



Visual Exploration of Time Use Data to Support Environmental Assessment of Lifestyles

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41st International Association for Time Use Research Conference

Washington, D.C., 12 July 2019

Agenda

1

Tool for visual exploration of time-use data (VETUS)

2

Impact of information and communication technology (ICT)
on time use and the environment

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Visual exploration of time-use data

- As humans are good at visual perception [1], visualization of time-use data can help researchers to explore time-use data in an intuitive way [2].
- Therefore, we want to create a tool to
 - visualize time-use data
 - make time-use data accessible to a broader audience
 - compare time-use patterns of individuals from different regions, time frames and with different demographic and socio-economic backgrounds

Multinational Time Use Study

The Multinational Time-use Study by the Centre for Time-use Research at University of Oxford describes the time (in minutes) individuals spend on distinct activities on a specific day [3]

Dataset

- Aggregate time-use data
- Number of countries: 23 countries (we focused on Europe later on)
- Survey years: 1960s to the 2010s

Variables in Multinational Time-Use Study

Activity data

- Time spent on 69 distinct activities, e.g.
 - sleep and naps
 - food preparation, cooking
 - out-of-home leisure
 - travel as part of work
 - leisure-time travel
 - watch TV
 - ...

Demographic and socio-economic data

- Sex
- Age
- Employment status
- Civil status
- Access to motorized vehicle
- Highest level of education
- Computer/Internet access
- Urban/rural living environment
- ...

Meta data

- Country the survey was conducted
- Year the survey was conducted
- Day of the week the diary was kept
- Low quality observations
- ...

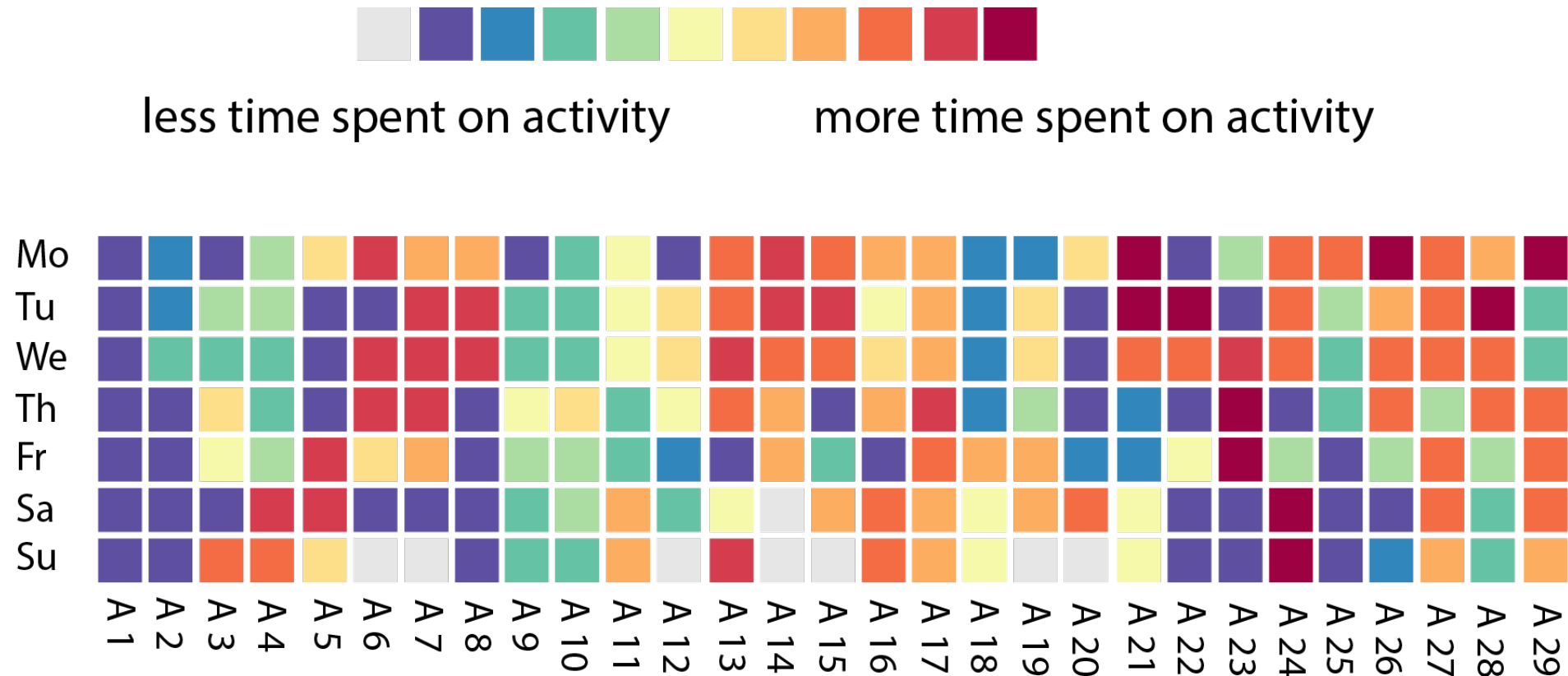
Visualization trade-offs

How to display so many variables to support visual exploration of time use data, considering [4]

- cognitive limitations of humans,
- limitations in display, and
- limitations in computing power?

