

# Anatomy of an AI System

The Amazon Echo as an anatomical map of  
human labor, data and planetary resources  
By Kate Crawford and Vladan Joler  
2018

# Authors

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## Kate Crawford

Researcher, academic and author in the field of **social and political implications of AI**

### Career

Professor at the University of Southern California

Senior Principal Researcher at Microsoft NY

Co-founder of multiple interdisciplinary research groups, e.g. AI Now Institute

Advisor of policy makers in United Nations, European Parliament, White House, etc.

### Published

in academic journals, incl. *Nature*

in non-academic journals, incl. *The New York Times*

books, incl. *Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence* (2021)

# Authors

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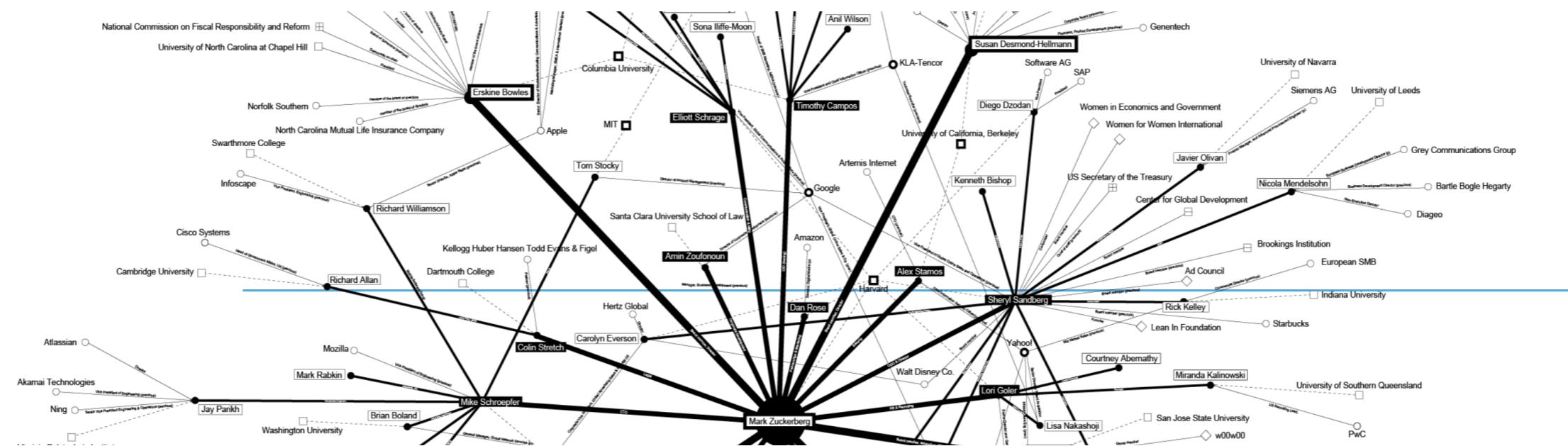
## Vladan Joler

Academic, researcher and artist in the field of **data investigation and visualisation of contemporary phenomena in the intersection between technology and society**

### Career

Professor at New Media department of the University of Novi Sad (Serbia)

Leader and co-founder of SHARE Lab an independent investigation group that works with data visualization and digital forensic methodologies to expose black box technologies



# Format

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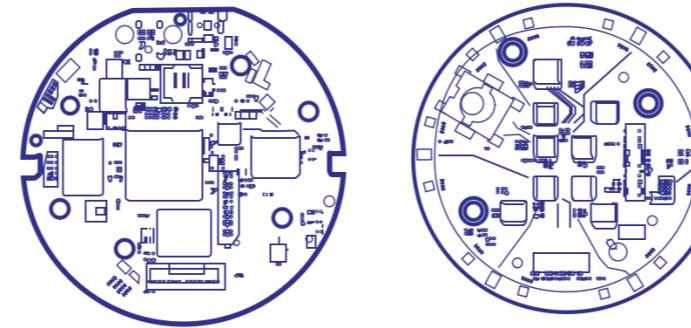
Infographic and research project

[diagram, essay]

Publicly available on its own website: [anatomyof.ai](http://anatomyof.ai)

Beazley Design of the Year Award

Permanent collection of MoMA in New York, V&A in London, and more

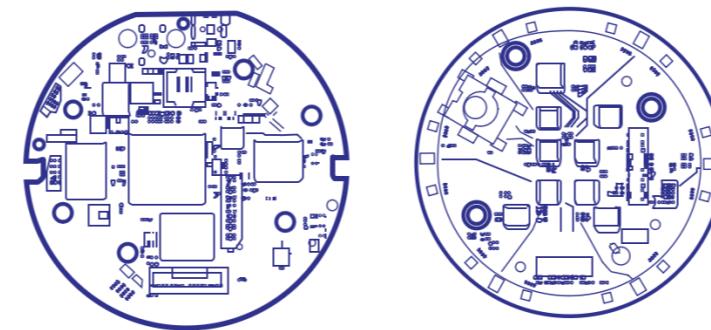


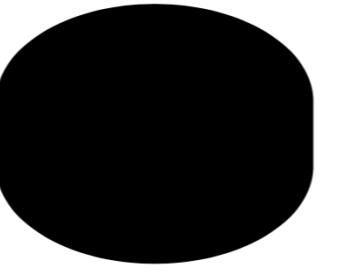
# Anatomy of an AI System

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"Anatomical map of an AI system"  
using example of Amazon Echo as AI system  
detailed **stakeholder map**  
including production, usage, and disposal

