The gender differences of cognitive household labour and mental load in the digital space

Using web tracking data to estimate cognitive household labour tasks

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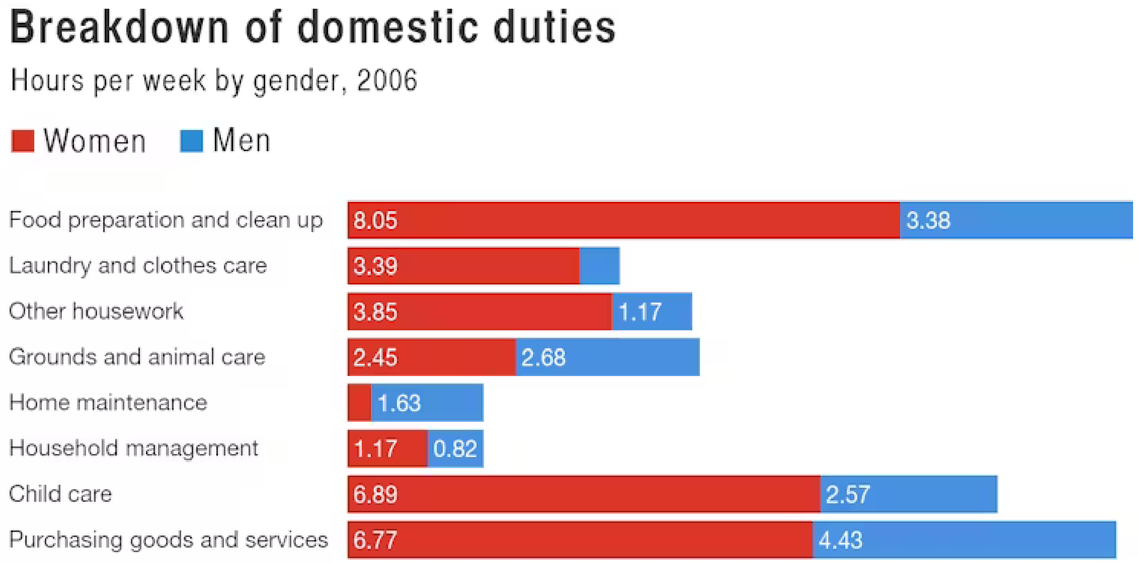
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The Sociological Problem
The Measurement Challenge
The Solution (?)

