

Tips & Tricks for Charts

How to make your report look great

The Nokia Bell Labs logo is positioned inside a large blue arrow that points to the left. The logo consists of the words "NOKIA", "BELL", and "LABS" stacked vertically in a blue, sans-serif font. The arrow is a thick, solid blue shape that originates from the right edge of the slide and points towards the left, framing the text on the left side.

NOKIA
BELL
LABS

Congrats, you wrote a report!

Impact Assessment Card: Communicate AI Uses

EDYTA BOGUCKA, Nokia Bell Labs, United Kingdom and URSULA MARIOS CONSTANTINIDES, CYENS Centre of Excellence, Cyprus; SANJA ŠĆEPANOVIC, Nokia Bell Labs, United Kingdom and DANIELE QUERCIA, Nokia Bell Labs, United Kingdom and Po

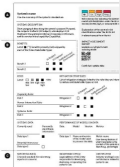


Fig. 1. Template of the Impact Assessment Card showing AI risks and the system's name, purpose, and EU AI Act risk level. Section B and technical details. Section C lists reporting channels, registered office for AI systems appear in Appendix A.6–A.7 and online at: <https://social-dynamics.net/ai-risks/impact-card/>

Communicating the risks and benefits of AI is important for regulatory methods such as technical reports often exclude people without tech expertise, and members of the public selected to reflect the US, people either the card or a full impact assessment report to write an AI system. The card led to faster task completion and higher-quality design choices can improve accessibility and support AI user <https://social-dynamics.net/ai-risks/impact-card/>

Authors' Contact Information: Edyta Bogucka, Nokia Bell Labs, Cambridge, United Kingdom, edyta.bogucka@nokia-bell-labs.com; Marios Nicosia, Cyprus and Nokia Bell Labs, Cambridge, United Kingdom, uriolu@nokia-bell-labs.com; Sanja Šćepanović, United Kingdom, sanja.sc@nokia-bell-labs.com; Daniele Quercia, Nokia Bell Labs, Cambridge, United Kingdom, daniele@nokia-bell-labs.com

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CSCW301:2 Edyta Bogucka, Marios Constanti

CSC Concepts – Human-centered computing → Interactive s social computing. Additional Key Words and Phrases: impact assessment, regulation. ACM Reference Format: Edyta Bogucka, Marios Constantinides, Sanja Šćepanović, and Da Card: Communicating Risks and Benefits of AI Uses. Proc. ACM Hum (November 2023), 42 pages. <https://doi.org/10.1145/3757482>

1 Introduction

The transformative potential of AI in society requires a thoo benefits [48, 92], with policymakers advocating that providor will improve risk predictions, and, in turn, lead to better and This need has led to the creation of fully-fledged impact asses and mitigating potential risks associated with AI systems, benefits to individuals, society, and the environment [62]. In-depth grasp of the AI system, from its initial intention to its knowledge of the training data, the underlying algorithms, have on society and the environment. Moreover, it is essenti, with all parties involved, including legal entities and the gr affected by the AI systems [73]. As AI governance continues are set to become a legal requirement. The EU AI Act, for exa impact of high-risk AI uses on human rights, the environme reports aim to increase transparency regarding AI functiona for the ethical and societal consequences of their AI system comprehend the risks and benefits of AI uses to make inforu

However, a review of more than 300 AI auditing tools fo systems and effectively communicating these harms have rec the technical performance of those systems [71]. Current rep filled with technical jargon [56], are mainly aimed at experts impacted by AI's societal integration. This creates a barrier to v in AI-related discussions. Therefore, it is crucial to explore risks and benefits of AI uses that are inclusive and understa Drawing from the HCI and CSCW literature, as we sha communicate complex concepts pertaining to AI uses for braa the use of clear language, icons, metaphors, and color coding c accessible to ordinary individuals [36, 93]. With that aim in m

- Through an iterative design process, we conducted the who identified design requirements for an impact asse speculative cards. The design requirements were groupe the information (i.e., what the card should contain), and the card should convey the information), by reviewing feedback from the research team, we designed our int
- We evaluated our card's effectiveness for conducting expert typically writes emails to the ethics committee an AI or advising against it), and compared it against in an online study with 235 participants across three experts, and ordinary individuals who reflect US Cens

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Fig. 4. The online study involved 9 steps. Initially, participants see and tasks (Step 1). Then, they interacted with the first randomly a biometric checkout, completing a task (Step 2). Subsequently, assistance (Step 4) of the treatment. This process was repeated for a different AI system (e.g., C2 – a card for the license plate detector). Fit treatment for the task (Step 8), and self-evaluated their knowledge

Below this bar, we provided recommendations for each risk level (to relevant articles from the EU AI Act [25]. We also included date of the card's last edit.

We also refined the language describing the collected data the types of data collected. We iteratively transitioned fro card (e.g., “factual data”) to more precise descriptions in versio median accessibility (R7), we revised the risk classification co their contrast ratios. Finally, to improve cultural inclusivity (R the types of data collected. Although they work well for sy creation become problematic as the system expands to ma types. Moreover, the use of numerous icons on a small card co the clarity of the information presented.

4.2.3 Refined Version of the Card.

Figure 3B presents the section of the card contains the expanded header and a corner system's benefits, the risk management framework with con and the technical details on data and models. The bottom secti mechanisms, registered office and compliance certifications.

5.5 Evaluate the Impact Assessment Card

Having refined the card, we then evaluated it in a large-scal to explore the effectiveness of the card to communicate the r that is accessible beyond technical roles. Next, we describe execution (\$5.3), metrics (\$5.2), and Nextx (\$5.4).

5.1 Setup

We developed a web-based survey that included a real-world card or with the impact assessment report as baseline (Figure

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Impact Assessment Card

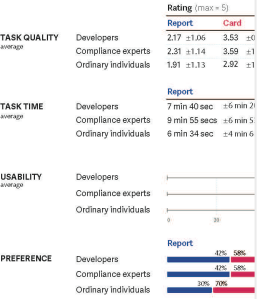


Fig. 5. Card outperformed report across all quantitative metrics: quality equals in less time, while being more usable and preferred!

5.4.2 Qualitative Results.

Through thematic analysis of partit fed key factors affecting their experience with the card and suggestions for improving the card. Participant quotes are ref their anonymized Profile ID.

The card was favored for its clear, concise presentatio the risks and benefits of AI uses, though some found decisions. On the positive side, the card was favored for its co of information. Participants found it easier to digest, with vi that allowed for quick understanding of the main risks and For example, C19 stated that “The card assisted me by highlight while CP5 appreciated “The card’s structured overview of the identification of key technical aspects of the AI system.” A c that “The card was easy to use and conveyed the gist of the / commented on the card’s format to be “really accessible to experts). Participants also echoed the sentiment that despite even helped them produce emails of higher quality. CP190, an “the best thing really is, just that more thought went into make less intimidating, so that it would be easy to get what you need consult with more technical people to be sure you understand it side, some participants noted that the card lacked the depth as

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Table 4. The results of a linear mixed-effects regression analysis with task quality as the dependent variable. The most significant difference in task quality arises from the choice of treatment. The coefficients represent the effect sizes for each factor relative to its reference category, with statistical significance indicated by **. For $p < 0.01$, and *** for $p < 0.001$. Non-significant factors ($p > 0.05$) are also reported for completeness. Random effects were included to account for variability in task quality between participants’ self-selected decisions to reject or recommend the system, ensuring fair comparisons across all fixed factors.

Factor	Values	Coefficient	p-value
Intercept		2.795	0.000
Type of task			
Recommendation System	Reject vs Recommend	0.860	0.323
	Plate Detector vs. Checkout	0.150	0.079
Participant’s cohort			
Cohort	Developers vs Ordinary individuals	0.131	0.257
	Compliance experts vs. Ordinary individuals	0.287	0.007**
Expertise levels			
Task Expertise	Low vs High	-0.013	0.819
Technological Expertise	Low vs High	0.052	0.392
AI Expertise	Low vs High	-0.046	0.580
Treatment			
Treatment type	Card vs Report	-0.967	0.000***

Table 5. The mean difference testing underscores the strong influence of treatment choice on task quality. We conducted statistical significance testing on the mean differences between two factor values, presenting Mann-Whitney test p-values with the notations* for $p < 0.05$, ** for $p < 0.01$, and *** for $p < 0.001$.

Factor	Value Pair	Averages	Difference	p-value
Type of task				
Recommendation System	Reject vs Recommend	3.0 vs 3.014	-0.014	0.719
	Plate Detector vs. Checkout	2.801 vs 2.645	-0.156	0.139
Participant’s cohort				
Cohort	Developers vs Compliance experts	2.852 vs 2.95	-0.098	0.534
	Developers vs. Ordinary individuals	2.852 vs 2.595	0.347	0.013*
	Compliance experts vs. Ordinary individuals	2.95 vs 2.595	0.455	0.0002**
Expertise levels				
Task Expertise	Low vs High	2.73 vs 2.714	0.015	0.832
Technological Expertise	Low vs High	2.609 vs 2.653	-0.16	0.25
AI Expertise	Low vs High	2.654 vs 2.603	-0.149	0.204
Treatment				
Treatment type	Card vs Report	3.327 vs 2.12	1.207	0.0***

There were also mentions of the card being too simplistic for complex decision-making. CP6, a developer, felt that it “was a little simple, so I can’t help but think there may be something missing in the big picture”. Despite its concise format, some participants found the card too brief. For example, CP5, a developer, commented that “The card was brief which I enjoyed, however, it probably could have used a little more substance”.

The report was valued for its depth and details, though its complexity and dense format challenged quick comprehension and accessibility. On the positive side, participants appreciated the report for its detailed and comprehensive information, which helped them understand the AI system better. They mentioned that the report laid out the positive and negative aspects effectively and clearly in a well-structured way, providing a good foundation of knowledge.

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But honestly, this is how most people (incl. managers) will read it

Rule #1 Keep it skimmable:

Readers should be able to understand the flow and main results of your research just by looking at the figures and their captions.

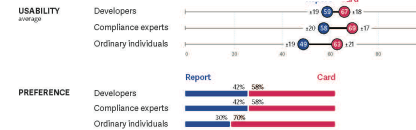
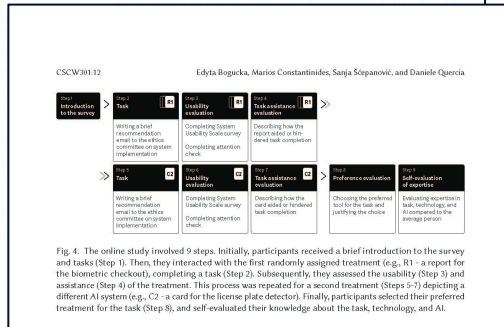


Fig. 5. Card outperformed report across all quantitative metrics and cohorts. It helped produce higher quality emails in less time, while being more usable and preferred for the task.

Table 4. The results of a linear mixed-effects regression analysis with task quality as the dependent variable. The most significant difference in task quality arises from the choice of treatment. The coefficients represent the effect sizes for each factor relative to its reference category, with statistical significance indicated by ** for $p < 0.01$, and *** for $p < 0.001$. Non-significant factors ($p > 0.05$) are also reported for completeness. Random effects were included to account for variability in task quality based on participants' self-selected decisions to reject or recommend the system, ensuring fair comparisons across all fixed factors.