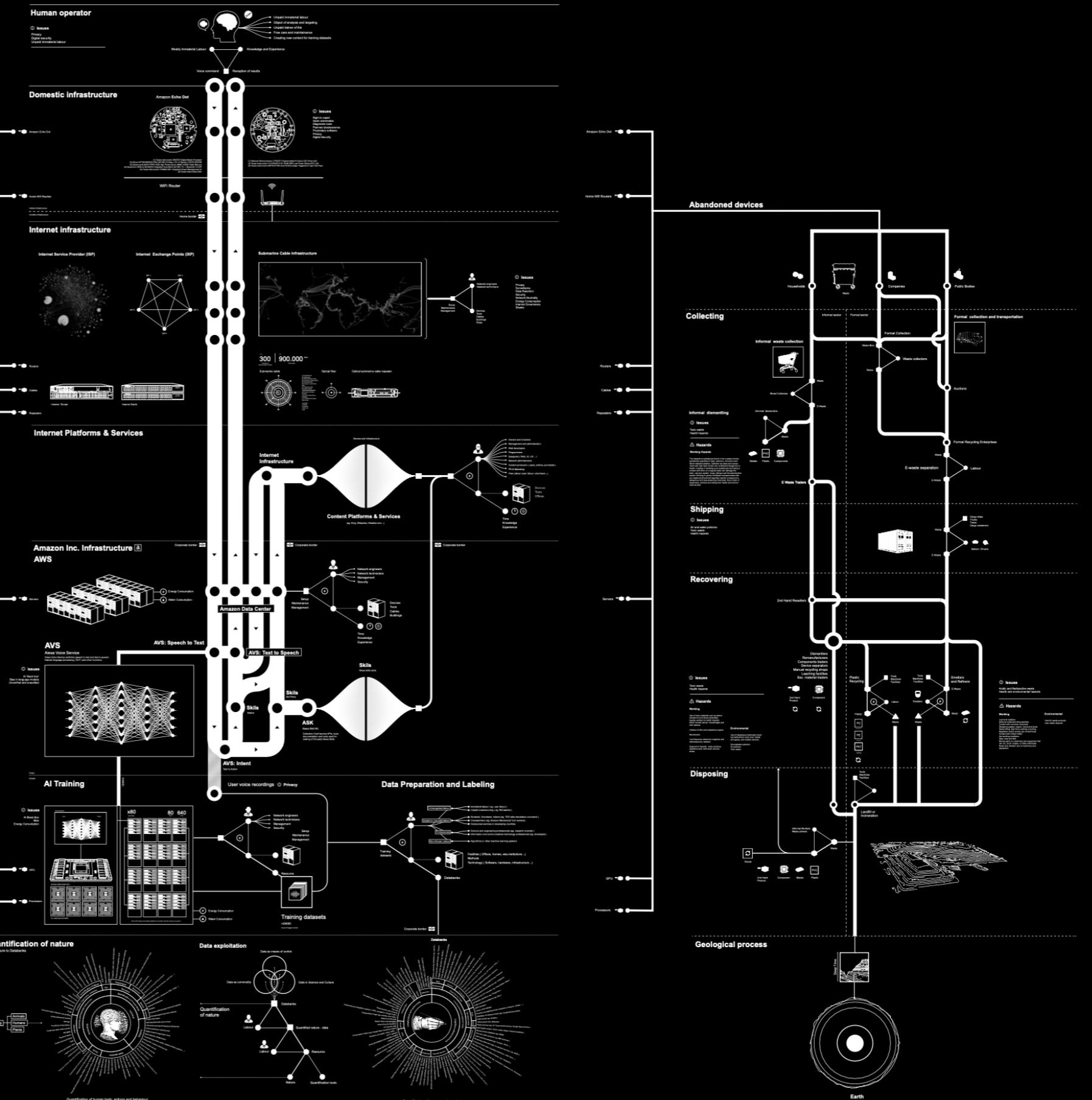
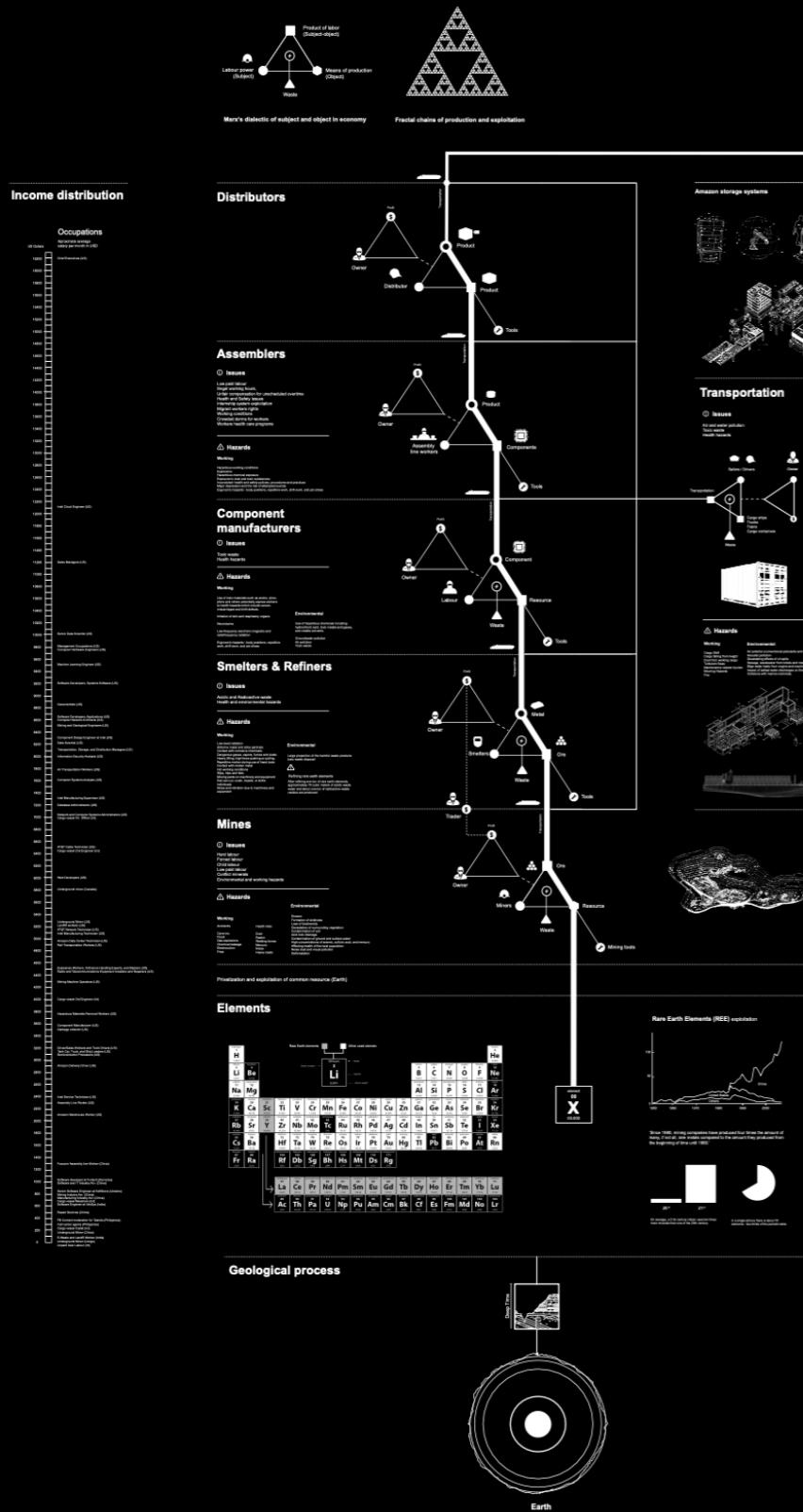
Stakeholder groups: **human labor, data and planetary resources**