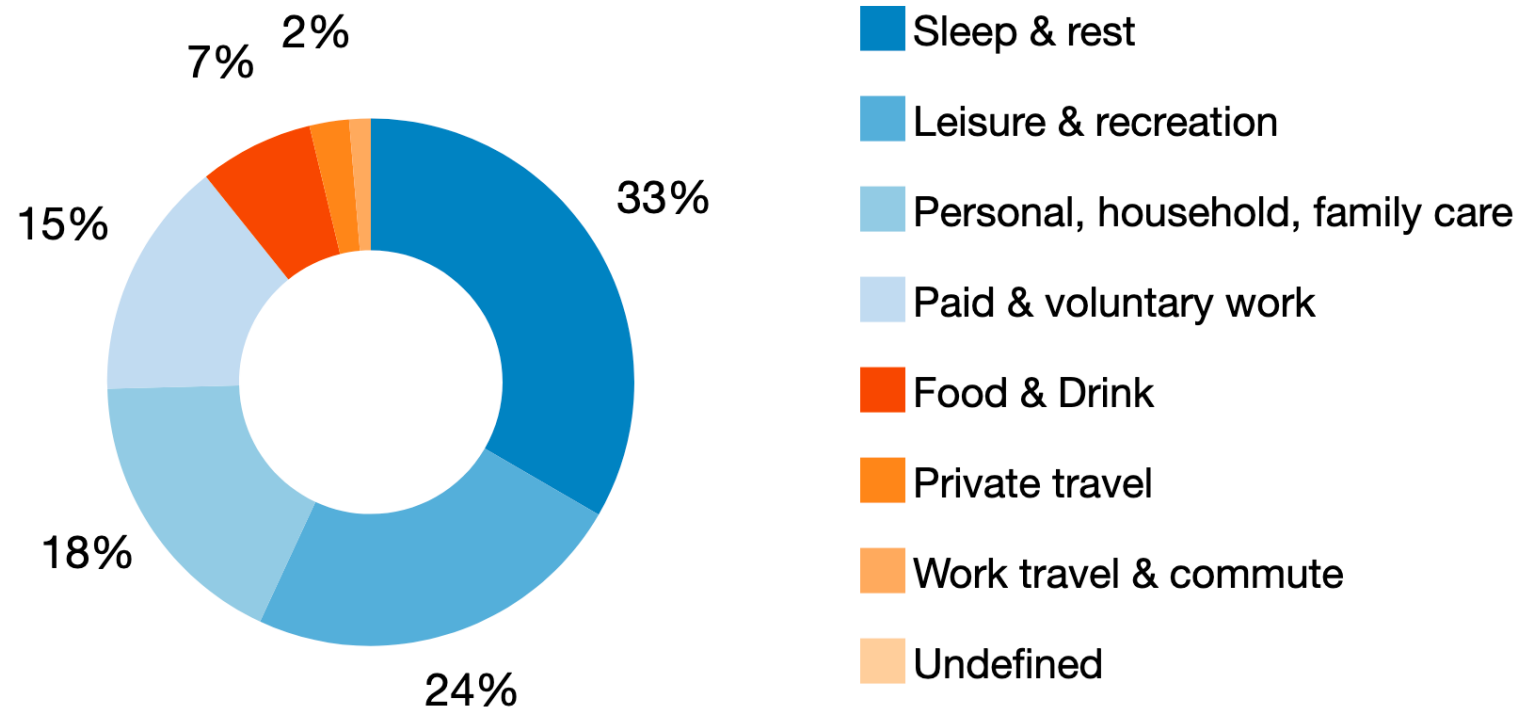
Visualization idioms:

Time spent on activities by day of the week



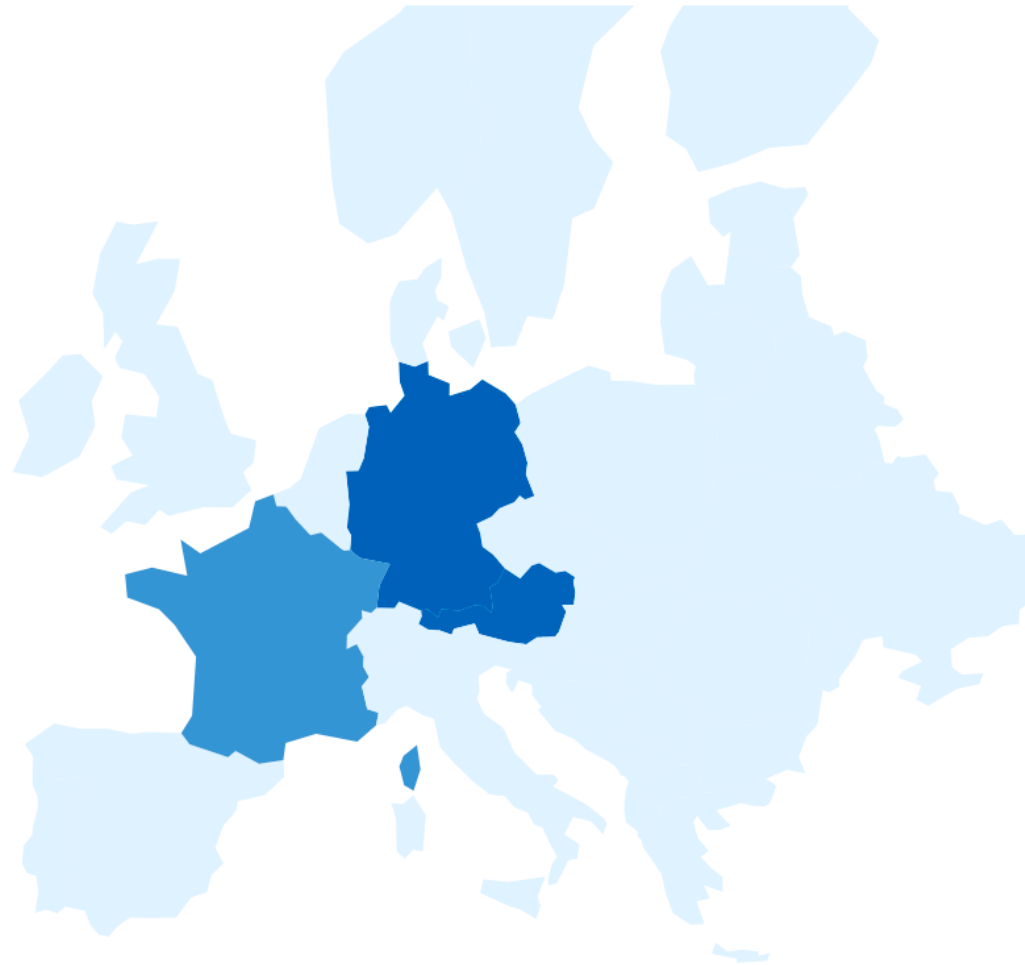
Visualization idioms:

Time spent on activity categories



Visualization idioms: Survey country

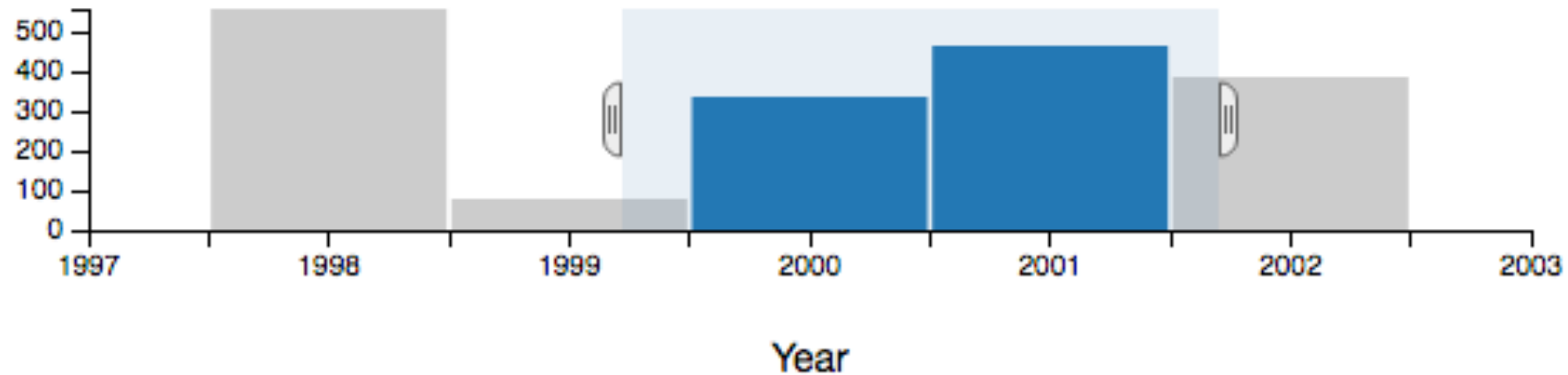
+ filter functionality



Visualization idioms:

Year the survey was conducted

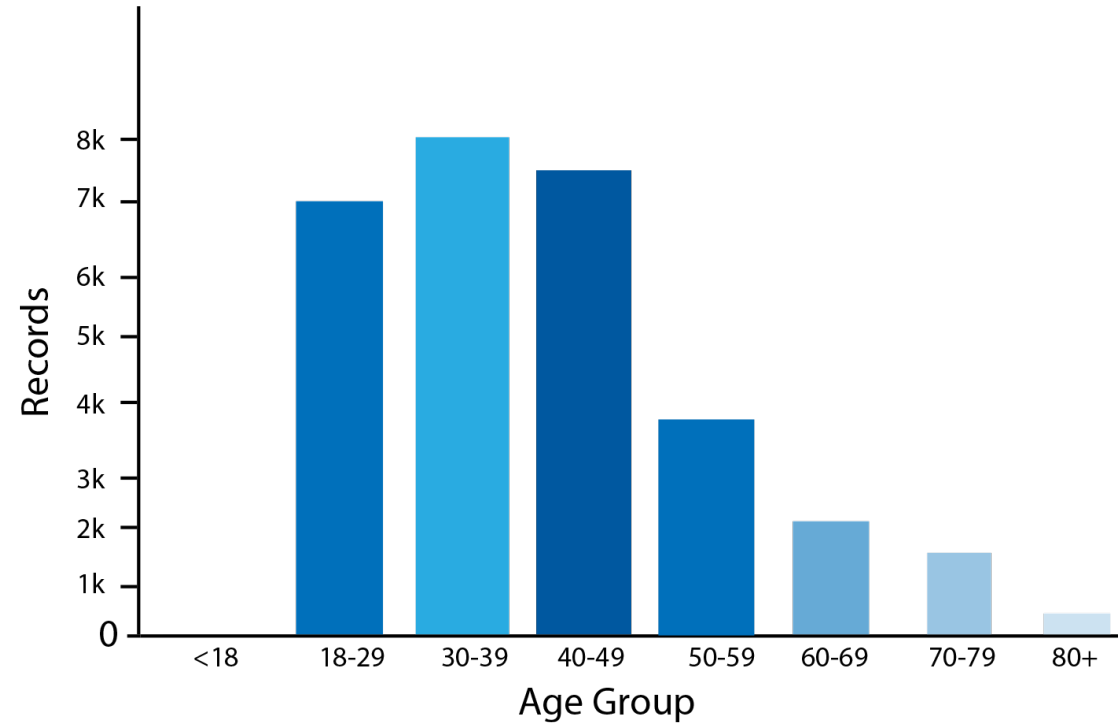
+ filter functionality



Visualization idioms:

Day of the week, age group, family status, working hours

+ filter functionality



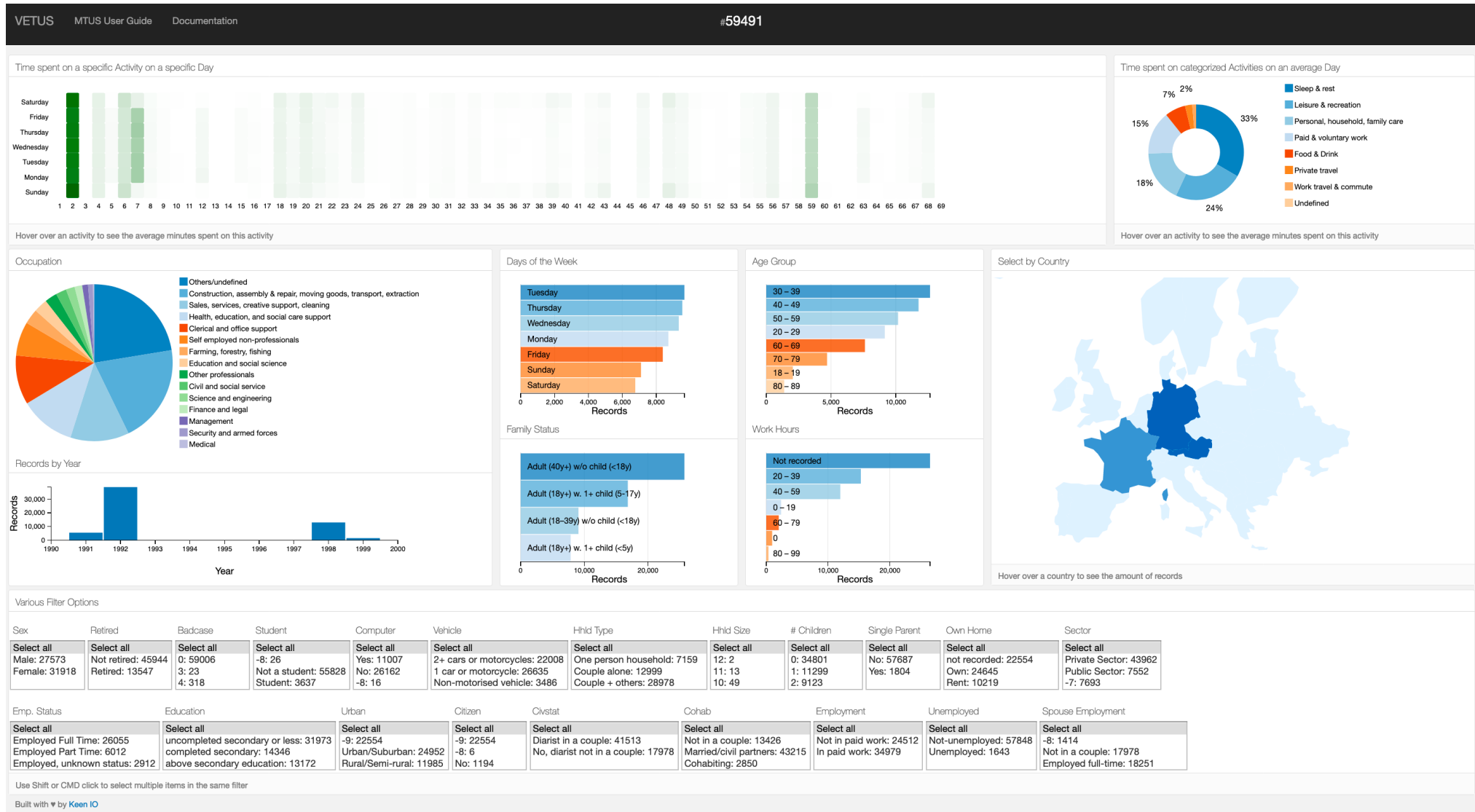
Visualization idioms:

Further demographic and socio-economic variables

+ filter functionality

Sex	Retired	Badcase	Student
Select all	Select all	Select all	Select all
Male: 947	Not retired: 1793	0: 1789	Not a student: 1777
Female: 864	Retired: 18	3: 21	Student: 34
		4: 1	

Visualization dashboard



Live Presentation

Link to web version of the tool: <https://files.ifi.uzh.ch/datavis/>
(tool contains a limited data set of roughly 60.000 observations)

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1

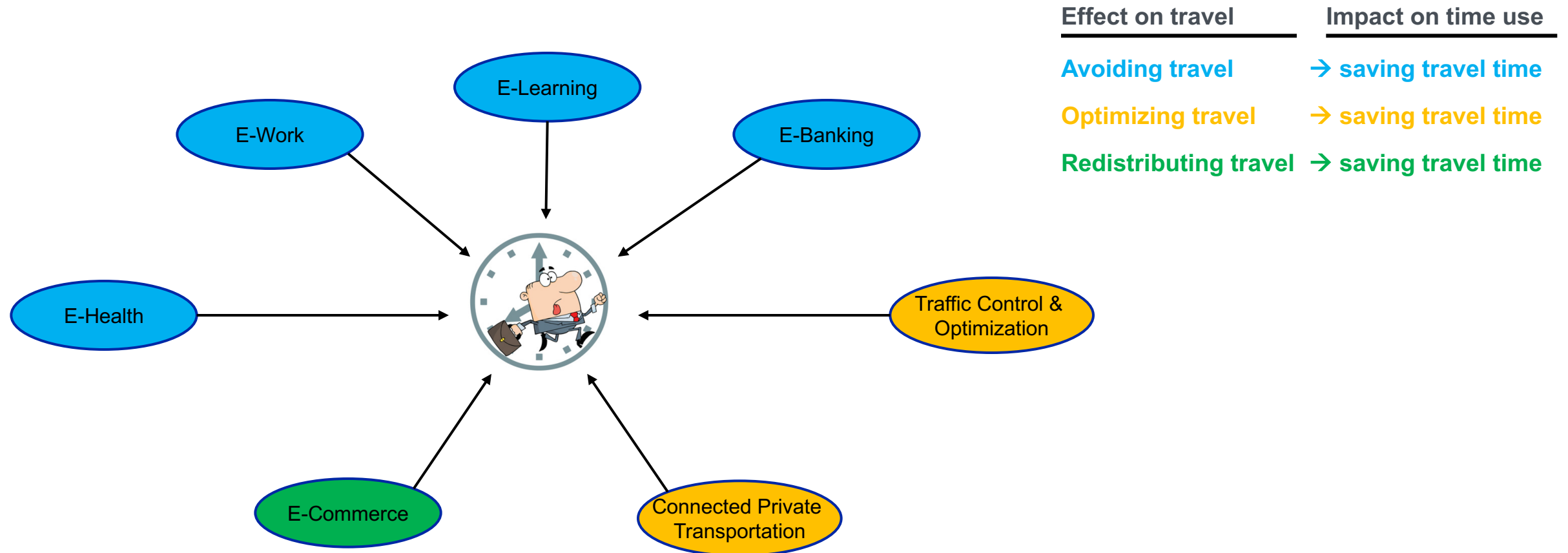
Tool for visual exploration of time-use data (VETUS)