Factor	Values	Coefficient	p-value
Intercept		2.795	0.000
Type of task			
Recommendation	Reject vs. Recommend	0.880	0.325
System	Plate Detector vs. Checkout	0.150	0.679
Participant's cohort			
Cohort	Developers vs. Ordinary individuals	0.133	0.257
Cohort	Compliance experts vs. Ordinary individuals	0.287	0.007***
Expertise levels			
Task Expertise	Low vs. High	-0.013	0.839
Technological Expertise	Low vs. High	0.055	0.392
AI Expertise	Low vs. High	-0.056	0.382
Treatment			
Treatment type	Card vs. Report	-0.987	0.000***

Part 1

Discuss common chart types you may need for your paper

Part 2

Write clear, self-contained captions for your figures

Part 3

Avoid the most common figure mistakes

Part 4

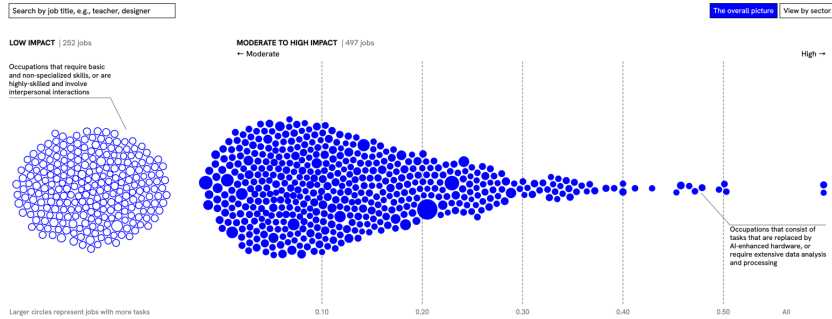
Improve your figure production pipeline

Part 1

Discuss common chart types
you may need for your paper

Two chart types often used in papers

THE LEAST AND THE MOST IMPACTED OCCUPATIONS

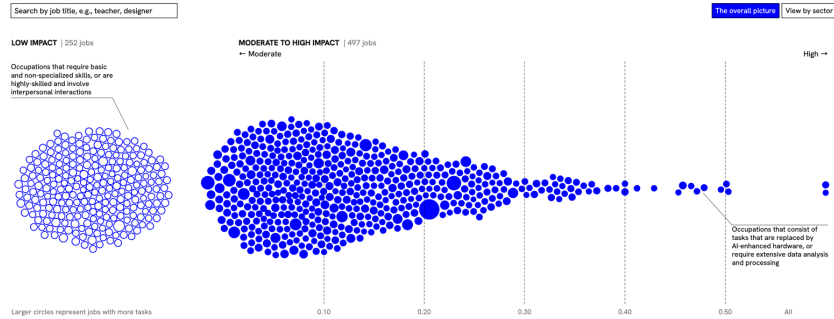


Data-driven charts for your experiments and results

<https://social-dynamics.net/aii>

Two chart types often used in papers

THE LEAST AND THE MOST IMPACTED OCCUPATIONS



Data-driven charts for your experiments and results

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Risk Assessment Checklist for Mobile Computing

- 1 Use**
 - 1.1 What is the purpose of the use?
 - 1.2 What is the intended domain, industry or sector for the use?
 - 1.3 What are the technical capabilities that enable the use?
 - 1.4 Who are the individuals or groups affected by the use?
 - 1.5 Who are the individuals or entities responsible for overseeing the use?
- 2 Data**
 - 2.1 Does the device/application collect personal data to enable the use? If yes, specify the type of collected data (e.g., biometric)
 - 2.2 Does the device/application collect data only after receiving clear consent from users?
 - 2.3 Are users able to opt-out of data collection?
 - 2.4 Are users informed about how their data is used, stored, and shared?
 - 2.5 Are there clear policies on data usage, storage, and sharing?
 - 2.6 Are there encryption methods implemented to safeguard the data?
- 3 Risks**
 - 3.1 Are there aspects of the device/application/use that could present challenges for users of different abilities or vulnerable backgrounds?
 - 3.2 Are there aspects of the application/device/use that could be seen as discriminatory towards certain users?
 - 3.3 Are there aspects of the application/device/use that could lead to habit-forming behaviors with adverse personal or social consequences?
- 4 Mitigations**
 - 4.1 Are there measures in place to prevent unauthorized access to the device/application/data?
 - 4.2 Are there measures in place to prevent the misuse of the device/application/data for unethical purposes?
 - 4.3 Are there mechanisms in place that enable users to provide feedback or report problems?
 - 4.4 Are there measures in place to minimize the environmental footprint of the device/application?
 - 4.5 Are there preventive features integrated in the device/application to safeguard personal and social well-being?
- 5 Compliance with Legal and Regulatory Standards**
 - 5.1 Does the device/application/use comply with relevant laws and regulations (e.g., GDPR, HIPAA, EU AI Act)?
 - 5.2 Are there procedures in place for compliance verification and regular audits?





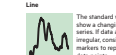



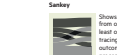



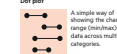






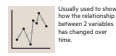


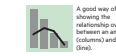








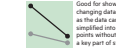







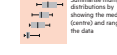


















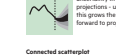







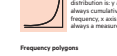











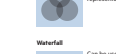











Diagrams of your methods, workflows, and final products (e.g., tools you built)

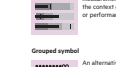
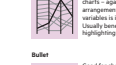
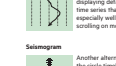
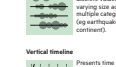
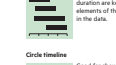
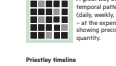
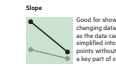
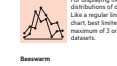
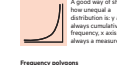
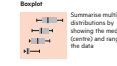
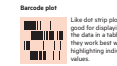
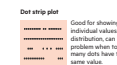
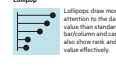
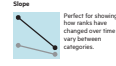
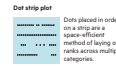
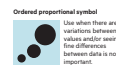
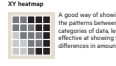
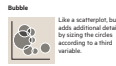
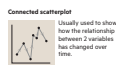
<https://social-dynamics.net/docs/risky-mobile.pdf>

Designing charts around a single insight

- **Focus each chart on one idea:** ensure every chart answers [one specific research question](#) or illustrates [one key insight](#).
- **Run the Aha-test:** ask yourself, “What’s the one ‘Aha!’ message this chart should deliver to my readers?”
 - Reveal a striking [correlation](#) between two variables?
 - Show an important [change over time](#)?
 - Showcase my new co-design methodology?
 - Clarify my user study setup?
- Once you’re clear on the message, the choice of charts becomes easier!
- **Design around your one insight:** Chart type, layout, labels, and annotations should all reinforce that one key idea.
- **Prioritize quality over quantity:** 2–3 well-designed, relevant charts beat ten random ones straight from Matplotlib ;-)