# Anatomy of an AI system

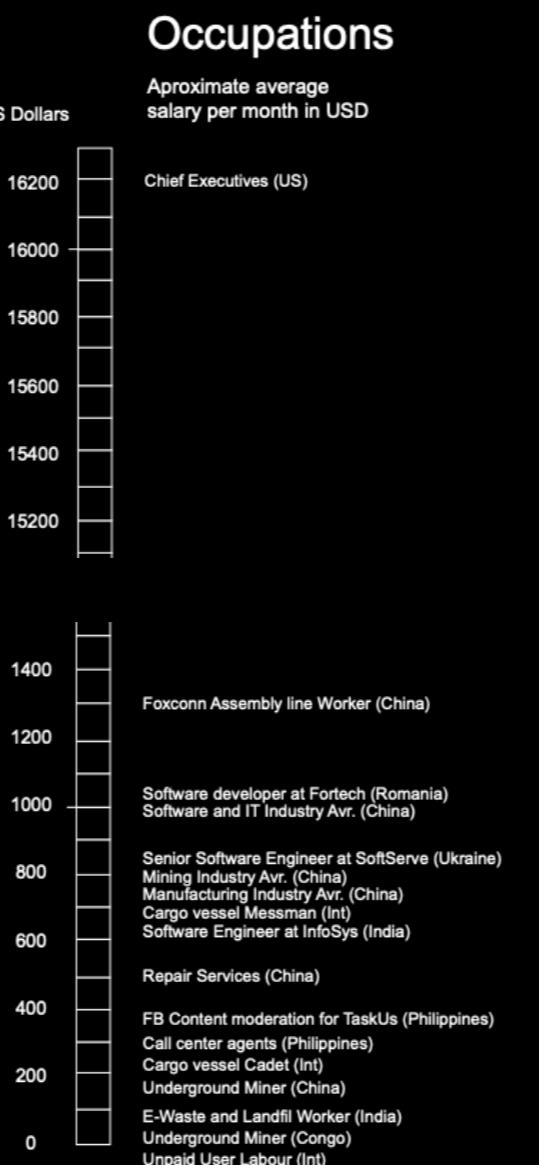
An anatomical case study of the Amazon echo as a artificial intelligence system made of human labor