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Impact of information and communication technology (ICT)
on time use and the environment

ICT use changes time allocation of individuals.

Example: Travel

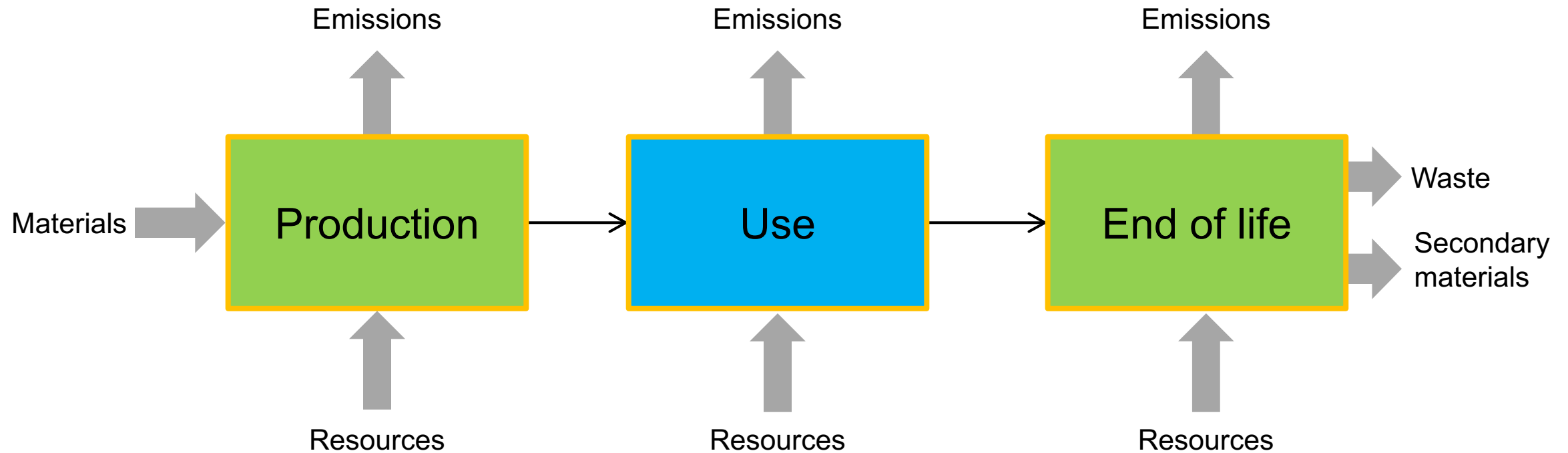


Activities require resources and cause emissions to the environment.

Example sources of environmental impacts of activities

Activity	Direct	Embedded
Watching TV	Electricity consumption of TV	Production of TV
Vacuum cleaning	Electricity consumption of vacuum cleaner	Production of vacuum cleaner
Food preparation/eating	Electricity consumption of cooking/lighting	Production of food
Travel	Fuel consumption of vehicle	Production of vehicle and infrastructure