The Sociological Problem

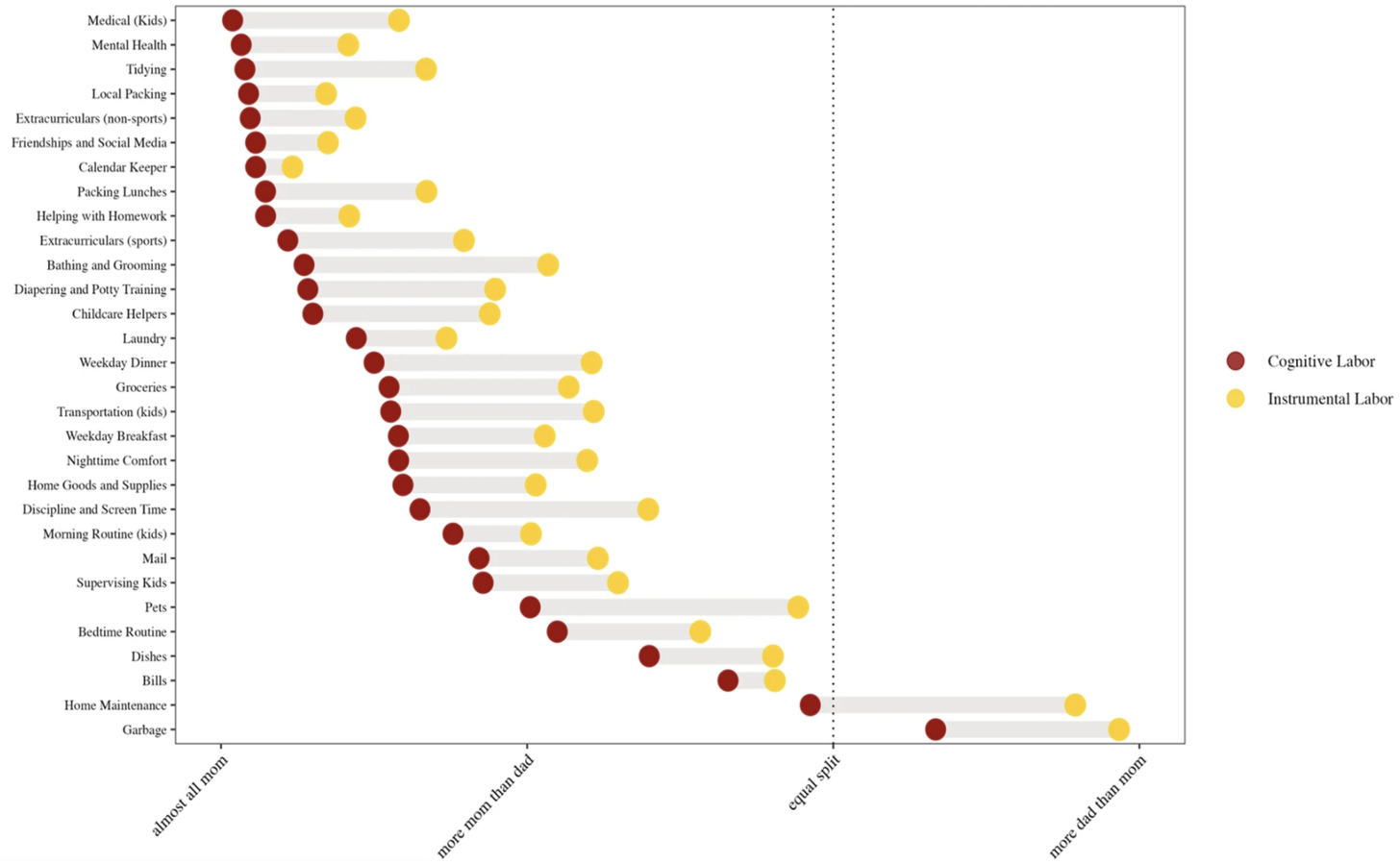
Household labor is gendered



Source: ABS Time Use Survey 2006. Note: the latest available trend data is from 2006.

There is an invisible component of household labor

“Cognitive labor as a four-part phenomenon that consists of anticipating needs, identifying options for filling them, deciding among these options, and monitoring the results“ (Daminger, 2019: 628)



Aviv et al. (2025), US data from 2023

Gendered differences in cognitive household labor are easily overlooked

“Cognitive labor is rarely talked about, acknowledged, or outsourced, making it an ever-present burden that falls mostly on women“ (Haupt & Gelbgiser, 2024: 829)

The Measurement Challenge

Cognitive household labor is inherently difficult to measure

Not episodic
Not salient
Hard to recall

ranging from 1 = *never* to 7 = *always*, based on the past month.