# Digital Labour

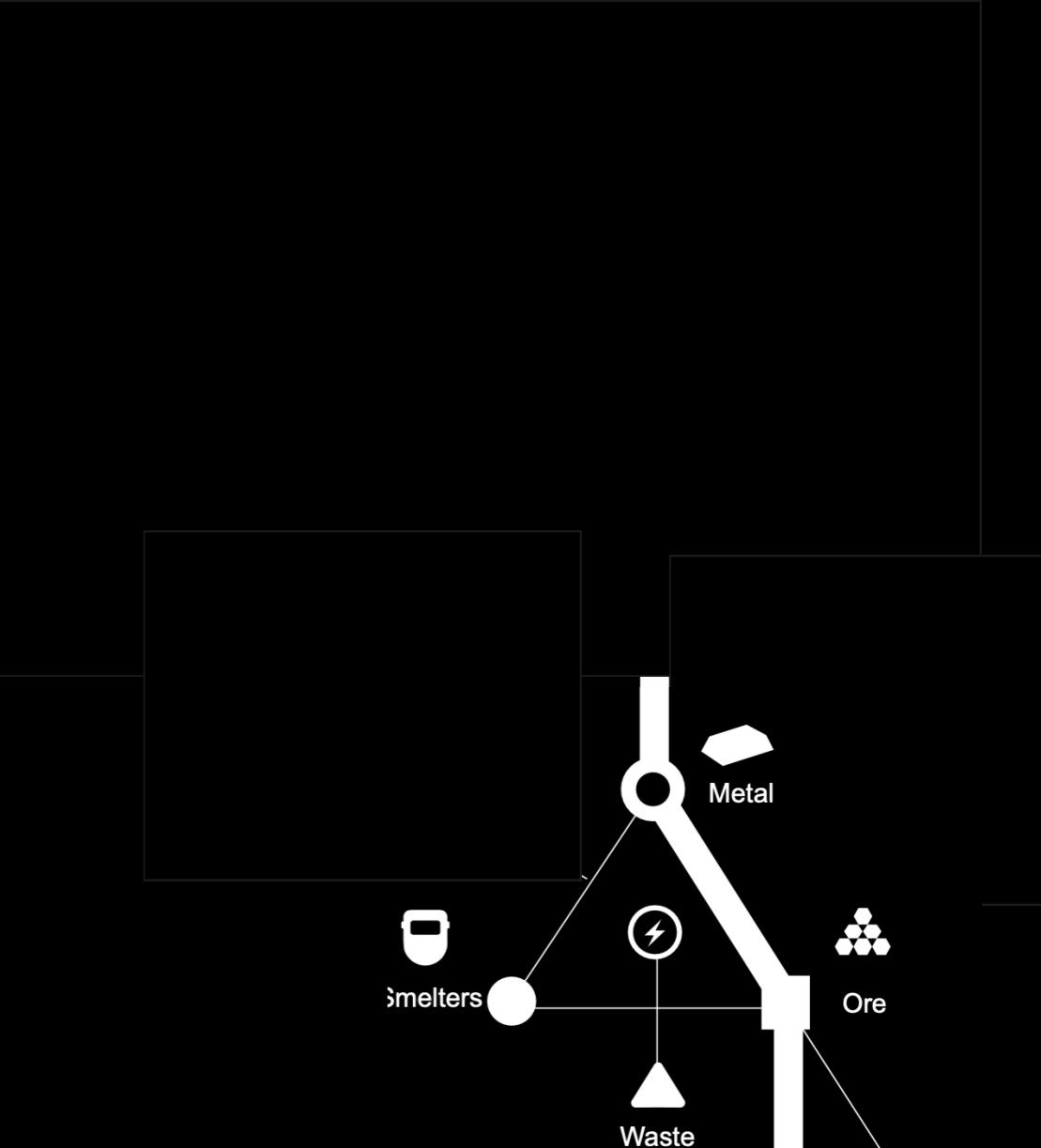
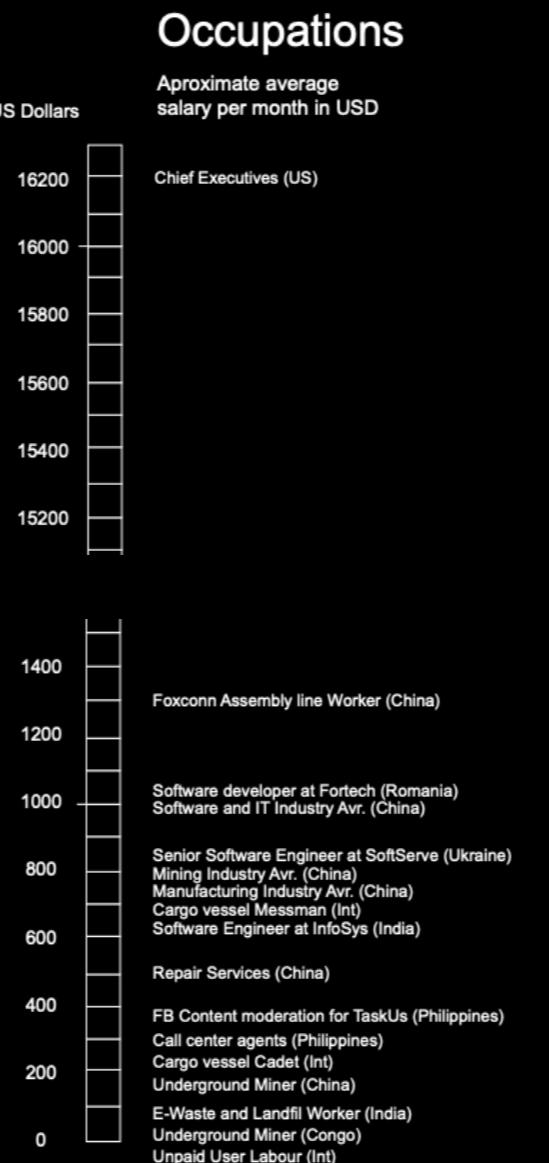
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**Production: miners, manufacturers, assembler, distributor**  
Exacerbating social inequalities and exploitation