How to choose the right chart type for your paper? Tool 1

Deviation	Correlation	Ranking	Distribution	Change over Time	Magnitude	Part-to-whole	Spatial	Flow
<p>Example FT uses Trade surplus/deficit, climate change</p> <p>Empirical variables (Y) from a fixed reference point. Typically the reference point is zero but it can also be a target or a long-term average. Can also be used to show sentiment (positive/negative).</p>	<p>Example FT uses Inflation and unemployment, income and life expectancy</p> <p>Show the relationship between two or more variables. Be mindful that, unless you list them otherwise, many readers will assume the relationships you show them to be causal (i.e. one causes the other).</p>	<p>Example FT uses Health deprivation, league tables, constituency election results</p> <p>Use scores on a fixed point as an ordered list is more important than the absolute or relative position. Don't be afraid to highlight the points of interest.</p>	<p>Example FT uses Income distribution, population (GDP) distribution, revealing inequality</p> <p>Show the shape of a distribution and then explain the shape (or skew) of a distribution or describe the way of highlighting the lack of uniformity or equality in the data.</p>	<p>Example FT uses Share price movements, economic time series, sector changes in a market</p> <p>Use emphasis to changing trends. These can be short (intra-day) movements or describe longer trends. Reversing declines or continuities. Choosing the correct time scale is important for suitable context to the reader.</p>	<p>Example FT uses Commodity production, market capitalisation, volumes in general</p> <p>Show size comparisons. These are relative (can be able to see large/small) or describe the size of differences. Usually these show a total number (for example, barrels, dollars) or people (rather than a calculated rate per cent.</p>	<p>Example FT uses Fossil fuels, company structures, national election results</p> <p>Show how a single entity can be broken down into its component elements. If the reader's interest is only in the size of the components, consider a magnitude-type chart instead.</p>	<p>Example FT uses Population density, natural resource locations, natural disaster risk, rainfall, catchment areas, variation in election results</p> <p>Aside from location, most only care about precise locations or geographical patterns in data are most important to the reader than anything else.</p>	<p>Example FT uses Movement of funds, trade, migrants, lawsuits, information relationship graphs.</p> <p>Show the reason (often in terms of movement between two or more states or conditions). These might be logical sequences or geographical locations.</p>
<p>Diverging bar  A simple standard bar chart that can handle both negative and positive magnitude values.</p>	<p>Scatterplot  The standard way to show the relationship between two continuous variables, each of which has its own axis.</p>	<p>Ordered bar  Standard bar charts display the rank of values, with more items being sorted into order.</p>	<p>Histogram  The standard way to show a statistical distribution - keep the axis between categories small to highlight the 'shape' of the data.</p>	<p>Line  The standard way to show a changing time series. If data are irregular, consider markers to represent data points.</p>	<p>Column  See above. Good when the data are not time series and labels have long category names.</p>	<p>Stacked column/bar  A simple way of showing part-to-whole relationships but can be difficult to read with more than a few components.</p>	<p>Basic choropleth (contour/hatch)  The standard approach for getting data on a map - but be aware that used differently, data will be hard to see.</p>	<p>Sankey  Shows changes in flows from one condition to at least one other, good for tracing the eventual outcome of a complex process.</p>
<p>Diverging stacked bar  Perfect for presenting survey results which involve sentiment (eg. disagree/neutral/agree).</p>	<p>Column + line timeline  A good way of showing the relationship between an amount (columns) and a rate (line).</p>	<p>Ordered column  See above.</p>	<p>Dot plot  A simple way of showing the change or range (or both) of data across multiple categories.</p>	<p>Column  Columns work well for showing data with only one series of data at a time.</p>	<p>Bar  See above.</p>	<p>Martimeko  A good way of showing the size and proportion of data at the same time - as long as the data are not too complicated.</p>	<p>Proportional symbol (count/magnitude)  Use for maps where data will be hard to see.</p>	<p>Waterfall  Designed to show the sequencing of data through a process, typically budgets. Can include +/- components.</p>
<p>Spine  Sets a single value into two contrasting components (eg. male/female).</p>	<p>Connected scatterplot  Usually used to show how the relationship between 2 variables has changed over time.</p>	<p>Ordered proportional symbol  Use when there are big variations between values and/or seeing flow differences between data is not important.</p>	<p>Dot strip plot  Good for showing individual values in a distribution, can be a column when too many data have the same value.</p>	<p>Column + line timeline  A good way of showing the relationship over time between an amount (columns) and a rate (line).</p>	<p>Paired column  As per standard column chart but for multiple series. Can become tricky to read with more than 2 series.</p>	<p>Pie  A common way of showing part-to-whole data - but be aware that if the data are not too complicated, compare the size of the segments.</p>	<p>Flow map  For showing unambiguous movement across a map.</p>	<p>Chord  A complex but powerful diagram which can illustrate 2-way flows (and not just 1-way) in a matrix.</p>
<p>Surplus/deficit filled line  The shaded area of these charts shows a difference to be shown - either against a reference line or between two series.</p>	<p>Bubble  Like a scatterplot, but adds additional detail to the data points according to a third variable.</p>	<p>Dot strip plot  Data plotted in order on a strip are a simple method of laying out multiple individual values.</p>	<p>Barcode plot  Like dot strip plots, good for displaying all the data in a table, few work best when highlighting individual values.</p>	<p>Slope  Good for showing changing data as long as the data can be simplified into 2 or 3 points without missing a key part of a story.</p>	<p>Paired bar  See above.</p>	<p>Donut  Similar to a pie chart - but the centre can be a good use of real estate. Make sure to include more information about the data (eg. total).</p>	<p>Contour map  For showing areas of equal value on a map. Can use desirable colour schemes for representing voting regions with equal value.</p>	<p>Network  Used for showing the strength and kind of relationships of varying types.</p>
<p>XY heatmap  A good way of showing the patterns between 2 categories of data, less effective at showing fine differences in amounts.</p>	<p>XY heatmap  A good way of showing the patterns between 2 categories of data, less effective at showing fine differences in amounts.</p>	<p>Slope  Perfect for showing how data have changed over time or vary between categories.</p>	<p>Boxplot  Summarise multiple distributions by showing the median (centre) and range of the data.</p>	<p>Area chart  Use with care - these are good for showing changes to total, but seeing changes in components can be very difficult.</p>	<p>Martimeko  A good way of showing the size and proportion of data at the same time - as long as the data are not too complicated.</p>	<p>Treemap  Use for hierarchical data to show part-to-whole relationships, can be difficult to read with many small segments.</p>	<p>Equalized cartogram  Concentrating each unit on a map to equalize and relationships can be difficult to represent, voting regions with equal value.</p>	<p>Equalized cartogram  Concentrating each unit on a map to equalize and relationships can be difficult to represent, voting regions with equal value.</p>
<p>Lollipop  Lollipops draw more attention to the data values than standard bar/line and value effectively.</p>	<p>Lollipop  Lollipops draw more attention to the data values than standard bar/line and value effectively.</p>	<p>Population pyramid  A standard way for showing the age and sex breakdown of a population distribution, effectively, back to back histograms.</p>	<p>Cumulative curve  A good way of showing how much of a distribution is always cumulative, it is always a measure.</p>	<p>Calendar heatmap  A great way of showing temporal patterns (daily, weekly, monthly) - at the expense of showing precision in quantity.</p>	<p>Proportional symbol  Use when there are big variations between values and/or seeing few differences between data is not so important.</p>	<p>Veronut  A way of having points into areas - any that point further away is closer to the central between data is not so important.</p>	<p>Scalded cartogram (value)  Overlaying and shrinking a map so that point further away is closer to the central between data is not so important.</p>	<p>Scalded cartogram (value)  Overlaying and shrinking a map so that point further away is closer to the central between data is not so important.</p>
<p>Bump  Effective for showing changes across multiple dates. For large datasets, consider grouping lines using colour.</p>	<p>Bump  Effective for showing changes across multiple dates. For large datasets, consider grouping lines using colour.</p>	<p>Cumulative curve  A good way of showing how much of a distribution is always cumulative, it is always a measure.</p>	<p>Frequency polygons  For displaying multiple distributions of data. Like a regular line chart, but linked to a measuring precision in quantity.</p>	<p>Calendar heatmap  A great way of showing temporal patterns (daily, weekly, monthly) - at the expense of showing precision in quantity.</p>	<p>Isotype (Giotropism)  Excellent solution in some instances - use only with whole numbers (do not use off an arm to represent a decimal).</p>	<p>Arc  A heuristic, often used for illustrating parliamentary composition by number of seats.</p>	<p>Dot density  Used to show the location of individual events/locations - make sure to include any patterns the reader should see.</p>	<p>Dot density  Used to show the location of individual events/locations - make sure to include any patterns the reader should see.</p>
<p>Beeswarm  Use to emphasise individual points in a distribution. Points can be sized to vary with medium-sized datasets.</p>	<p>Beeswarm  Use to emphasise individual points in a distribution. Points can be sized to vary with medium-sized datasets.</p>	<p>Frequency polygons  For displaying multiple distributions of data. Like a regular line chart, but linked to a measuring precision in quantity.</p>	<p>Cumulative curve  A good way of showing how much of a distribution is always cumulative, it is always a measure.</p>	<p>Calendar heatmap  A great way of showing temporal patterns (daily, weekly, monthly) - at the expense of showing precision in quantity.</p>	<p>Isotype (Giotropism)  Excellent solution in some instances - use only with whole numbers (do not use off an arm to represent a decimal).</p>	<p>Gridplot  Good for showing % information, they work best with small whole numbers and don't have to be in a multiple layout form.</p>	<p>Heat map  Grid based data values mapped with an intensity color scale. As choropleth maps - but not accepted by an administrative unit.</p>	<p>Heat map  Grid based data values mapped with an intensity color scale. As choropleth maps - but not accepted by an administrative unit.</p>
<p>Priority timelines  Use when date and duration are key elements of the story in the data.</p>	<p>Priority timelines  Use when date and duration are key elements of the story in the data.</p>	<p>Frequency polygons  For displaying multiple distributions of data. Like a regular line chart, but linked to a measuring precision in quantity.</p>	<p>Cumulative curve  A good way of showing how much of a distribution is always cumulative, it is always a measure.</p>	<p>Calendar heatmap  A great way of showing temporal patterns (daily, weekly, monthly) - at the expense of showing precision in quantity.</p>	<p>Isotype (Giotropism)  Excellent solution in some instances - use only with whole numbers (do not use off an arm to represent a decimal).</p>	<p>Gridplot  Good for showing % information, they work best with small whole numbers and don't have to be in a multiple layout form.</p>	<p>Heat map  Grid based data values mapped with an intensity color scale. As choropleth maps - but not accepted by an administrative unit.</p>	<p>Heat map  Grid based data values mapped with an intensity color scale. As choropleth maps - but not accepted by an administrative unit.</p>
<p>Parallel coordinates  An alternative to radar charts - again, the relationships of the variables is important. Usually benefits from being organised in a way that make sense to reader.</p>	<p>Parallel coordinates  An alternative to radar charts - again, the relationships of the variables is important. Usually benefits from being organised in a way that make sense to reader.</p>	<p>Frequency polygons  For displaying multiple distributions of data. Like a regular line chart, but linked to a measuring precision in quantity.</p>	<p>Cumulative curve  A good way of showing how much of a distribution is always cumulative, it is always a measure.</p>	<p>Calendar heatmap  A great way of showing temporal patterns (daily, weekly, monthly) - at the expense of showing precision in quantity.</p>	<p>Isotype (Giotropism)  Excellent solution in some instances - use only with whole numbers (do not use off an arm to represent a decimal).</p>	<p>Gridplot  Good for showing % information, they work best with small whole numbers and don't have to be in a multiple layout form.</p>	<p>Heat map  Grid based data values mapped with an intensity color scale. As choropleth maps - but not accepted by an administrative unit.</p>	<p>Heat map  Grid based data values mapped with an intensity color scale. As choropleth maps - but not accepted by an administrative unit.</p>



Visual vocabulary

Designing with data

There are so many ways to visualise data - how do we know which one to pick? Use the categories across the top to decide which data relationship is most important in your story, then look at the different types of chart within the category to form some initial ideas about what might work best. This list is not meant to be exhaustive, nor a wizard, but is a useful starting point for making informative and meaningful data visualisations.

FT graphic: Alex Shirok; Chris Campbell; Ben Liss; Fawaz; Graham Gherin; Phil Dunning; Stephen Paul; Nick Clarke; Martin Dudgeon; Inspired by The Graphic: Continuum by Jon Schwabish and Semirio Ribera

 ft.com/vocabulary

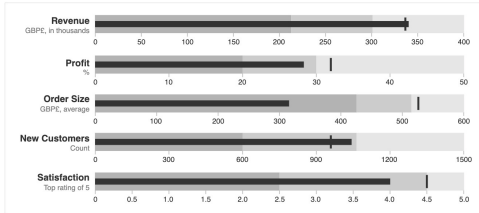


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How to choose the right chart type for your paper? Tool 2

Bullet Graph



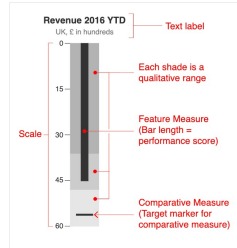
Description

Used typically to display performance data, a Bullet Graph functions like a Bar Chart, but is accompanied by extra visual elements to pack in more context. Originally, Bullet Graphs were developed by Stephen Egan as an alternative to dashboard gauges and meters, because they often displayed not enough information, were less space-efficient and were cluttered with "chartjunk".

In a Bullet Graph, the main data value is encoded by length with the bar in the centre of the chart, which is known as the **Feature Measure**. The line marker that runs perpendicular to the orientation of the graph is known as the **Comparative Measure** and is used as a target marker to compare against the Feature Measure value. So if the main bar has passed the position of Comparative Measure, you know you've hit your goal.

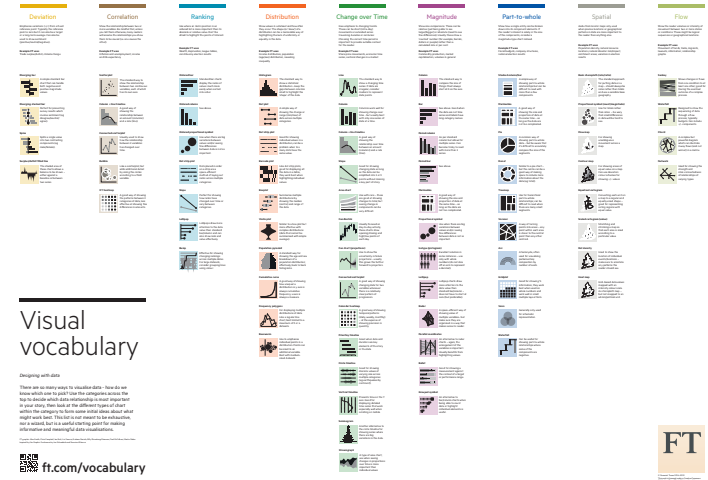
The segmented coloured bars behind the Feature Measure are used to display qualitative range scores. Each colour shade (the three shades of grey in the example above) are used to assign a performance range rating. So for example, poor, average and great. When using Bullet Graphs, it's ideal to keep the maximum number of performance ranges to five.

