.27	7486.538	7573.847	60.856	26.394	2.306	0.021	1.19	0.811	1.467	0.142	-3.555	3.466	-1.0
18	eas	b1	female	aeh	150	8	-2825.3	5708.606	5795.914	9.225	7.158	1.289	0.197	0.286	0.231	1.237	0.216	-0.949	1.443	-0.6
19	eas	b1	female	aeh	150	8	-2910.72	5879.44	5966.749	14.142	7.545	1.874	0.061	0.362	0.232	1.56	0.119	-1.206	1.531	-0.7
20	eas	b1	female	aeh	150	8	-3450.76	6959.528	7046.837	10.8	13.947	0.774	0.439	0.247	0.583	0.423	0.672	1.455	3.278	[illegible]
21	eas	b1	female	aeh	72	8	-1316.58	2691.156	2757.179	2.34	3.898	0.6	0.548	0.012	0.179	0.068	0.946	0.26	0.828	0.3



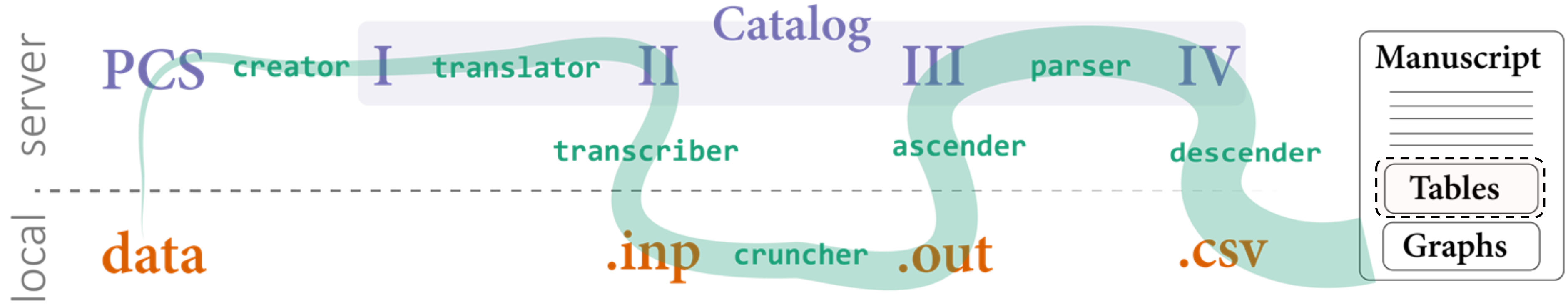
Script run on driver's local machine.

Copies the entire catalog as a `.csv` on the driver's local machine.

This disconnected CSV allows the drivers to pursue their own analyses after the workshop.



The catalog forms the dataset for META-ANALYSIS,
in which models are the new units.
MANUSCRIPTS reports and interprets the results of meta-analysis.



DYNAMIC tables store all extracted model estimates.
These are useful for EXPLORATION.
You can filter and sort to guide your search for patterns.

Dynamic Table

Show 10 entries

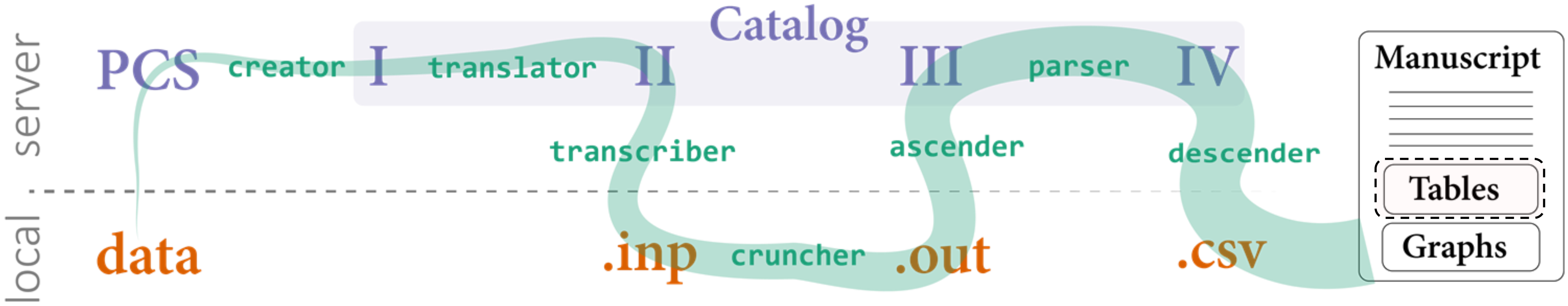
Search:

Random Effects Growth Curve Model Solution

	study name	process a	process b	subgroup	model type	n	r intercept	r slope	r residual
							All	All	All
1	eas	gait	block	female	a	563	0.25(0.08),p<.01	0.30(0.27),p=.26	-0.02(0.05),p=.72
2	eas	gait	block	female	ae	563	0.22(0.08),p=.01	0.46(0.31),p=.14	-0.02(0.05),p=.73
3	eas	gait	block	female	aeh	150	0.26(0.14),p=.06	0.03(0.63),p=.96	-0.06(0.08),p=.41
4	eas	gait	block	female	aehplus	150	0.17(0.16),p=.28	0.02(0.67),p=.98	-0.07(0.08),p=.36
5	eas	gait	block	female	full	150	0.14(0.17),p=.41	0.01(0.69),p=.99	-0.07(0.08),p=.38
6	eas	gait	block	male	a	350	0.40(0.11),p<.01	0.39(0.70),p=.58	-0.05(0.07),p=.50
7	eas	gait	block	male	ae	350	0.40(0.12),p<.01	0.40(0.78),p=.61	-0.05(0.07),p=.50
8	eas	gait	block	male	aeh	72	0.28(0.30),p=.34	0.22(3.38),p=.95	0.01(0.13),p=.91
9	eas	gait	block	male	aehplus	72	0.29(0.37),p=.43	0.15(7.19),p=.98	0.01(0.15),p=.95
10	eas	gait	block	male	full	72	0.25(0.43),p=.56	0.17(4.41),p=.97	0.00(0.16),p=.98

Showing 1 to 10 of 987 entries

Previous 1 2 3 4 5 … 99 Next



STATIC tables print targeted results.
These are useful to have for
DEMONSTRATION and MANUSCRIPT CONSTRUCTION.

Dynamic Table

Show 10 entries

Search:

Random Effects Growth Curve Model Solution

	study name	process a	process b	subgroup	model type	n	r intercept	r slope	r residual
							All	All	All
1	eas	gait	block	female	a	563	0.25(0.08),p<.01	0.30(0.27),p=.26	-0.02(0.05),p=.72
2	eas	gait	block	female	ae	563	0.22(0.08),p=.01	0.46(0.31),p=.14	-0.02(0.05),p=.73
3	eas	gait	block	female	aeh	150	0.26(0.14),p=.06	0.03(0.63),p=.96	-0.06(0.08),p=.41
4	eas	gait	block	female	aehplus	150	0.17(0.16),p=.28	0.02(0.67),p=.98	-0.07(0.08),p=.36
5	eas	gait	block	female	full	150	0.14(0.17),p=.41	0.01(0.69),p=.99	-0.07(0.08),p=.38
6	eas	gait	block	male	a	350	0.40(0.11),p<.01	0.39(0.70),p=.58	-0.05(0.07),p=.50
7	eas	gait	block	male	ae	350	0.40(0.12),p<.01	0.40(0.78),p=.61	-0.05(0.07),p=.50
8	eas	gait	block	male	aeh	72	0.28(0.30),p=.34	0.22(3.38),p=.95	0.01(0.13),p=.91
9	eas	gait	block	male	aehplus	72	0.29(0.37),p=.43	0.15(7.19),p=.98	0.01(0.15),p=.95
10	eas	gait	block	male	full	72	0.25(0.43),p=.56	0.17(4.41),p=.97	0.00(0.16),p=.98

Showing 1 to 10 of 987 entries

Previous 1 2 3 4 5 … 99 Next

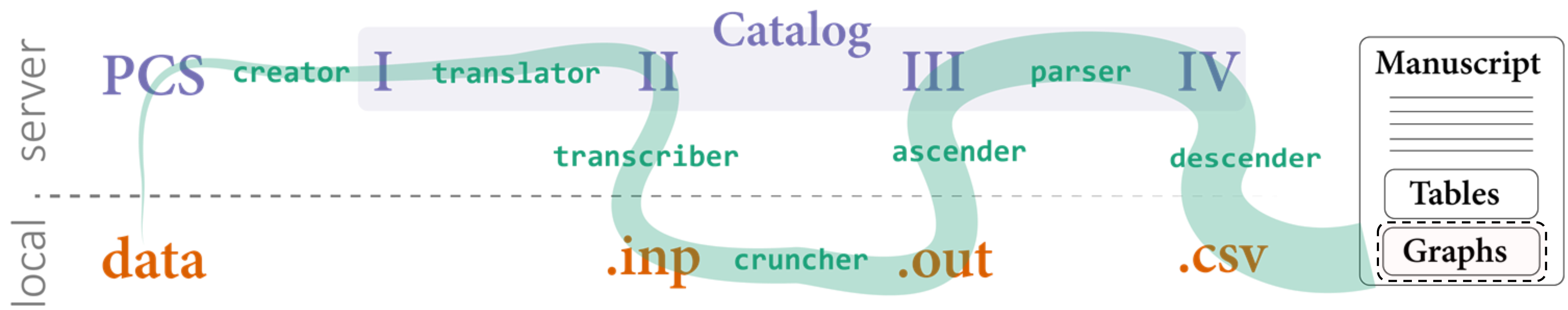
Static Tables

The 'aehplus' model (with covariates *a*ge, *e*ducation, *h*ealth, and others) is shown for each combination of