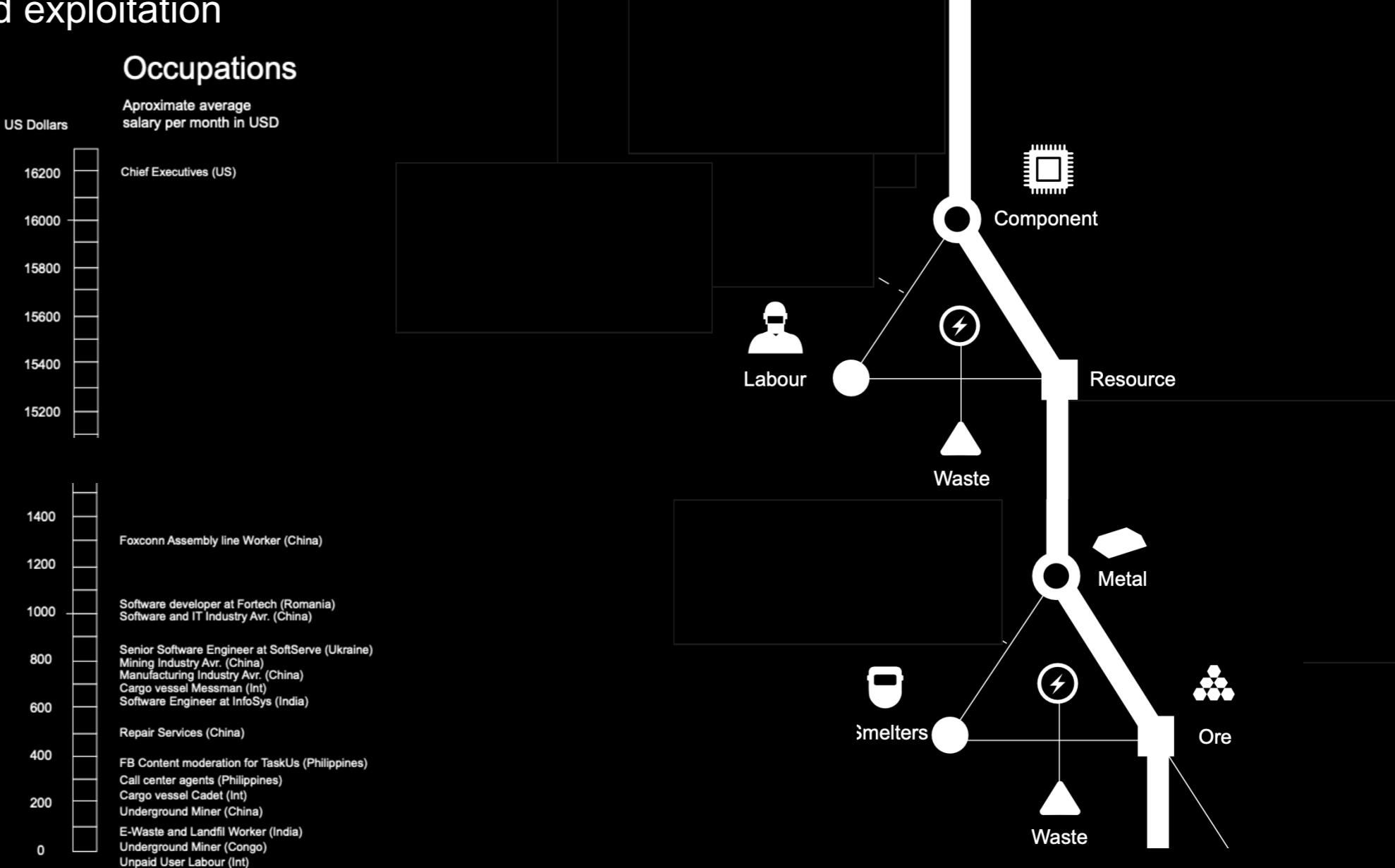
# Digital Labour

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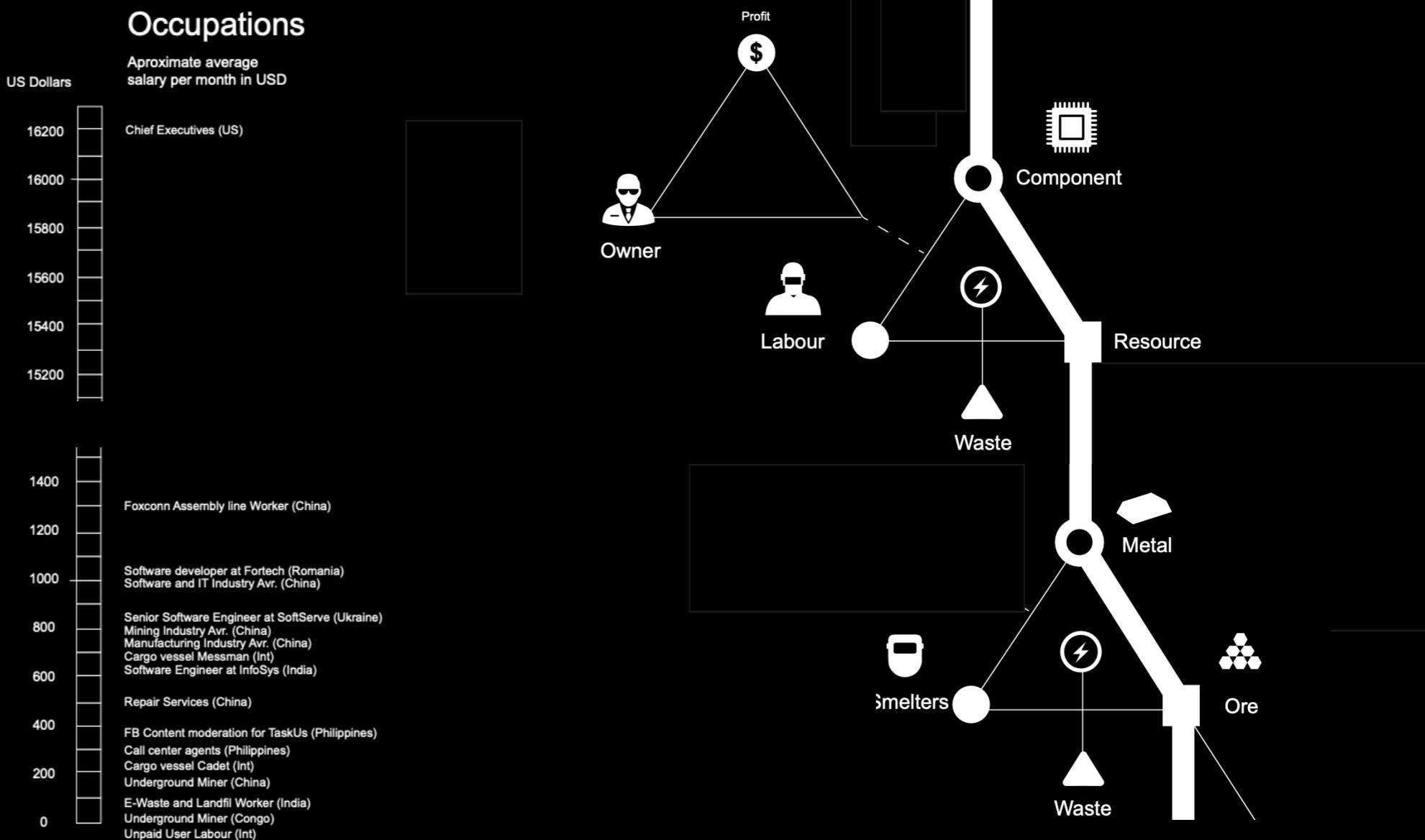
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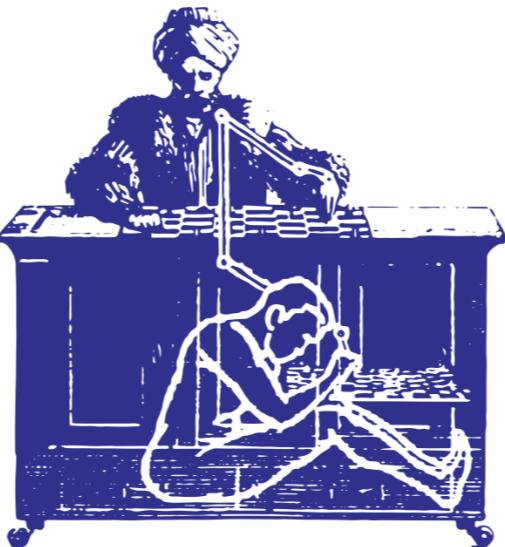


# Digital Labour

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Production: miners, manufacturers, assembler, distributor  