Anatomy



The Data Visualisation Catalogue

<https://datavizcatalogue.com>



Visual Vocabulary by Financial Times

<http://ft.com/vocabulary>

How to choose the right chart type for your paper? (1)

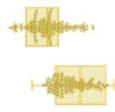
Distribution



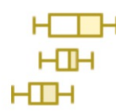
Barcode Plot



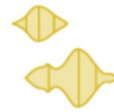
Bean Plot



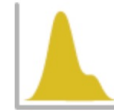
Bee Swarm Box Plot



Box Plot



Box-Percentile Plot



Density Plot



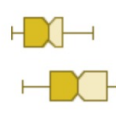
Dot Distribution Plot



HDR Box Plot



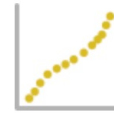
Histogram



Notched Box Plot



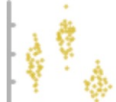
Population Pyramid



Q-Q Plot



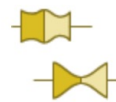
Ridgeline Plot



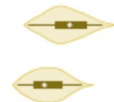
Sina Plots



Stem & Leaf Plot



Vase Plot



Violin Plot

How to choose the right chart type for your paper? (2)

Ranges and Correlations



Barbell Plot



Gantt Chart



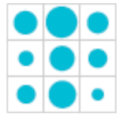
Ranged Area
Graph



Span Chart



Bubble Chart



Correlation
Matrix



Heatmap



Scatterplot

<https://datavizcatalogue.com/blog/chart-selection-guide/>

How to choose the right chart type for your paper? (3)

Comparisons (e.g., across categories)



Bar Chart



Bullet Graph



Column Chart



Dot Graph



Grouped Bar
Chart



Lollipop Chart



Pictogram Chart



Radial Column
Chart



Side by Side Bar
Chart



Slopegraph



Stacked Bar
Chart



Unit Chart

<https://datavizcatalogue.com/blog/chart-selection-guide/>

How to choose the right chart type for your paper? (4)

Proportions (e.g., a parts-to-a-whole relationship)



Bubble Chart



Bubble Map



Circle Packing



Demers
Cartogram



Dorling Map



Marimekko
Chart



Parallel Sets



Pie Chart



Proportional
Area Chart



Sankey Diagram



Treemap



Unit Chart
(Area)



100% Stacked
Bar Chart



Donut Chart



Marimekko
Chart



Pie Chart



Treemap



Waffle Chart

How to choose the right chart type for your paper? (5)

Geographical



Bubble Map



Cartogram



Choropleth Map



Connection
Map



Demer
Cartogram



Dorling Map



Dot Map



Flow Map



Isochrone Map



Non-contiguous
Cartogram



Tile Grid Map

<https://datavizcatalogue.com/blog/chart-selection-guide/>

How to choose the right chart type for your paper? (6)

Data over time



Area Graph



Connected
Scatterplot



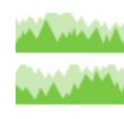
Control Chart



Gantt Chart



Heatmap



Horizon Plot



Line Graph



Run Chart



Spiral Plot



Stacked Area
Graph



Streamgraph



Timeline

<https://datavizcatalogue.com/blog/chart-selection-guide/>

How to choose the right chart type for your paper? (7)

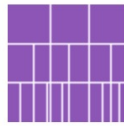
Hierarchy



Circular Tree
Diagram



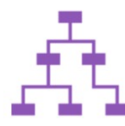
Circular
Treemap



Icicle Chart



Sunburst
Diagram



Tree Diagram

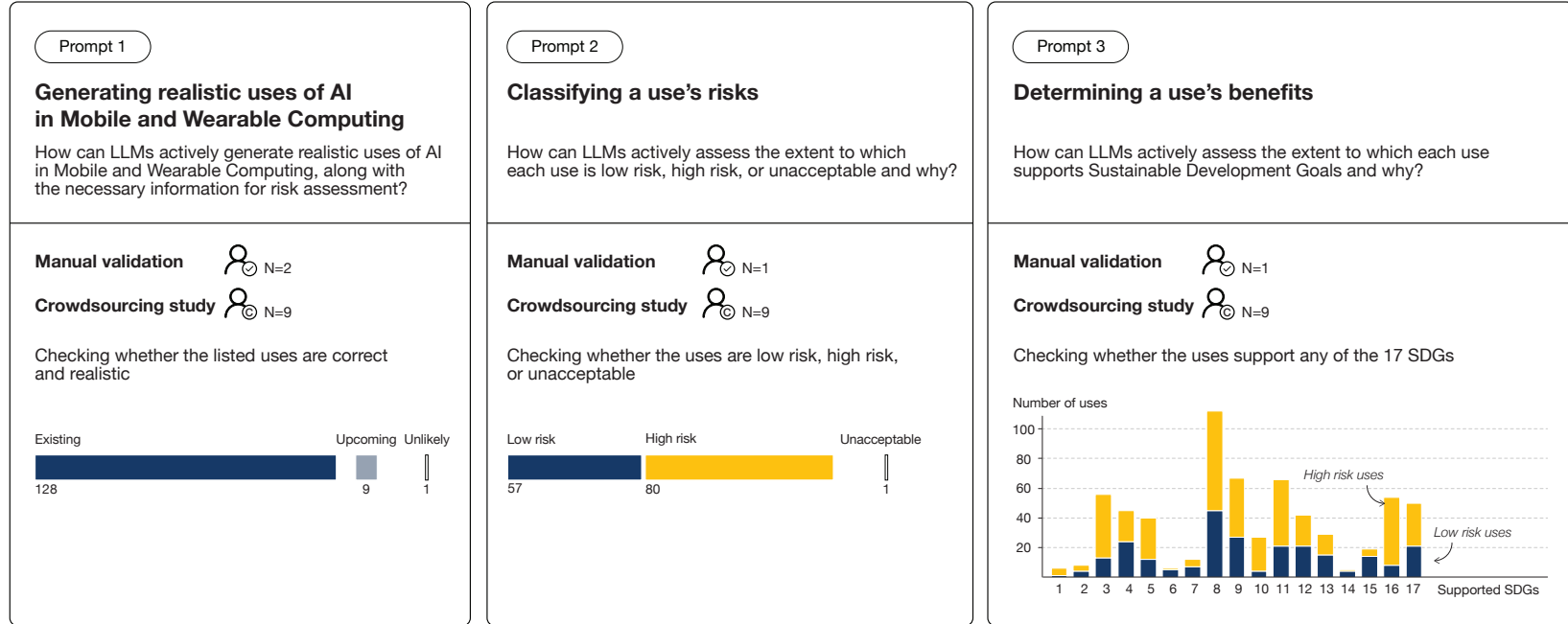


Treemap

<https://datavizcatalogue.com/blog/chart-selection-guide/>

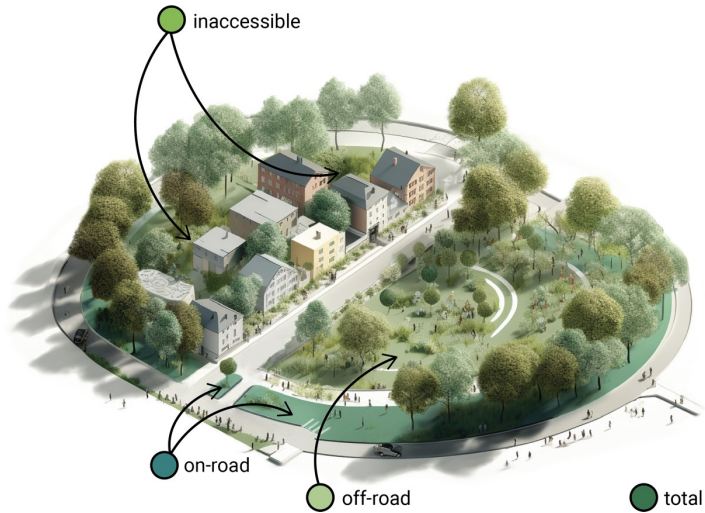
How to choose the right chart type for your paper? (7)

Illustration (Teaser of a 3-prompt method)



How to choose the right chart type for your paper? (7)

Illustration



E System role

A Instructions

- (1) Classification
- (2) Four steps
- (3) Make accurate judgments
- (4) Consider all regulations

B Legal documents

Relevant Section of the EU AI Act (for what is unacceptable and high-risk) and its amendments

C Placeholder for an LLM-generated use to be assessed along five risk concepts

D Output structure

```

messages = [
  {
    'role': 'system',
    'content': ""You are an experienced regulatory compliance specialists who works in the field of AI technology regulation. You are thoughtful, decisive, experienced and conscientious. You have access to the entirety of the EU AI Act and its amendments, which outline how various AI technologies are to be regulated and risk-classified within the European Union.""
  },
  {
    'role': 'user',
    'content': "Classify the following AI system by utilizing a three-tier classification: 1) Unacceptable Risk, 2) High Risk, and 3) Not Classified as High Risk or Unacceptable Risk. Follow these four steps below: 1. Write a brief description of the AI system, using similar language to the EU AI Act. The description should start with 'The AI system intended to be used ...', and be no longer than two sentences. 2. Determine whether the AI system is of Unacceptable Risk or High Risk, providing the exact text from the EU AI Act and explaining the reasoning. Be very strict and verify the reasoning. Assume High Risk unless there is clear evidence for Unacceptable Risk. Pay particular attention to the subject and user of the AI system, as this is critical for classification. Ensure that the subject and user align with the text. They are very important. Also, ensure that you understand the purpose and the capability of the AI system as this is highly critical for the risk classification. For example, the capability to verify patient identities by using AI technology implies the use of biometric identification of patients. Be aware of these and similar cases. 3. Go through all the amendments to the EU AI Act and ensure that nothing has changed that would affect the classification. If something has changed, update the classification accordingly and explicitly reference the amendment that most closely resembles the AI system. The amendments can be found under the text: 'Here are some important amendments to the Act:' 4. If the AI system is neither High Risk nor Unacceptable Risk, classify it as Not Classified as High Risk or Unacceptable Risk. It is of utmost importance to exercise precision and make accurate judgments when classifying the risk associated with the AI system. Please carefully consider all the regulations listed below during the risk classification of the AI system: The relevant portions of the Act for what is unacceptable: 5.2.2. PROHIBITED ARTIFICIAL INTELLIGENCE PRACTICES (TITLE II) Title II establishes a list of prohibited AI [continued ...] The relevant portions of the Act for what is high risk: CLASSIFICATION OF AI SYSTEMS AS HIGH-RISK Article 6. Classification rules for high-risk AI systems [continued ...] Here are some important amendments to the EU AI Act: It is very important to consider them for the risk classification. Please read them carefully: Amendment 709 Proposal for a regulation. Annex III – paragraph 1 – introductory part High-risk AI systems pursuant to Article 6(2) are the AI systems listed in any of the following areas: [continued ...] Here are the details of the AI technology: [1], [1], [1], [1], [1], [1] Please return the classification in the following format: { 'Description': 'The AI system intended to be used ...', 'Classification': '[Unacceptable Risk]/[High Risk]/[Not Classified as High Risk or Unacceptable Risk]', 'Relevant Text from the EU AI Act': '[Quotation if applicable] - include the amendment or EU AI Act section that most closely resembles the text.', 'Reasoning': '[Explanation]' } }
response = get_completion_from_messages(messages)
print(response)
    
```

Part 2

Write clear, self-contained captions
for your figures

Write captions that do more than just name the chart

State what is being measured and what the reader should notice - highlight the pattern or anomaly.