Environmental impacts throughout the life cycle of a product/service system



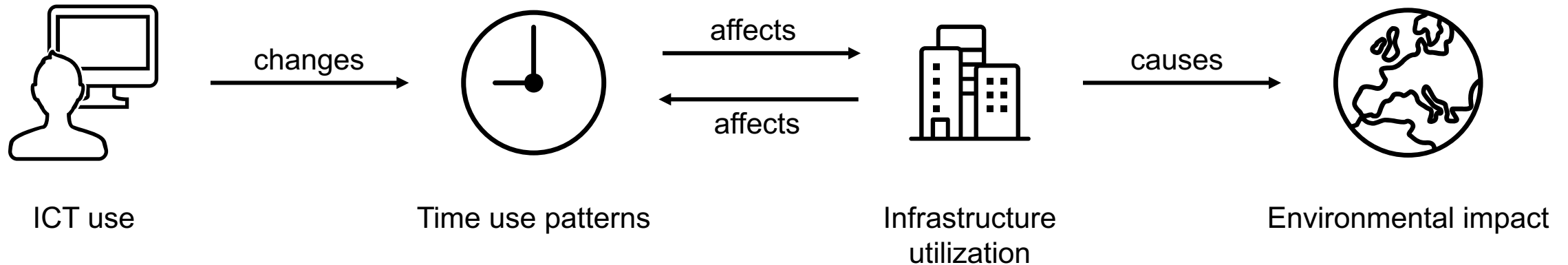
Embedded

No immediate impact of change in time use

Direct

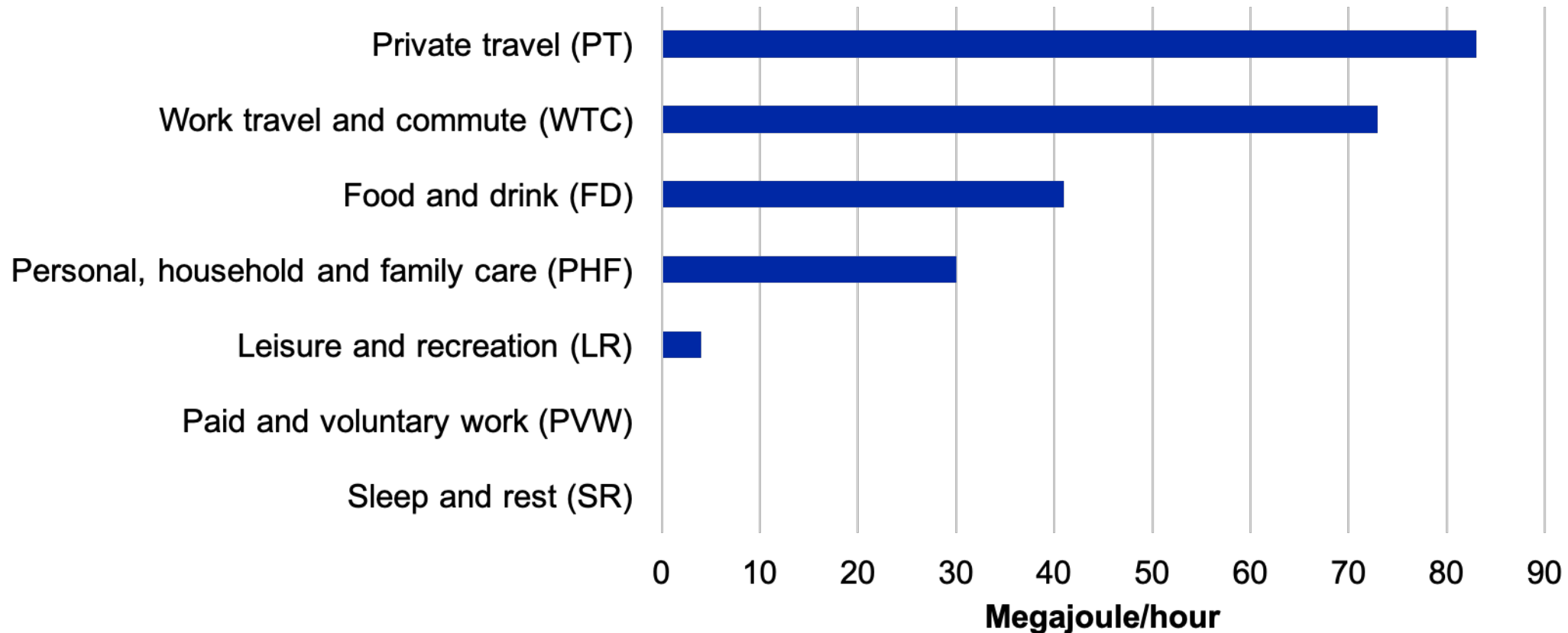
Immediate impact of change in time use

Causal relationship between ICT use, time use patterns, infrastructure utilization and environmental impact [6]