Exacerbating social inequalities and exploitation

**Algorithm: Data Labeler**  
Hidden work, often low paid



*Mechanical Turk*

# Digital Labour

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**Production: miners, manufacturers, assembler, distributor**

Exacerbating social inequalities and exploitation

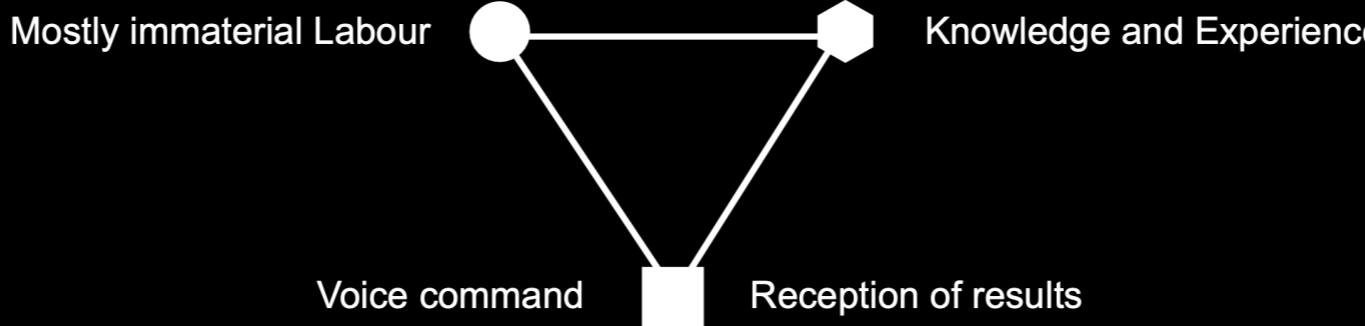
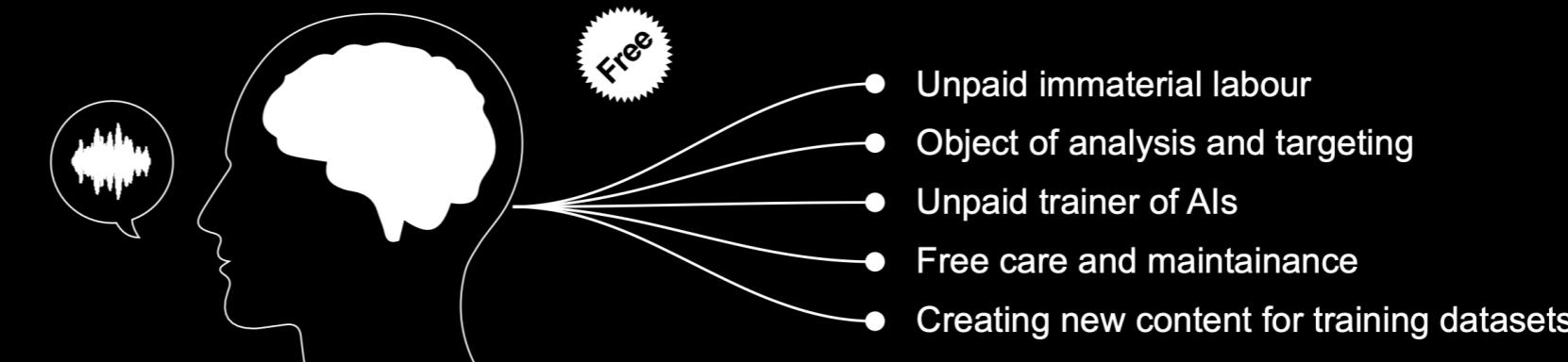
**Algorithm: Labelling**