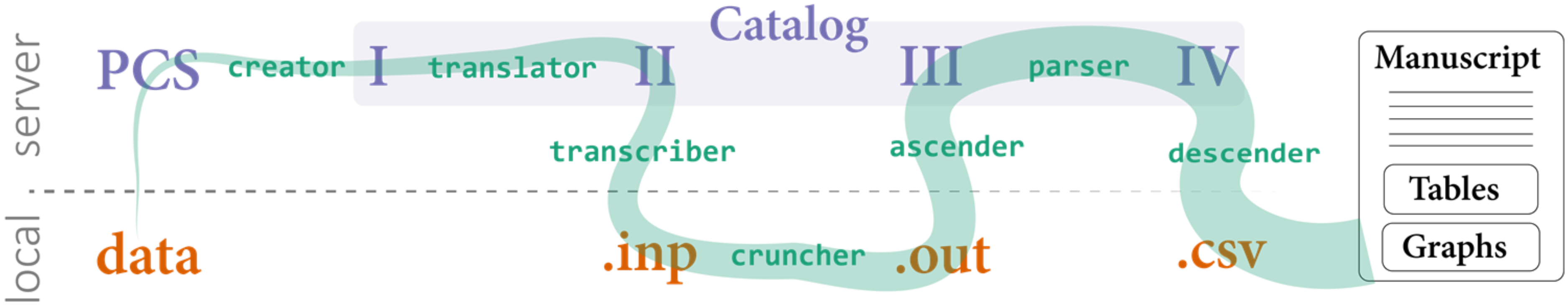
- study,
- process, and
- gender.

eas

Processes	Gender	n	$r_{intercepts}$	r_{slopes}	$r_{residuals}$
gait vs block	female	150	0.17(0.16),p=.28	0.02(0.67),p=.98	-0.07(0.08),p=.36
gait vs block	male	72	0.29(0.37),p=.43	0.15(7.19),p=.98	0.01(0.15),p=.95
gait vs bnt	female	150	0.09(0.18),p=.63	0.67(0.49),p=.18	-0.01(0.12),p=.97
gait vs bnt	male	72	0.17(0.38),p=.64	0.27(2.80),p=.92	-0.02(0.20),p=.91
gait vs categories	female	150	0.01(0.13),p=.93	0.38(0.44),p=.39	0.05(0.11),p=.67
gait vs categories	male	72	0.24(0.38),p=.52	0.92(1.14),p=.42	-0.02(0.17),p=.90
gait vs digit_tot	female	150	0.18(0.17),p=.29	0.65(0.40),p=.10	0.07(0.08),p=.40
gait vs digit_tot	male	72	0.06(0.37),p=.87	0.71(1.50),p=.63	-0.01(0.18),p=.96
gait vs fas	female	150	0.26(0.14),p=.06	0.49(0.61),p=.42	-0.07(0.08),p=.40
gait vs fas	male	72	-0.05(0.29),p=.86	0.68(2.69),p=.80	-0.02(0.22),p=.93
gait vs information	female	130	0.12(0.22),p=.58	-0.54(1.41),p=.70	-0.02(0.11),p=.87
gait vs information	male	70	0.44(0.44),p=.32	-0.21(8.37),p=.98	0.02(0.19),p=.91
gait vs logic_tot	female	150	0.08(0.15),p=.60	0.31(0.76),p=.69	0.02(0.10),p=.83
gait vs logic_tot	male	72	0.17(0.36),p=.62	0.62(2.40),p=.80	-0.03(0.19),p=.90
gait vs mmms	female	72	0.27(0.63),p=.67	0.14(3.05),p=.96	0.03(0.17),p=.85
gait vs mmms	male	72	0.27(0.63),p=.67	0.14(3.05),p=.96	0.03(0.17),p=.85
gait vs symbol	female	150	0.18(0.15),p=.24	0.79(0.61),p=.19	-0.08(0.10),p=.44
gait vs symbol	male	72	0.01(0.29),p=.97	0.82(1.15),p=.47	-0.05(0.22),p=.83



FOREST plots display the values from the tables
To optimize for useful comparisons.



Big Data, Big Analysis:

A Collaborative Modeling Framework for Multi-study Replication

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University of Victoria

Special thanks to the drivers of the Portland 2015 workshop

Study		Driver
Einstein Aging Study	EAS	Andrea Zammit
English Longitudinal Study of Aging	ELSA	Annie Robitaille
Health and Retirement Study	HRS	Chenkai Wu
Interdisciplinary Longitudinal Study of Aging	ILSE	Philipp Handschuh
Normative Aging Study	NAS	Lewina Lee
Quebec Longitudinal Study on Nutrition and Aging	NuAge	Valerie Jarry
Octogenarian Twins	OCTO	Marcus Praetorius
Rush Memory and Aging Project	MAP	Cassandra Brown
Swedish Adoption Twin Study of Aging	SATSA	Deborah Finkel