Energy intensities by activity category

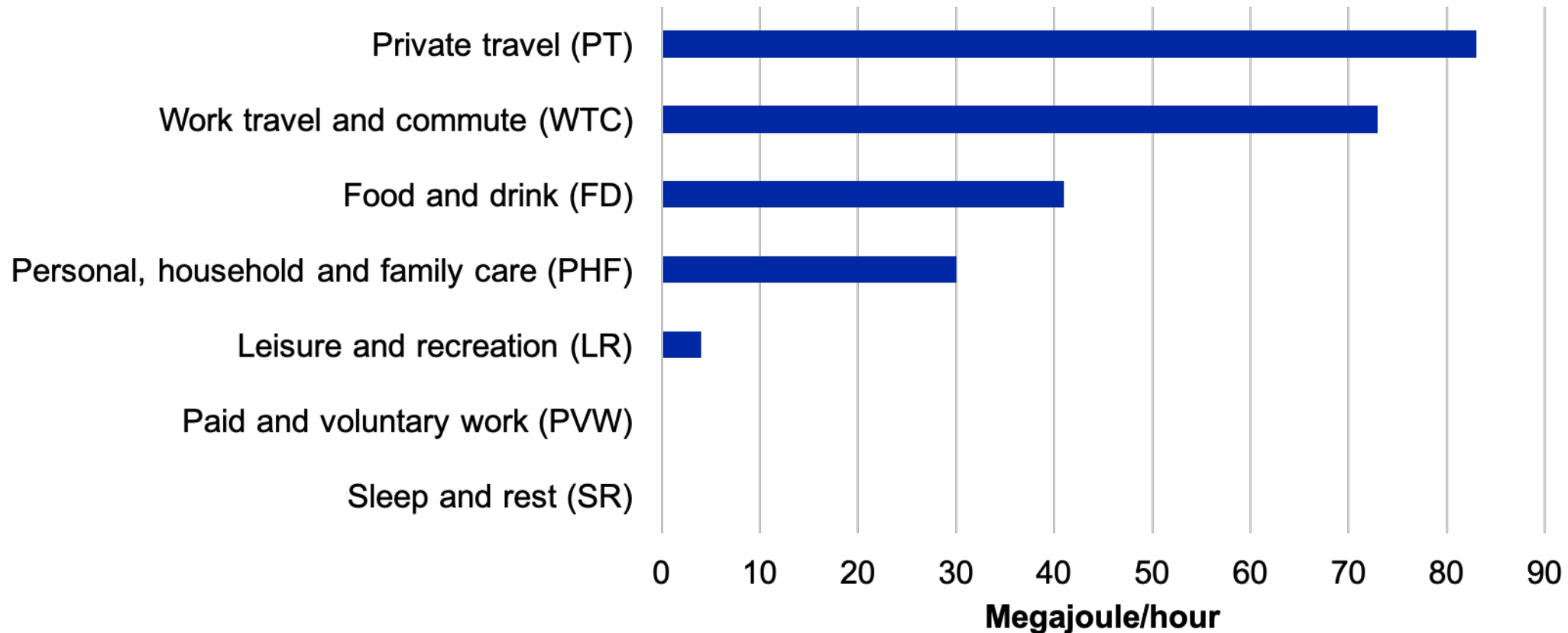
Energy intensities of activity categories in Finish households 1998-2000 based on Jalas [5]



Sleeping is assigned an energy intensity of zero since housing, domestic heating and lighting have not been considered. Work has an energy intensity of zero since no final consumption is allocated to it.

Energy intensities by activity category

Energy intensities of activity categories in Finish households 1998-2000 based on Jalas [5]



But what are the environmental consequences of changes in time allocation?

Example ICT use case:

Telecommuting

Direct effects

- Telecommuting can reduce time spent in commuting and associated resource consumption and emissions.
- Saved time needs to be spent on other activities (zero-sum game). These can cause resource consumption and emissions to the environment and compensate for the savings (time-use rebound effect).

Indirect/systemic effects

- Telecommuting may influence decisions of families regarding settlement, jobs, investments in their dwellings and vehicles, simply because they longer commuting distances become more acceptable [8]. This again feeds back on time use and the environment.
- In the long term, such developments can even lead to changes in land-use patterns, such as more dispersed residential and industrial areas [9].

Challenges and next steps

Impact of ICT on time use

- Investigation of ICT impacts on time use (e.g. through telecommuting)
- Attribution of changes in time use to ICT

Environmental impacts of time use

- Investigation of environmental impacts of changes in activity allocation
- Recent data on environmental impact of activities

References

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- [2] B. H. McCormick, T. DeFanit, and M. D. Brown, “Visualization in Scientific Computing,” 21, 1987.
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- [5] M. Jalas, “The Everyday Life Context of Increasing Energy Demands: Time Use Survey Data in a Decomposition Analysis,” *Journal of Industrial Ecology*, vol. 9, no. 1–2, pp. 129–145, Jan. 2005.
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- [9] Mokhtarian, P. L. (1990). A Typology of Relationships Between Telecommunications And Transportation. *University of California Transportation Center*. Retrieved from <http://escholarship.org/uc/item/4rx589m0>

Thank you for your kind attention!



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