Hidden work, often low paid

**User becomes a consumer, a resource, a worker, and a product**

Unpaid trainer of AI

Object of analysis and targeting



# Planetary Resources

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Natural resources not limitless



*Palaquium gutta*

# Planetary Resources

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Natural resources not limitless

**Short-life time of devices made from old and rare materials**  
For example lithium

scandium <b>21</b> <b>Sc</b> 44.956	yttrium <b>39</b> <b>Y</b> 88.906	lanthanum <b>57</b> <b>La</b> 138.91	cerium <b>58</b> <b>Ce</b> 140.12
praseodymium <b>59</b> <b>Pr</b> 140.91	neodymium <b>60</b> <b>Nd</b> 144.24	promethium <b>61</b> <b>Pm</b> [145]	samarium <b>62</b> <b>Sm</b> 150.36
europeum <b>63</b> <b>Eu</b> 151.96	gadolinium <b>64</b> <b>Gd</b> 157.25	terbium <b>65</b> <b>Tb</b> 158.93	dysprosium <b>66</b> <b>Dy</b> 162.50
holmium <b>67</b> <b>Ho</b> 164.93	erbium <b>68</b> <b>Er</b> 167.26	thulium <b>69</b> <b>Tm</b> 168.93	ytterbium <b>70</b> <b>Yb</b> 173.05
lutetium <b>71</b> <b>Lu</b> 174.97			

*Rare earth elements*

# Planetary Resources

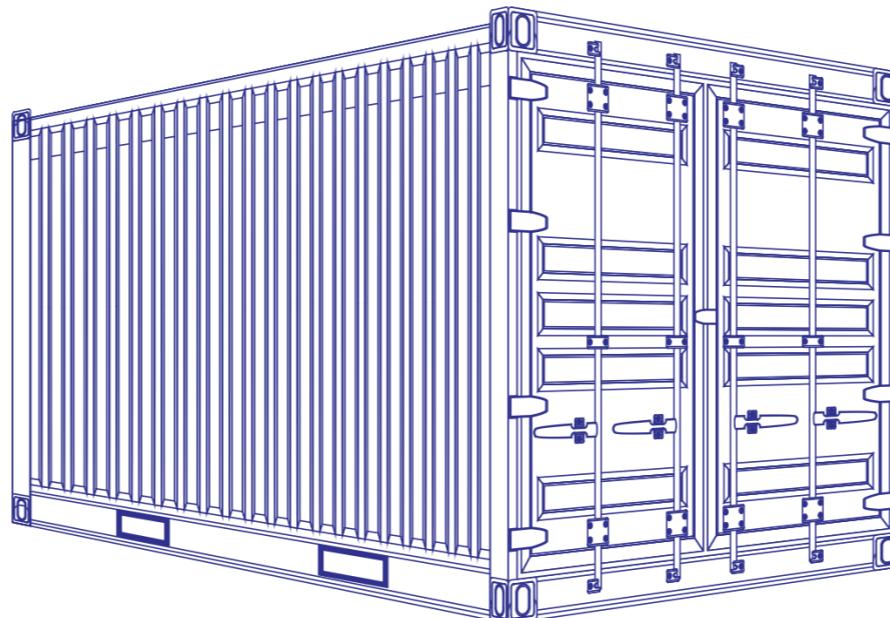
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Short-life time of devices made from old and rare materials

Natural resources not limitless

## Exacerbation of climate change

At different points, e.g. mining, shipping boats, energy needed for servers, ...

