Ethical Dimensions of Visualization Research

Presented by Torsten Möller

Resources

- M. Correll, “Ethical Dimensions of Visualization Research,” Conference on Human Factors in Computing Systems (CHI), 2019.
- IEEE 7000 Standard, Sarah Spiekermann
- M. Correll and J. Heer, “Black Hat Visualization,” Workshop on Dealing with Cognitive Biases in Visualisations (DECISIVe), 2017.

Motivation

- Rogaway :

  "I suspect that many of you see no real connection between social, political, and ethical values and what you work on. You don't build bombs, experiment on people, or destroy the environment. You don't spy on populations. You hack math and write papers. This doesn't sound ethically laden. I want to show you that it is."

Motivation

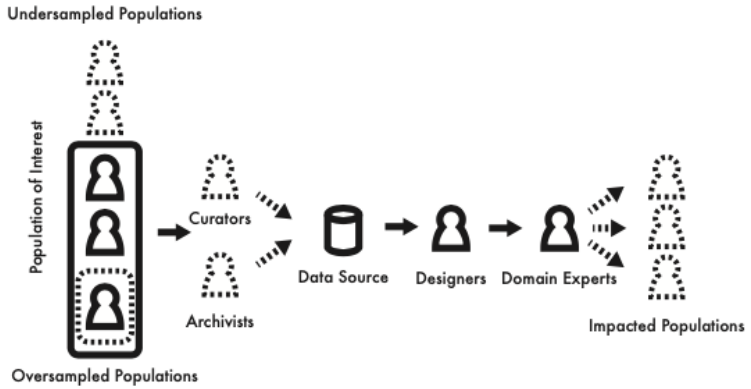
- Heidegger:

  "Everywhere we remain unfree and chained to technology, whether we passionately affirm or deny it. But we are delivered over to it in the worst possible way when we regard it as something neutral."

Main claim

"I will … illustrate that all visualization research, no matter how superficially apolitical or trivial, has a moral character."

(Against) neutrality of data

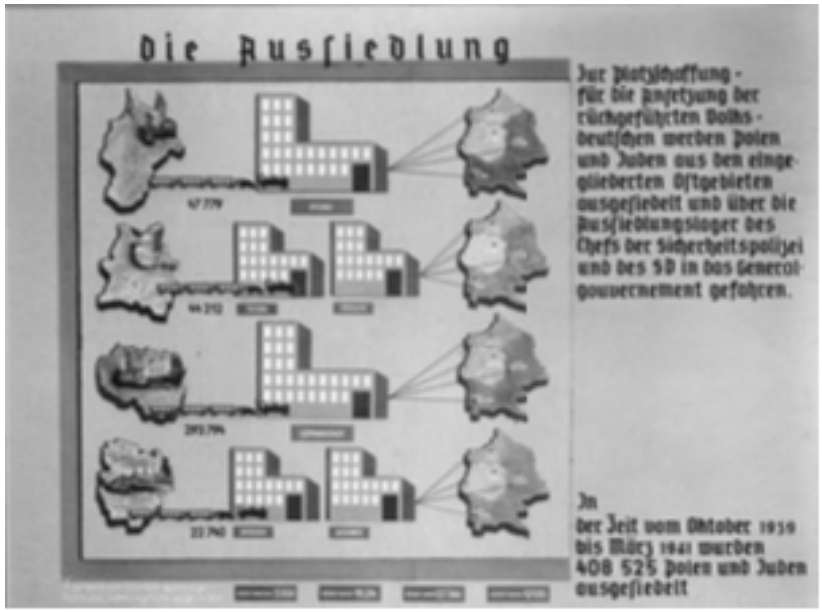


- "Middleman" between data and stakeholder
- "data are not naturally occurring phenomenon. The world does not spontaneously quantify, curate, or data-mine itself. Rather, the process of observing the world and quantifying it is a political act, and deserves ethical consideration"

(Against) neutrality of data

- Achenwall coined the term “Statistik” to be the “science of the state” (1752)
- “The relative emotional distance of collecting and reporting on data (as opposed to managing and reporting on people) arguably contributed to the uniquely bureaucratic horrors of the Holocaust [99], and to what Hannah Arendt refers to as the “banality of evil” [3].”