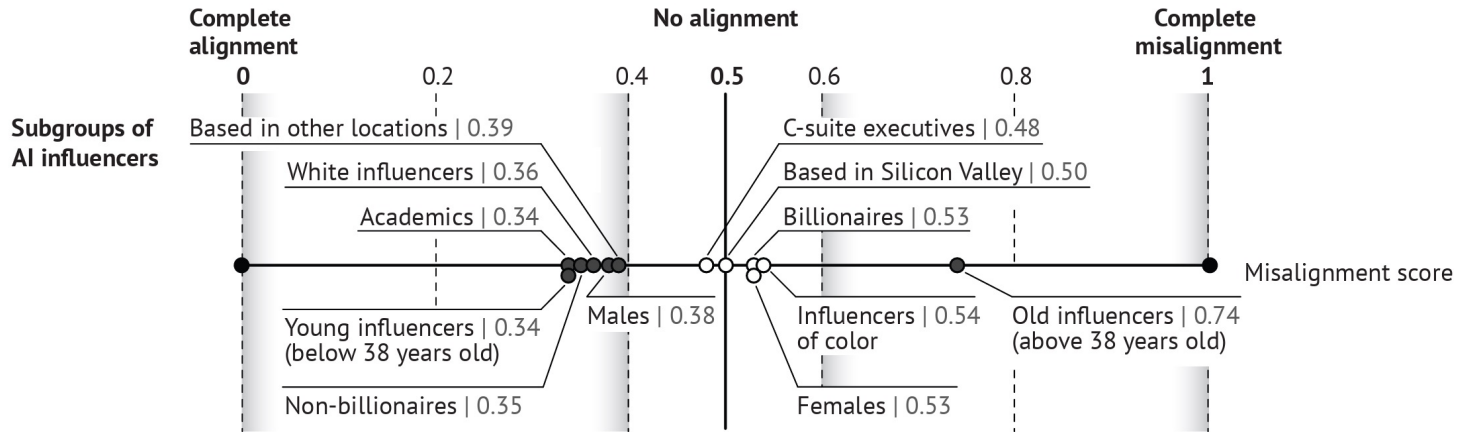


Figure 6: Misalignment scores between subgroups of AI influencers and participants representative of the U.S. population. Young influencers' views are most closely aligned with those of our participants, followed by academics and non-billionaires.

<https://social-dynamics.net/docs/fears-and-hopes.pdf>

Write captions that do more than just name the chart

Include extra details for more complex charts:

- Any transformations or scales used
- Statistical notes (e.g., error bars show 95% CI)

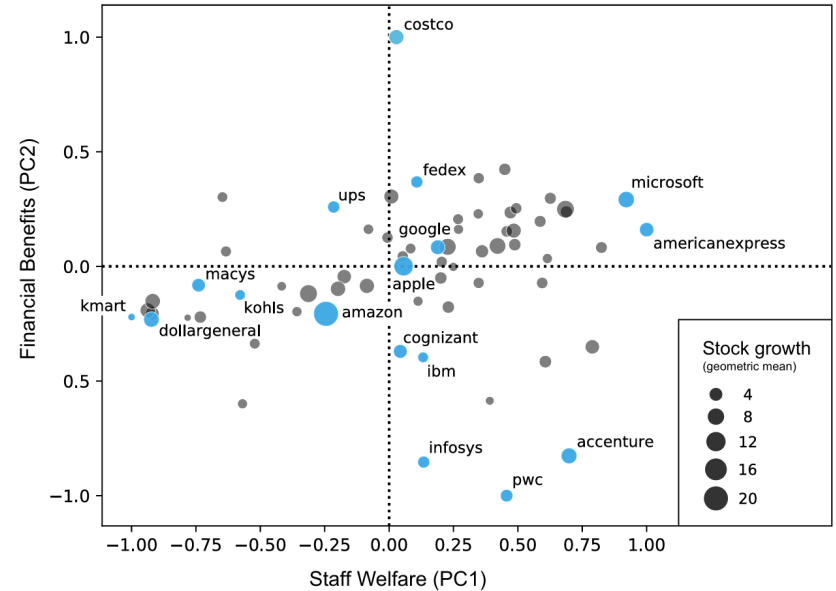


Fig. 7 Scatterplot of the scores of each company's staff welfare vs. financial benefits. The size of a company's dot represents its stock growth. We highlighted in blue some of the companies to assess them qualitatively. Consumer staples and discretionary companies like Kmart, Macy's, and Kohl's scored low for both types of sustainability. Traditional IT companies like Infosys, IBM, and Accenture scored high for staff welfare sustainability but not for financial benefits sustainability.

How to choose the right chart type for your paper? (7)

Link each part of the figure to the caption text

A

System's name
One-line summary of the system's intended use

SYSTEM'S DESCRIPTION
Short paragraph describing the system's purpose (Purpose), the subjects it affects (AI Subject), who deploys it (AI Deployer), the application domain it operates in (Domain), and its core technical capability (Capability).

RISK SUMMARY BAR
Min. Lim. High Unacc.

Risk summary bar indicating the system's overall risk classification under the EU AI Act: minimal, limited, high, or unacceptable risk

Explanation of the system's risk classification under the EU AI Act
A relevant excerpt from the Act

B

BENEFITS
List of benefits primarily (not) enjoyed by each of the three stakeholder types

Benefit 1

Benefit 2

IMPACT ASSESSMENT REPORT
available in multiple formats including Braille

Card's last update date

RISKS
List of risks very low low high very high

MITIGATION STRATEGIES
List of mitigation strategies linked to the risks they are intended to reduce and stakeholder types at risk

Capability Risks
Risk 1 Mitigation 1

Human Interaction Risks
Risk 2 Mitigation 2

Systemic Risks
Risk 3 Mitigation 3

SYSTEM'S DATA
Currently used Personally identifiable information

Data type 1

Potential future uses
Data type 2

PERFORMANCE OF MODELS ON DATA
Data Model Version Metrics

Data type 1 Name and version of the model used to process this data Metric name
One-line explanation of what it evaluates in the context of this system's use
Result (e.g., percentage)

C

REPORTING RISKS
Channels available for submitting reports or concerns

REGISTERED OFFICE
Legal address of the entity responsible for developing, deploying, or operating this system's use

CERTIFICATES
Industry and legal compliance certifications related to this system's use

Fig. 1. **Template of the Impact Assessment Card showing AI risks and benefits in plain terms.** Section A includes the system's name, purpose, and EU AI Act risk level. Section B outlines benefits, risks with mitigations, and technical details. Section C lists reporting channels, registered office, and certifications. Examples of cards for four AI systems appear in Appendix A.6–A.7 and online at: <https://social-dynamics.net/ai-risks/impact-card/>.

Part 3

Avoid the most common figure mistakes

Chart organization

- **One figure for all key metrics:** For quantitative results, it's good to have one figure that shows all the key metrics.

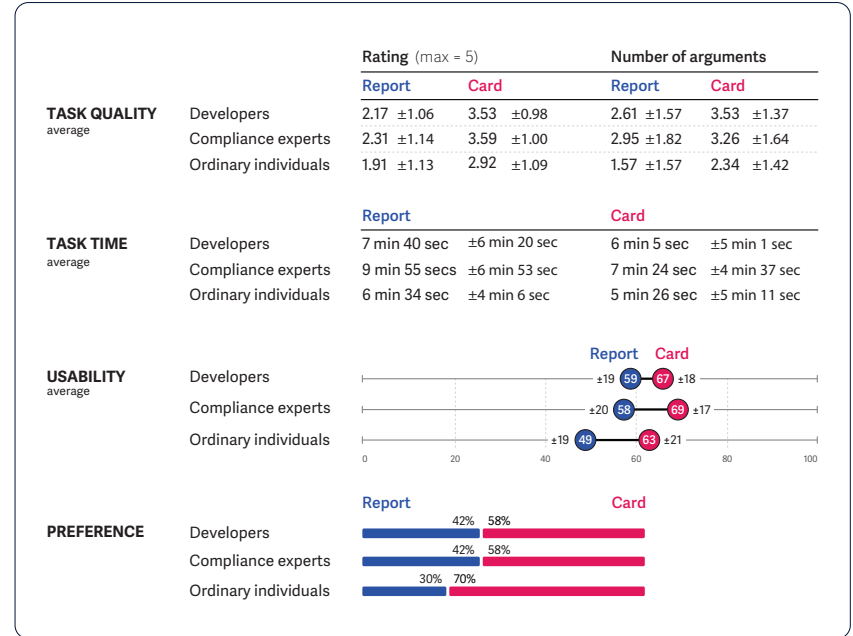
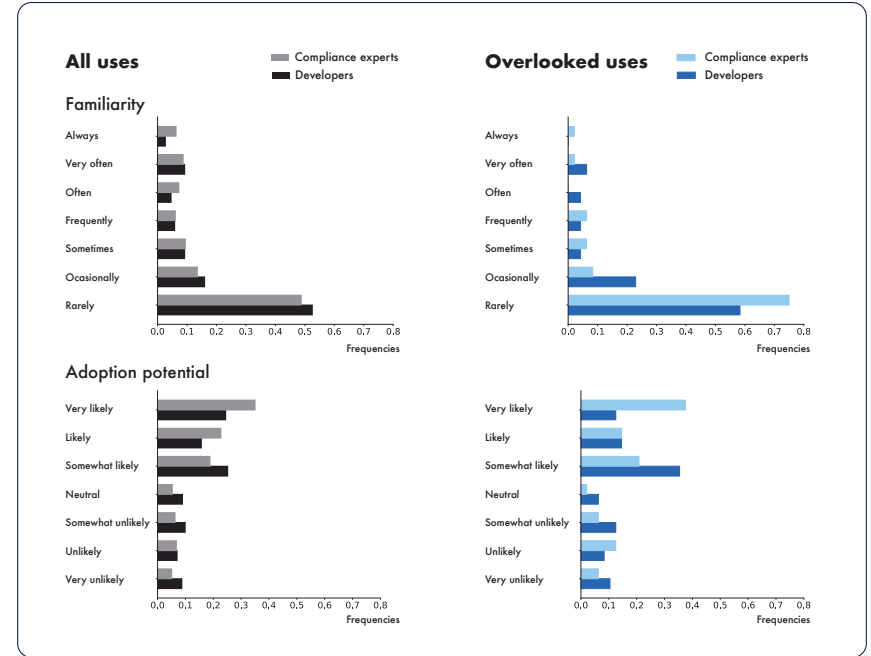


Chart organization

- **One figure for all key metrics:** For quantitative results, it's good to have one figure that shows all the key metrics.
- **Split when needed:** if a chart must cover multiple related insights, use panels instead of crowding everything into one image.