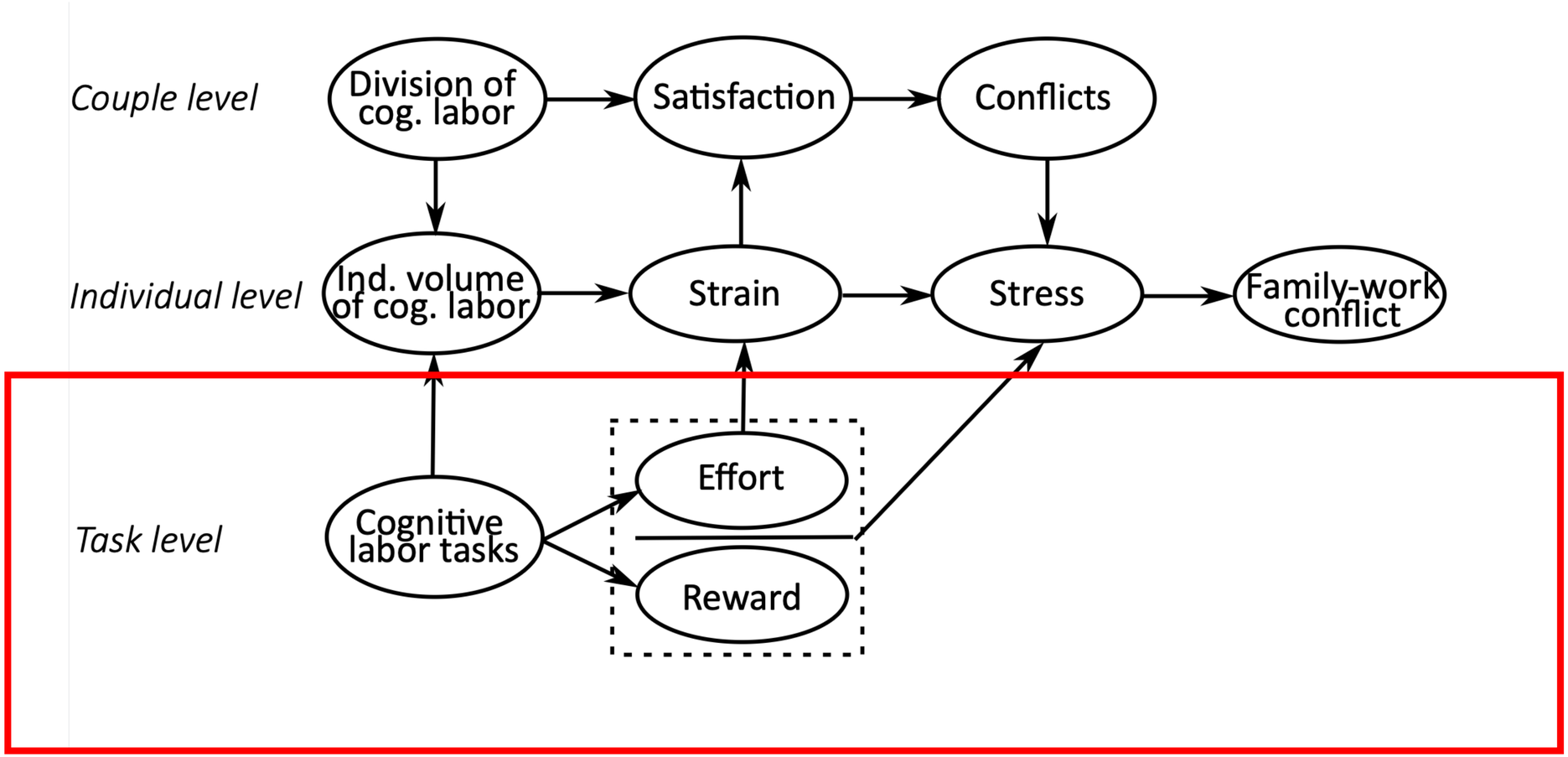
E8: Feel apprehensive about your family's needs, goals, activities, responsibilities, and/or well-being
E5: Feel troubled by your family's needs, goals, activities, responsibilities, and/or well-being
E7: Feel distressed about your family's needs, goals, activities, responsibilities, and/or well-being
C1: Process information related to your family's needs, goals, activities, responsibilities, and/or well-being
C8: Keep in mind your family's needs, goals, activities, responsibilities and/or well-being
C4: Think about your family's needs, goals, activities, responsibilities, and/or well-being
M10: Coordinate your family's needs, goals, activities, responsibilities, and/or well-being
M8: Make arrangements for what needs to get done for your family's needs, goals, activities, responsibilities, and/or well-being
M4: Make plans for your family's needs, goals, activities, responsibilities, and/or well-being

Source: Wayne et al., 2023

The Solution:

Digital trace data (in an increasingly digitalized world…)

Cognitive household labor and its gendered differences in web tracking data



Cognitive household labor and its gendered differences in web tracking data

- GESIS Panel.dbd Digital Behavioral Data Sample
- N≈700
- Cross-sectional survey - July 2025 using cognitive household labor measures from Haupt & Gelbgiser, 2024
- Webtracking data (browser plugin installed on PCs) - June to October 2025; incl. html code of websites visited

	id	panelist_	url	used_at	active_secor	web_visits_
227	2654921	4636749	facebook.com	2017-09-10 15:01:54	4	27532040
228	2654921	4636749	myonlinepanel.de	2017-09-10 15:01:57	2	27532042
229	2654921	4636749	google.de/search?q=meine+fritzbox&rlz=1C1CHBF_deDE735DE736&oc	2017-09-10 15:02:03	6	27532044
230	2654921	4636749	avm.de/service/fritzbox/fritzbox-7390/wissensdatenbank/publication/sh	2017-09-10 15:02:09	8	27532046
231	2654921	4636749	fritz.box	2017-09-10 15:02:17	14	27532048
232	2654921	4636749	fritz.box#	2017-09-10 15:02:31	1310	27532048
455	2657744	4771461	netflix.com/watch/70134037?trackId=14272744	2017-09-10 15:03:34	128	27563102
425	2661015	4914973	amazon.de/gp/product/B01LXPJOLY/ref=dv_web_wtls_list_ovl_wn0_wr	2017-09-10 15:03:40	16	27600170
90	2655464	4673793	bild.de/news/ausland/hurrikan-irma/die-zitterpartie-um-hurrikan-irma-5	2017-09-10 15:05:28	73	27537726
456	2657744	4771461	netflix.com/watch/70134037?trackId=14272744	2017-09-10 15:05:44	52	27563102
91	2655464	4673793	facebook.com	2017-09-10 15:06:41	44	27537708
457	2657744	4771461	netflix.com/watch/70134037?trackId=14272744	2017-09-10 15:06:52	232	27563102

Analysis Plan

- **Step I:** Establish a typology of websites that includes relevant categories, based on Weeks & Ruppanner (2025)
- **Step II:** Use URLs and domains
- **Step III:** Classifiy websites into categories from *Step I* using LLMs
    - Manual validation
- **Step IV:** Estimate cognitive household level characteristics on the task level
    - Time of tasks perfomed
    - Task multitasking
    - Task diversity
- **Step V:** Triangulate digital measures with survey measures

Step I: The classification

Cognitive household labor:

1. Food Planning & Grocery Management
2. Childcare Coordination
3. Scheduling & Appointment Management
4. Social & Enrichment Coordination
5. Household Monitoring & Cleaning Logistics
6. Home Maintenance & Repairs
7. Financial Household Management

General:

8. Search & Navigation
9. News & Political Information
10. Work & Professional Activities
11. Education & Academic Learning
12. Leisure: Media & Entertainment
13. Leisure: Shopping & Consumer Goods
14. Leisure: Social Media & Communication
15. Leisure: Health, Wellbeing & Lifestyle

Steps II & III: What we tried so far…

- 141 urls hand-classified (twice)
- Multiple prompts prepared
- Different models tested with prompt against hand-coded classification(s)

model	n	accuracy	cohens_kappa	macro_f1	weighted_f1	valid_share	avg_duration_s
qwen3:8b	141	0.496	0.444	0.366	0.534	1.000	21.61
llama3.3	141	0.468	0.418	0.377	0.490	1.000	2.96
qwen2.5:7b-instruct	141	0.348	0.287	0.272	0.369	1.000	0.49
llama3.2	141	0.333	0.260	0.227	0.325	0.879	0.46
olmo2:13b	141	0.177	0.134	0.126	0.116	0.965	0.57

Interpretation (Landis & Koch): Top models are in the moderate range. Substituting for human coding would require $\kappa > 0.6$.