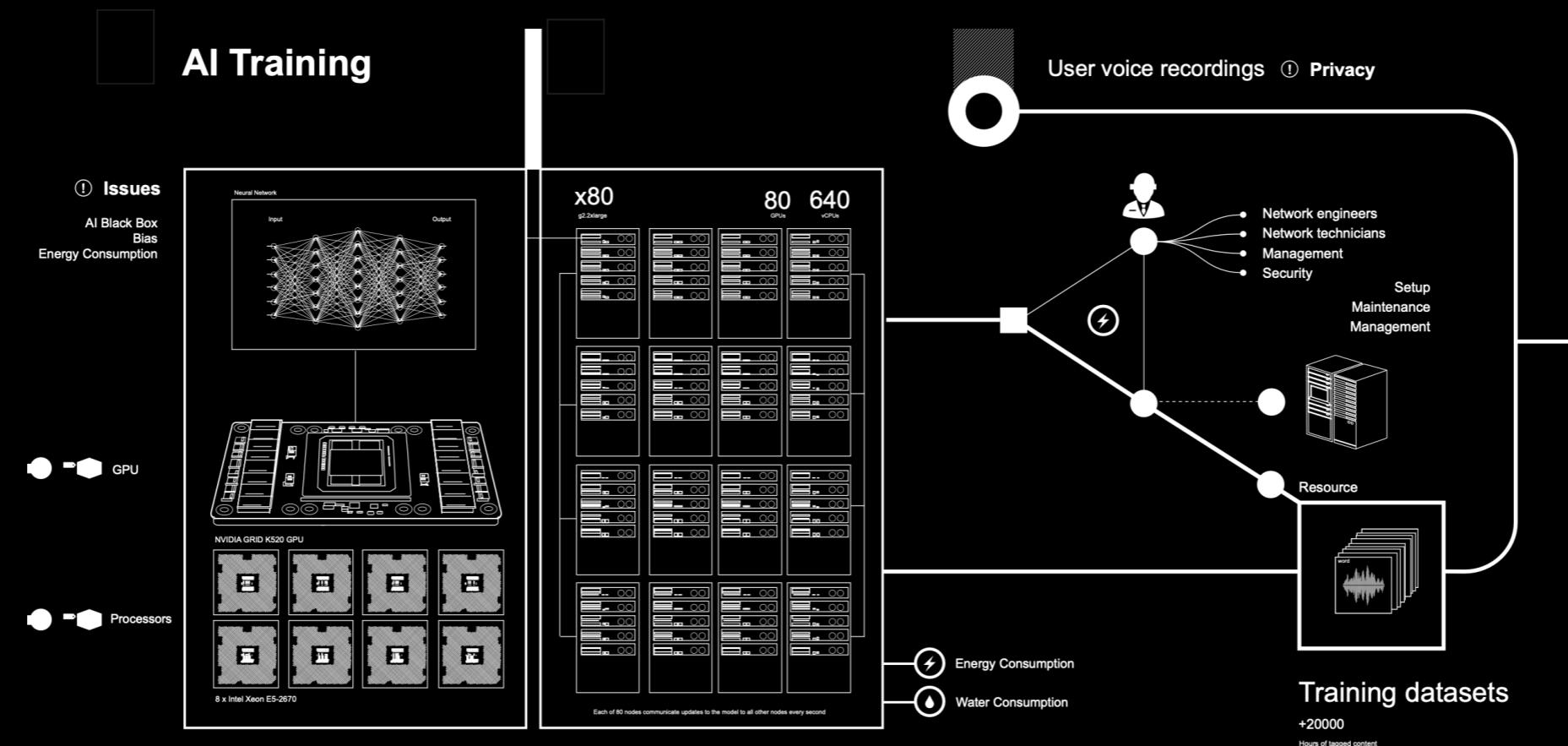


*Cargo container*

# Machine Learning

**High costs causing power imbalance**

Only few tech companies can afford training and maintenance of models



# Machine Learning

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High costs causing power imbalance

Only few tech companies can afford training and maintaining models

**Aspiration for full quantification of reality**

Including inner states



Quantification of Nature

# Machine Learning

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**High costs causing power imbalance**

Only few tech companies can afford training and maintaining models

**Aspiration for full quantification of reality**

Including inner states

**Bias in training data**

Exacerbating social inequalities

# Weaknesses

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**Positive impact of AI is neglected**

**Does not reflect the use of the resources for other devices and technologies**

**Problems are pointed out without providing solutions**

**No comparison to resources needed in other industries**

# Strengths

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**Brings together different aspects of AI systems**, that are often viewed individually, e.g. influence on environment, labour exploitation, data privacy, etc.

**Multiple formats** reach out to arts (essay), sciences (peer-reviewed journal), and the public (museum) to provide a common ground for discussion

Combination of **emotional message** and **scientific evidence** calls for action whilst providing realistic evidence



# Further Readings

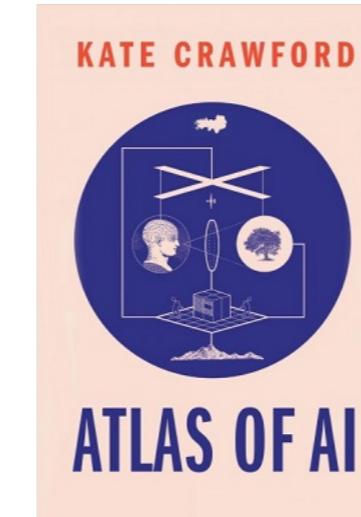
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## Further work by the authors

e.g. "The Atlas of AI" by Kate Crawford [2021] and  
SHARE Lab data visualisation projects: <https://labs.rs/en/>

**More specific work towards on of the three main topics human labor, data and planetary resources** and their involvement with AI Systems, e.g. "The Costs of Connections" by Nick Choudry & Ulysses Mejas [2019]

**Research and guidelines on AI Ethics and Governance** by research institutions, such as AI NOW Institute, Partnership on AI, The Ethics and Governance of AI Initiative (AI4People)



# Discussion

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Should companies be obliged to make these hidden human labour, effect on planetary resources and use of data **more visible to consumers?** And how?

In a globalised world, are AI systems unique in their way of exploitation of human labour, data and planetary resources? If so, in what way?

# References

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<https://anatomyof.ai>

<https://ars.electronica.art/outofthebox/en/anatomy-of-ai/>

<https://www.moma.org/collection/works/401279>

<https://www.katecrawford.net>

<https://futureeverything.org/profile/vladan-joler/>

<https://labs.rs/en/about/>

<https://technopolitics.info/evenings/index.html>

<http://connectedpapers.com>