1

Risky and Beneficial Uses

We are requesting you about 4 AI use cases for mobile devices (the photos and conversations) can be used: face and security. Every one you significant control risk to the safety, fundamental rights, or freedom of individuals and are listed in the EU Artificial Intelligence Act (EU AI Act). Beneficial uses support Sustainable Development Goals (SDGs).

Your two tasks

First task: you will be asked to read the definitions of 'high' and 'beneficial' uses.

Second task: you will be presented with assessment cards for 48 uses, containing the use risk classification and its justification.

For each use, you will be asked to read the assessment card and answer five mandatory questions:

- Q1 How probable do you find the use?
- Q2 Do you agree with the use risk classification? If not, please correct the classification.
- Q3 Do you agree with the use risk justification?
- Q4 Please explain your reasoning about the use risk classification and justification.
- Q5 Please select all SDGs that the use supports.

Please enter your Profile ID:

www.nokia.com/17124

2

Risky uses are listed in the EU Artificial Intelligence Act (EU AI Act)

EU AI Act is an upcoming regulatory framework for artificial intelligence in European Union. It analyses AI systems in various applications and classifies them based on the risk they present to users into **unacceptable, high risk and low risk uses**.

Unacceptable uses: These are AI applications that are deemed incompatible with EU values or are inherently prohibited. These uses are prohibited outright due to their potential to cause significant harm or violate fundamental rights and freedoms. Examples of unacceptable uses include AI systems designed to manipulate vulnerable categories of users, facilitate discrimination, or engage in fraud or identity theft. The EU AI Act bans in principle the development and deployment of such applications within the European Union.

High risk uses: These are AI applications that pose significant potential risks to the safety, fundamental rights, or freedom of individuals. These uses might include those related to health, safety, or emergency response, as primary examples of high risk uses include AI in critical infrastructure, law enforcement, healthcare, or transportation. These applications are subject to rigorous requirements and oversight to mitigate potential harm.

Low risk uses: These are AI applications that have a lower potential to cause harm to individuals or society. They are considered to pose minimal risks to safety, fundamental rights, or freedoms. Examples of low risk uses might include AI in entertainment, customer service, or basic administrative tasks. While these applications are subject to some regulations, they generally have fewer compliance requirements compared to high risk uses.

This is a simple color test. When asked for your favorite color you must select 'Green'. This is an attention check.

Red
 Blue
 Yellow
 Green
 Black

3

Beneficial uses support Sustainable Development Goals (SDGs)

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are calls to action for the development of a better world.

SDG 1 - No Poverty: End poverty in all its forms everywhere.

SDG 2 - Zero Hunger: End hunger, achieve food security and improved nutrition, and support sustainable agriculture.

SDG 3 - Good Health and Well-being: Ensure healthy lives and support well-being for all at all ages.

SDG 4 - Quality Education: Ensure inclusive and equitable quality education and support lifelong learning opportunities for all.

SDG 5 - Gender Equality: Achieve gender equality and empower all women and girls.

SDG 6 - Clean Water and Sanitation: Ensure availability and sustainable management of water and sanitation for all.

SDG 7 - Affordable and Clean Energy: Ensure access to affordable, reliable, sustainable, and modern energy for all.

SDG 8 - Decent Work and Economic Growth: Support sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all.

SDG 9 - Industry, Innovation, and Infrastructure: Build resilient infrastructure, support inclusive and sustainable industrialization, and foster innovation.

SDG 10 - Reduced Inequality: Reduce inequality within and among countries.

SDG 11 - Sustainable Cities and Communities: Make cities and human settlements inclusive, safe, resilient, and sustainable.

SDG 12 - Responsible Consumption and Production: Ensure sustainable consumption and production patterns.

SDG 13 - Climate Action: Take urgent action to combat climate change and its impacts.

SDG 14 - Life Below Water: Conserve and sustainably use the oceans, seas, and marine resources for sustainable development.

SDG 15 - Life on Land: Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

SDG 16 - Peace, Justice, and Strong Institutions: Support peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels.

SDG 17 - Partnerships for the Goals: Strengthen the means of implementation and revitalize the global partnership for sustainable development.

Please confirm that you have read the introduction to the EU AI Act and the SDGs.

I have read the introduction.

6

Thank you

for taking the time to complete this survey.

Click the button below to save your responses and end this survey.

[Submit >](#)

4 5

Annotate uses for their risk classification and support for SDGs

Use #1

Enhancing security through facial recognition using high-performance cameras in smartphones

High risk use

Justification: The AI system is used for biometric identification, which is listed as a high-risk AI system under Article 6(2) and Annex III of the EU AI Act. However, it does not fall under the category of 'Unacceptable Risk' as it does not violate any of the prohibitions listed under Article 5 of the Act. The amendments 710 and 711 further clarify that biometric and biometrics-based systems are considered high-risk, but the system in question does not fall under the exceptions mentioned in Article 5, thus confirming its classification as 'High Risk'.

Q1 How probable do you find this use?

Existing
 Upcoming
 Unrealistic

Q2 Do you agree with the risk classification? ①

Yes
 No

Q3 Do you agree with the risk justification?

Yes
 No

Q4 Please explain your reasoning about the use risk classification and justification.

Q5 Please select all Sustainable Development Goals that this use supports ①

- No Poverty
- Zero Hunger
- Good Health and Well-being
- Quality Education
- Gender Equality
- Clean Water and Sanitation
- Affordable and Clean Energy
- Decent Work and Economic Growth
- Industry, Innovation, and Infrastructure
- Reduced Inequality
- Sustainable Cities and Communities
- Responsible Consumption and Production
- Climate Action
- Life Below Water
- Life on Land
- Peace, Justice, and Strong Institutions
- Partnerships for the Goals

Chart organization

- **One figure for all key metrics:** For quantitative results, it's good to have one figure that shows all the key metrics.
- **Split when needed:** if a chart must cover multiple related insights, use panels instead of crowding everything into one image.
- **Place charts strategically:** position each chart as close as possible to its first mention in the text, ideally at the top or bottom of the page for easy reference → you can use a dummy placeholder pdf while writing

“Forced Me to Think Beyond a Simple List”: AI Design for Improving Risk, Benefit and Mitigation Identification in AI Uses 7

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Fig. 2. Example of a structured Impact Assessment Card generated by *AI Design*, showing three screens: (1) **EU AI Act Classification** for determining system risk category; (2) **Risk Assessment** with identified risks and corresponding mitigation strategies; and (3) **Benefits Analysis** highlighting potential positive impacts of the AI system.

contextually grounded, and more actionable than those produced without dedicated tool support. We now describe the study's setup, evaluation metrics, and execution protocol.

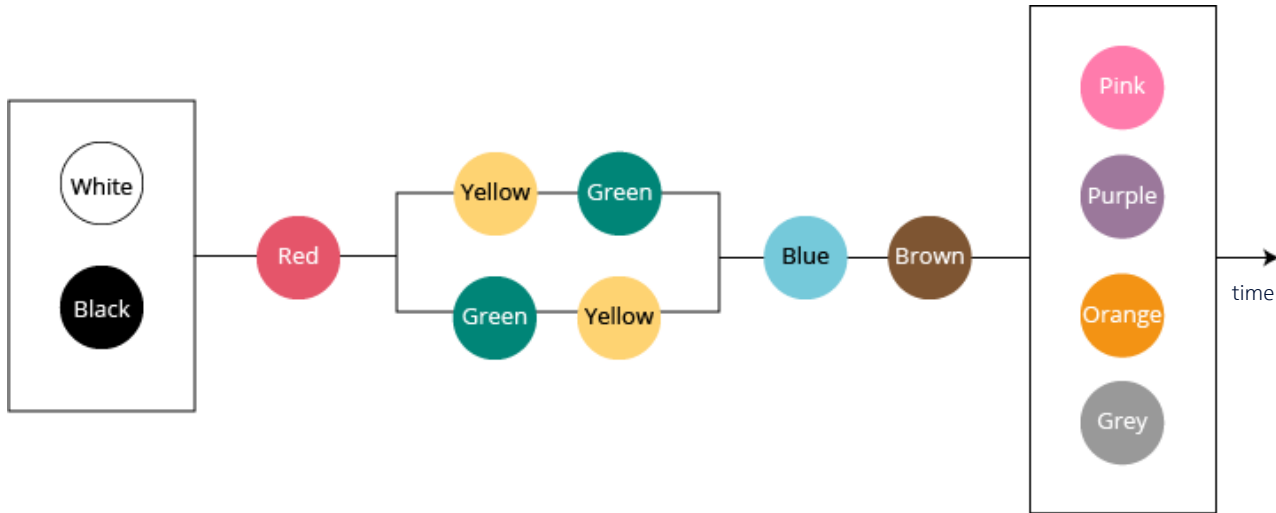
5.1 Study Setup

Treatment. We implemented the evaluation as a web-based study in which participants completed a realistic impact assessment task under one of two conditions:

Chart design principles (1)

Don't use too many colors!

The order of appearance of colour names in languages around the world is fixed and far away from rainbow ;-)

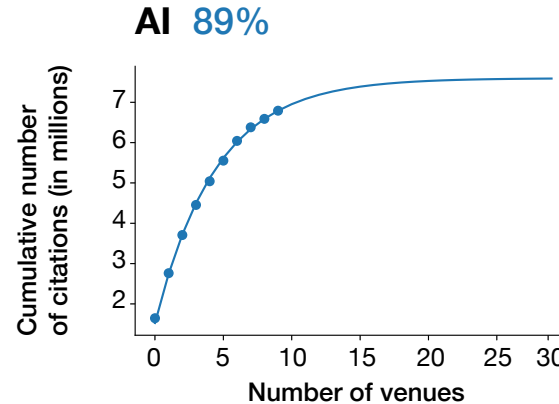
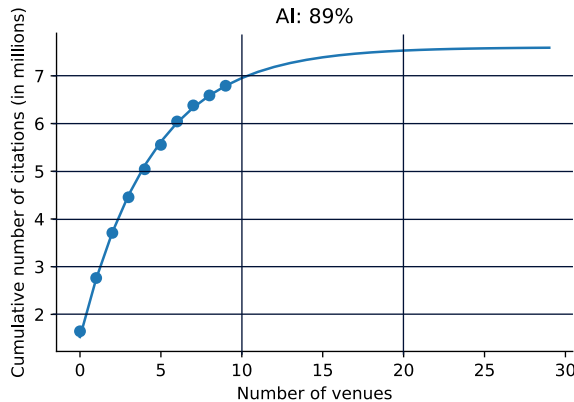


Berlin and Kay (1969); <https://www.eea.europa.eu/data-and-maps/daviz/learn-more/chart-dos-and-donts>

Chart design principles (2)

Use less “ink”