LLM-Duration

- All URLs in:
  - Llama 3.3 25 days
  - Qwen2.5 4 days
  - Qwen3 172 days

- Unique URLs: 711,264

What we have also done

- Reiterate the golden sample
- Iteratively improve the prompt
- Test different models

What we are going to do next

- External validation and substantive results
  - Comparing the measures derived from the websites to those from the survey
  - Looking at patterns – parents vs. no children; men vs. women

Thank you

References

- AAGAARD, Line Kryger. When smart technologies enter household practices: The gendered implications of digital housekeeping. Housing, Theory and Society, 2023, 40. Jg., Nr. 1, S. 60-77.
- ACHT, Martin; REBAUDO, Mara. A gender gap in gender gaps: social norms and housework reporting. Empirical Economics, 2025, S. 1-53.
- ANDELSMAN ALVAREZ, Victoria. “I am in charge of the whole family operation”: gendered norms and negotiations in digital parenting in Denmark. Feminist Media Studies, 2025, S. 1-20.
- AVIV, Elizabeth, et al. Cognitive household labor: gender disparities and consequences for maternal mental health and wellbeing. Archives of Women's Mental Health, 2025, 28. Jg., Nr. 1, S. 5-14.
- BIANCHI, Suzanne M., et al. Housework: Who did, does or will do it, and how much does it matter?. Social forces, 2012, 91. Jg., Nr. 1, S. 55-63.
- DAMINGER, Allison. The cognitive dimension of household labor. American sociological review, 2019, 84. Jg., Nr. 4, S. 609-633.
- DEAN, Liz; CHURCHILL, Brendan; RUPPANNER, Leah. The mental load: Building a deeper theoretical understanding of how cognitive and emotional labor over load women and mothers. Community, work & family, 2022, 25. Jg., Nr. 1, S. 13-29.
- GARIMELLA, Kiran; CHAUCHARD, Simon. WhatsApp explorer: A data donation tool to facilitate research on WhatsApp. Mobile Media & Communication, 2025, 13. Jg., Nr. 3, S. 481-503.
- HAKOBYAN, Olya, et al. Development and evaluation of Dona, a privacy-preserving donation platform for messaging data from WhatsApp, Facebook, and Instagram. Behavior Research Methods, 2025, 57. Jg., Nr. 3, S. 1-17.

References

- HAUPT, Andreas; GELBGISER, Dafna. The gendered division of cognitive household labor, mental load, and family–work conflict in European countries. European Societies, 2024, 26. Jg., Nr. 3, S. 828-854.
- HINDS, Joanne; JOINSON, Adam N. What demographic attributes do our digital footprints reveal? A systematic review. PloS one, 2018, 13. Jg., Nr. 11, S. e0207112.
- HOWISON, James; WIGGINS, Andrea; CROWSTON, Kevin. Validity issues in the use of social network analysis with digital trace data. Journal of the Association for Information Systems, 2011, 12. Jg., Nr. 12, S. 2.
- PANKOWSKA, Paulina, et al. Using hidden Markov models to assess and correct for measurement error in digital trace data. Communication Methods and Measures, 2025, S. 1-25.
- STIER, Sebastian, et al. Integrating survey data and digital trace data: Key issues in developing an emerging field. Social Science Computer Review, 2020, 38. Jg., Nr. 5, S. 503-516.
- QIAN, Yue; HU, Yang. The digitalization of family life: A multilevel conceptual framework. Journal of Marriage and Family, 2024, 86. Jg., Nr. 5, S. 1160-1183.
- WAYNE, Julie Holliday, et al. Who’s remembering to buy the eggs? The meaning, measurement, and implications of invisible family load. Journal of Business and Psychology, 2023, 38. Jg., Nr. 6, S. 1159-1184.
- WEEKS, Ana Catalano; RUPPANNER, Leah: A typology of US parents' mental loads: Core and episodic cognitive labor. Journal of Marriage and Family, 2025, 87. Jg., Nr. 3, S. 966-989.