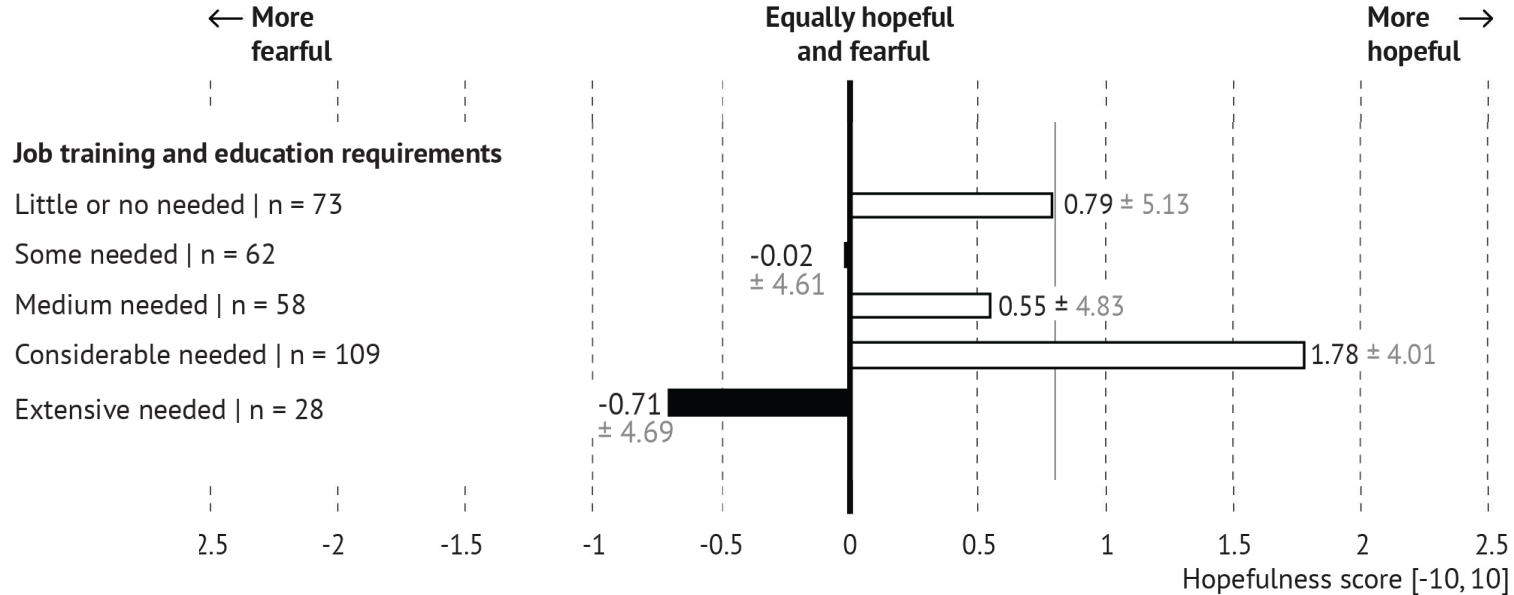
- Remove redundant gridlines, 3D effects, and backgrounds to make your insights pop -> Save your charts as a .pdf and edit them in vector graphic software like Adobe Illustrator, Canvas, or Inkscape
- Use legible fonts: choose a clear sans-serif typeface (e.g., Arial, Helvetica) and set font sizes large enough to remain readable when the chart is resized or printed



<https://social-dynamics.net/docs/rai-impact.pdf>

Chart design principles (3)

Sort and group by size or relevance - not A to Z!



<https://social-dynamics.net/docs/fears-and-hopes.pdf>

Chart design principles (4)

Label like a human

- Use real words, not variable names
- Make axes and legends understandable without reading the full report and twisting your head
- Include sample size (N) when relevant

Chart design principles (4)

Label like a human

patient, image, planning

module, robot, machine

patient, device, medical

computer, test, state

neural network, data, analysis

control, planning, path

control, image, neural network

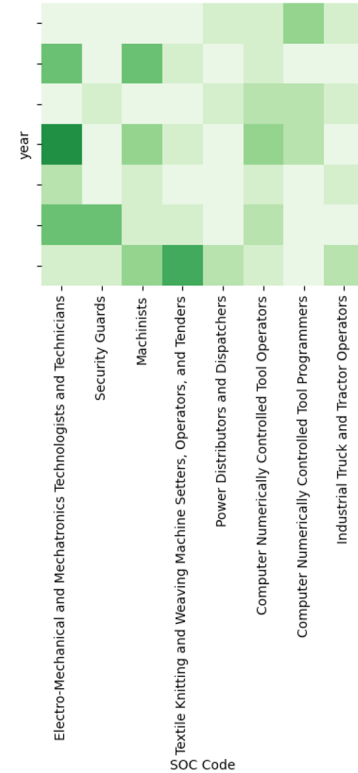
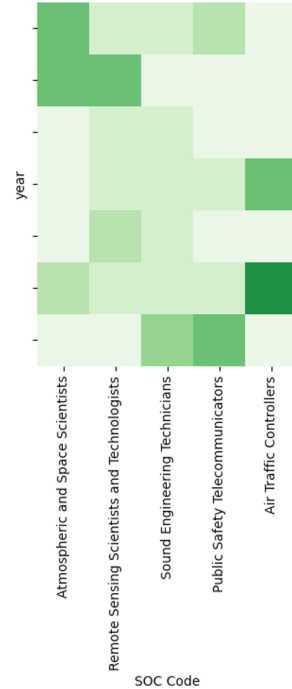
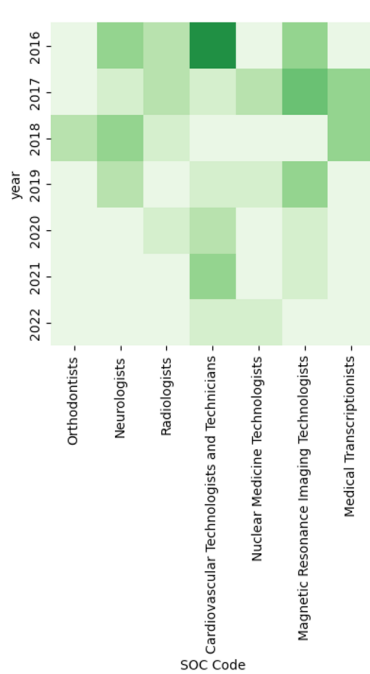
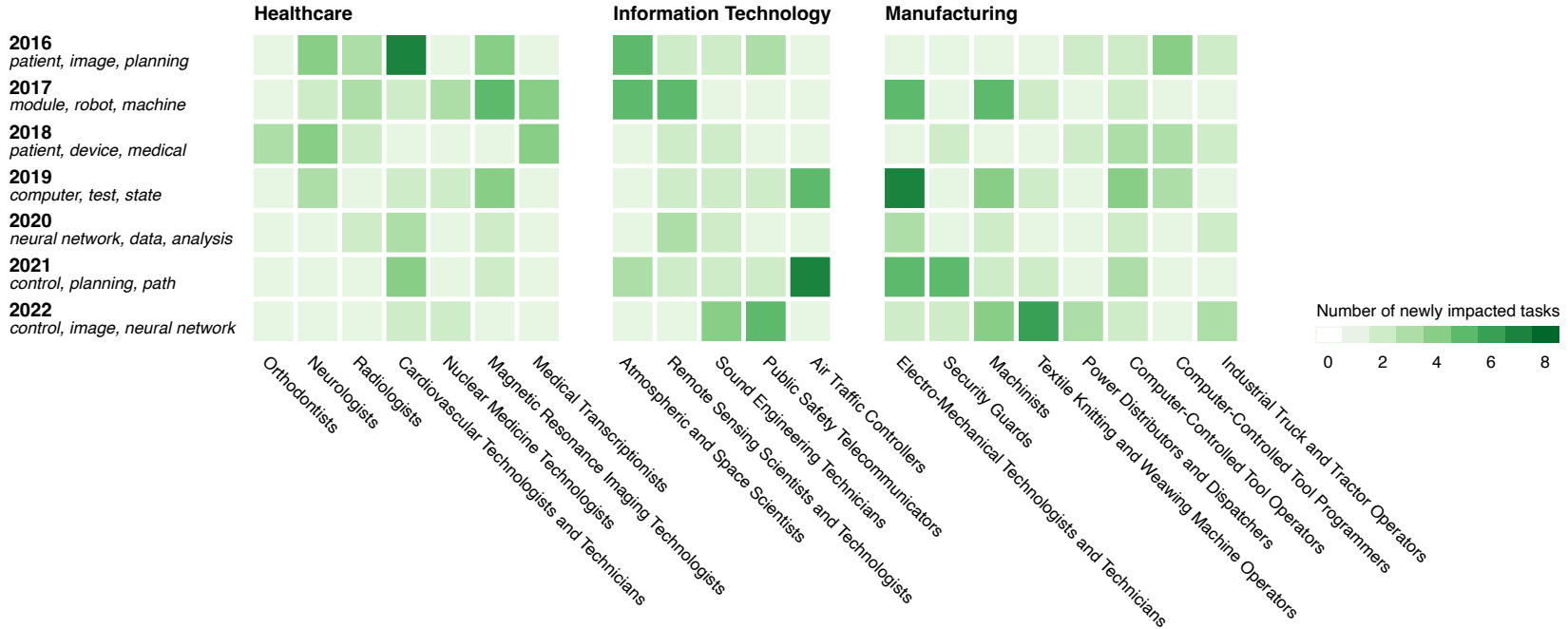


Chart design principles (4)

Label like a human

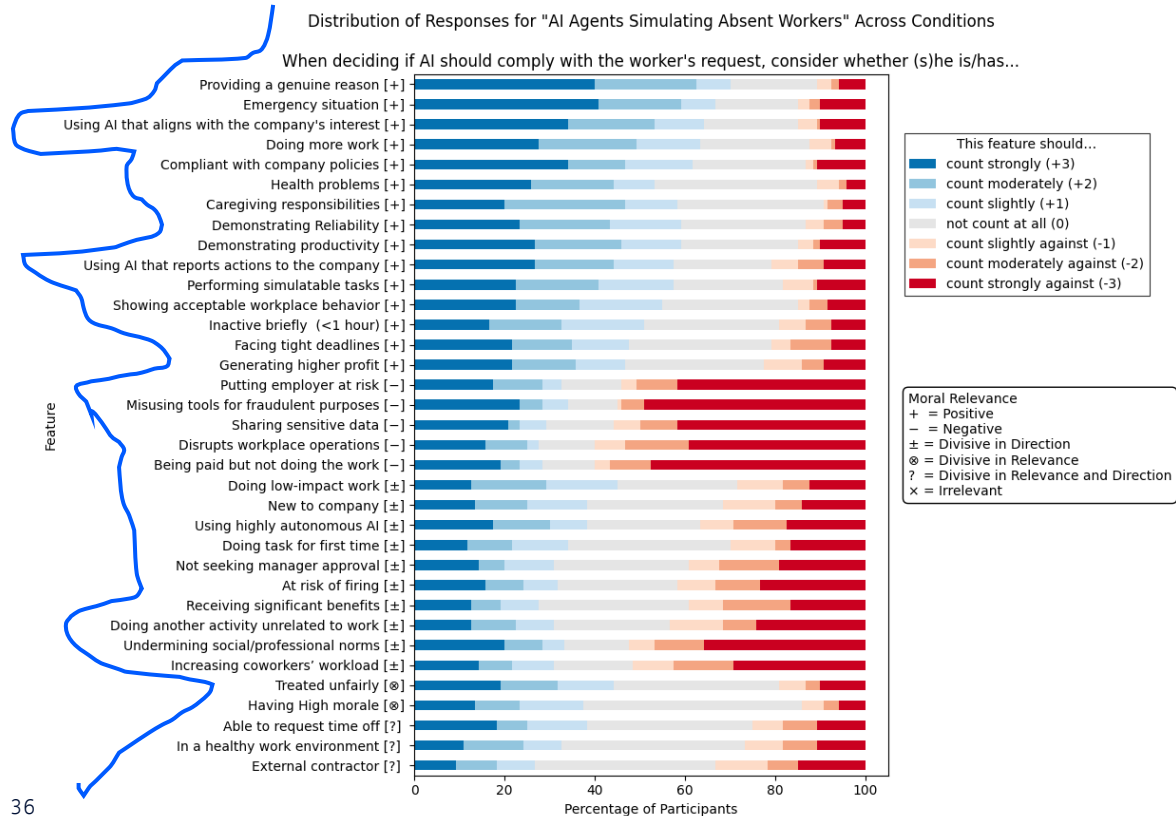


<https://social-dynamics.net/docs/aii.pdf>

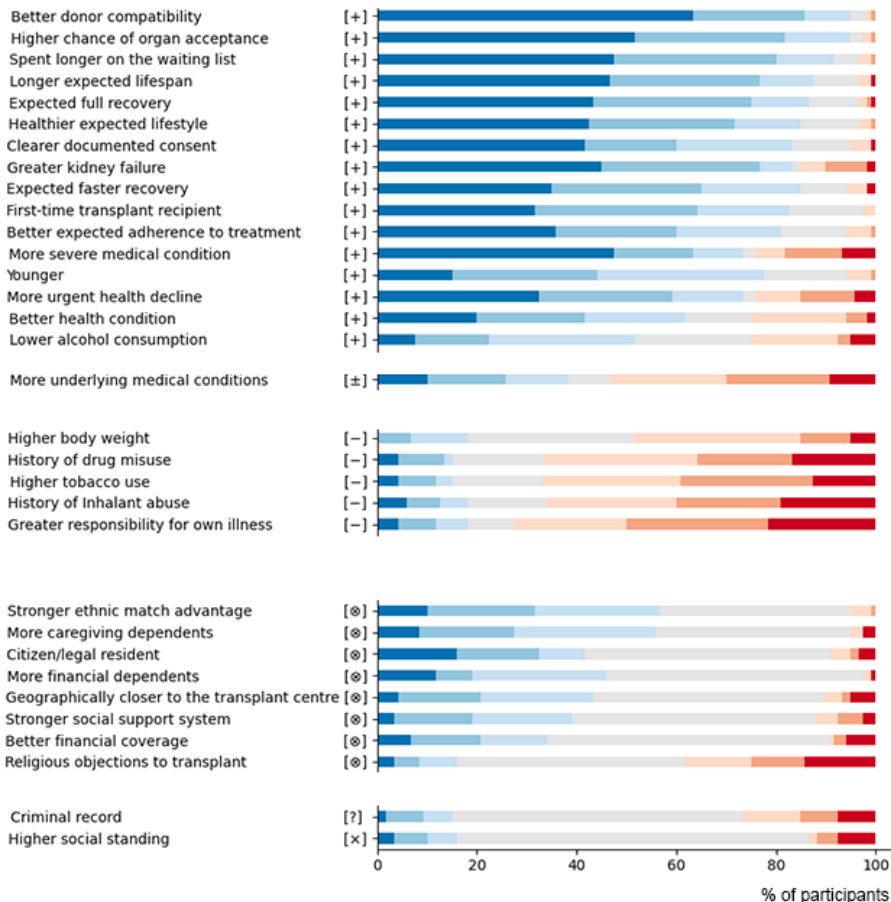
Chart design principles (4)

Guide the reader's eye

V1 of the chart



When the AI decides who will receive the kidney transplant, consider whether they are / have...



This feature should...

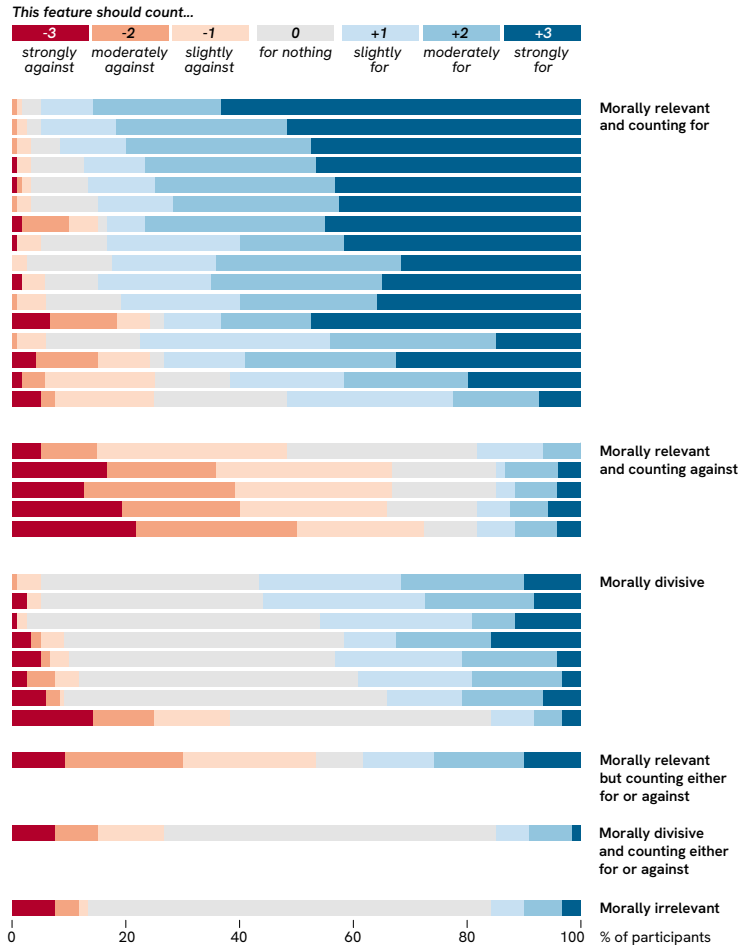
- count strongly in favor (+3)
- count moderately in favor (+2)
- count slightly in favor (+1)
- not count at all (0)
- count slightly against (-1)
- count moderately against (-2)
- count strongly against (-3)

Moral Relevance

- + = Positive
- = Negative
- ± = Divisive in Direction
- ⊗ = Divisive in Relevance
- ? = Divisive in Relevance and Direction
- x = Irrelevant

When the AI decides who will receive the kidney transplant, it should consider whether the patient is/has...

V3 of the chart



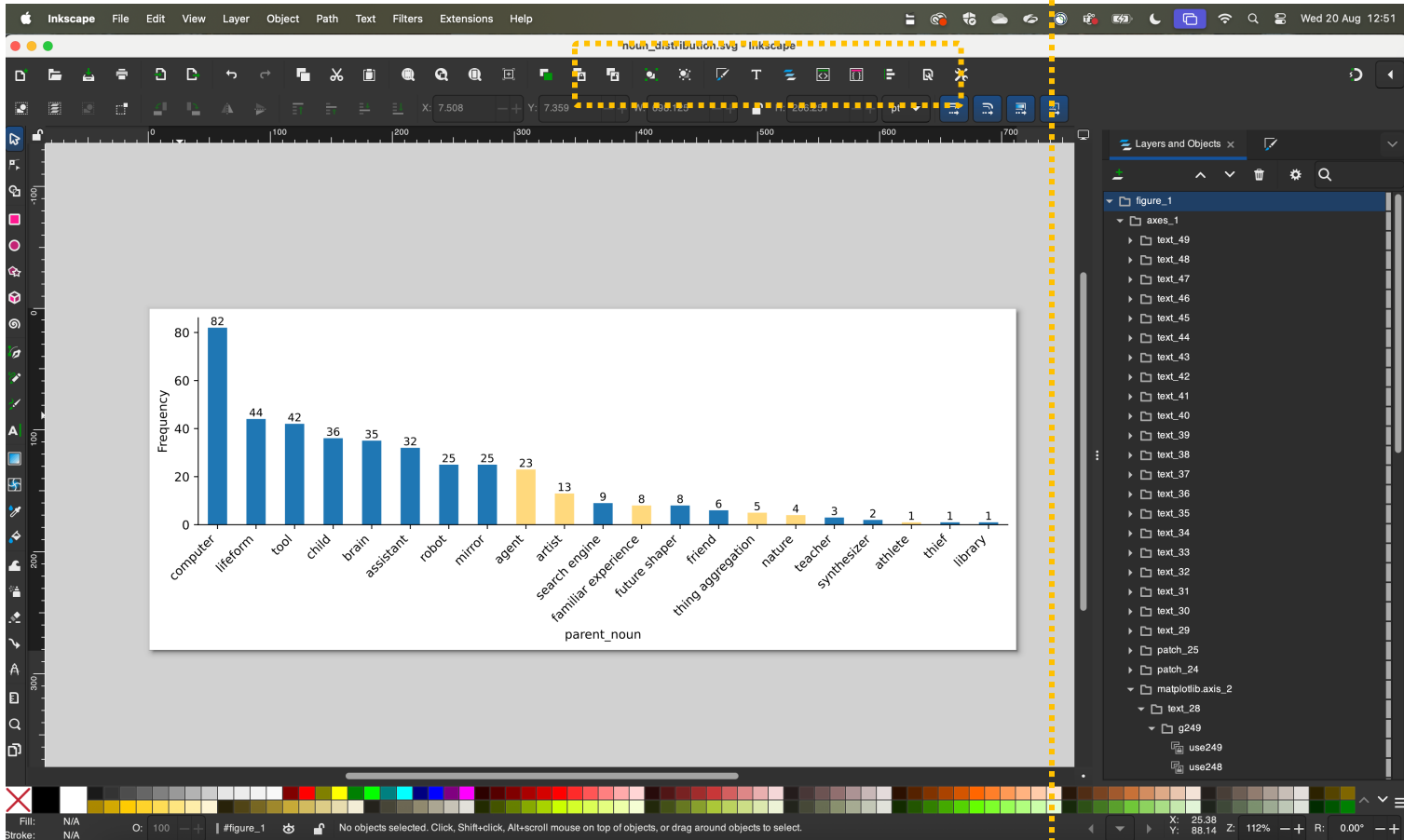
Part 4

Improve your figure production pipeline

Small Python tweaks

- **Set global styles with rcParams:** Define font family, font size (!!!), line widths, and color palette once, and reuse them across all figures for consistency.
- Tool for picking up the colors: <https://mapcolpal.github.io/>
- **Simplify the look:** Remove unnecessary axes, spines, and redundant ticks to keep the focus on the data.

```
ax.spines["top"].set_visible(False)  
ax.spines["right"].set_visible(False)
```
- **Export in vector format:** Save figures as **PDF or SVG**, not PNG, for publication-quality results.
- **Iterate manually:** Do a final pass in Inkscape, Illustrator, or PowerPoint for hand-crafted refinement.



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