The banality of evil



Source-destination map

Flow map

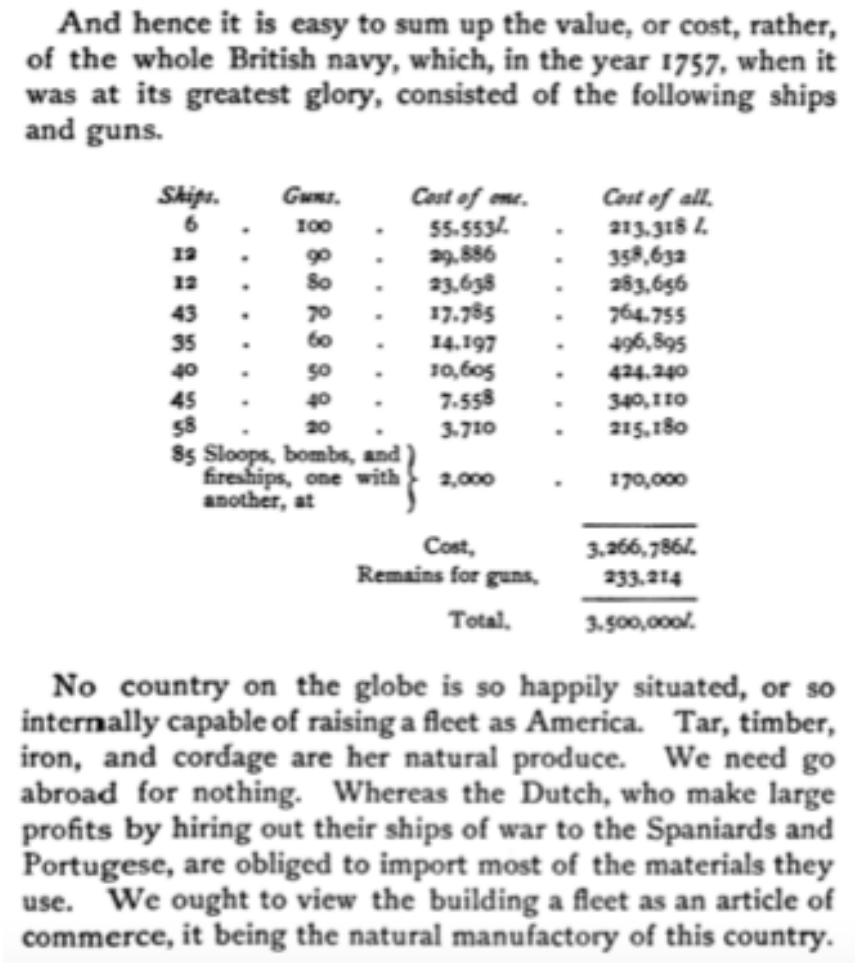
Bundesarchiv. 1940. Planung und Aufbau im Osten. https://en.wikipedia.org/wiki/Heim_ins_Reich

Konrad Meyer and Georg Blohm. 1942. Landvolk im Werden. Deutsche Landbuchhandlung.

(Against) neutrality of data

- There is no such thing as an objective view from nowhere: rather, knowledge is situated [49] within our perspectives and circumscribed by the limits of our experience.
- Often the work that goes into collecting and structuring data is made invisible.

Science of the state



And hence it is easy to sum up the value, or cost, rather, of the whole British navy, which, in the year 1757, when it was at its greatest glory, consisted of the following ships and guns.

Ships.	*Guns.*	*Cost of one.*	*Cost of all.*
6	100	55,553*l.*	213,318 *l.*
12	90	29,886	358,632
12	80	23,638	283,656
43	70	17,785	764,755
35	60	14,197	496,895
40	50	10,605	424,240
45	40	7,558	340,110
58	20	3,710	215,180
85	Sloops, bombs, and fireships, one with another, at	2,000	170,000
		Cost,	3,266,786*l.*
		Remains for guns,	233,214
		Total,	3,500,000*l.*

No country on the globe is so happily situated, or so internally capable of raising a fleet as America. Tar, timber, iron, and cordage are her natural produce. We need go abroad for nothing. Whereas the Dutch, who make large profits by hiring out their ships of war to the Spaniards and Portugese, are obliged to import most of the materials they use. We ought to view the building a fleet as an article of commerce, it being the natural manufactory of this country.

A table from Thomas Paine's 1775 pamphlet Common Sense. These data were collected for an initial accounting purpose, but are used by Paine to argue for the relative weakness and fragility of the English Navy, and the potential strength of the American Navy, as part of an argument for independence and revolution.

(Against) neutrality of visualization

- Drucker: "While it may seem like an extreme statement, I think the ideology of almost all current … visualization is anathema to humanistic thought, antipathetic to its aims and values. The persuasive and seductive rhetorical force of visualization performs such a powerful reification of information that graphics such as Google Maps are taken to be simply a presentation of "what is," as if all critical thought had been precipitously and completely jettisoned."

(Against) neutrality of visualization

- In other words, visualizations often depict data as a given, a collection of facts about the world that brook no argument or disagreement.
- … stifle critical or contradictory voices who do not have their own data sets to point to.
- Designers often exclude representation of factors like the uncertainty of the data or the variability of forecasts for reasons of complexity, scope, or anticipated innumeracy in the audience, which can contribute to the perception that the data are immutable truths about the world, rather than designed artifacts representing one flawed, incomplete, and potentially idiosyncratic set of structured observations
- … communicate authority and certainty in implicit but measurable ways
- danah Boyd (keynote 2021): “the illusion of precision”

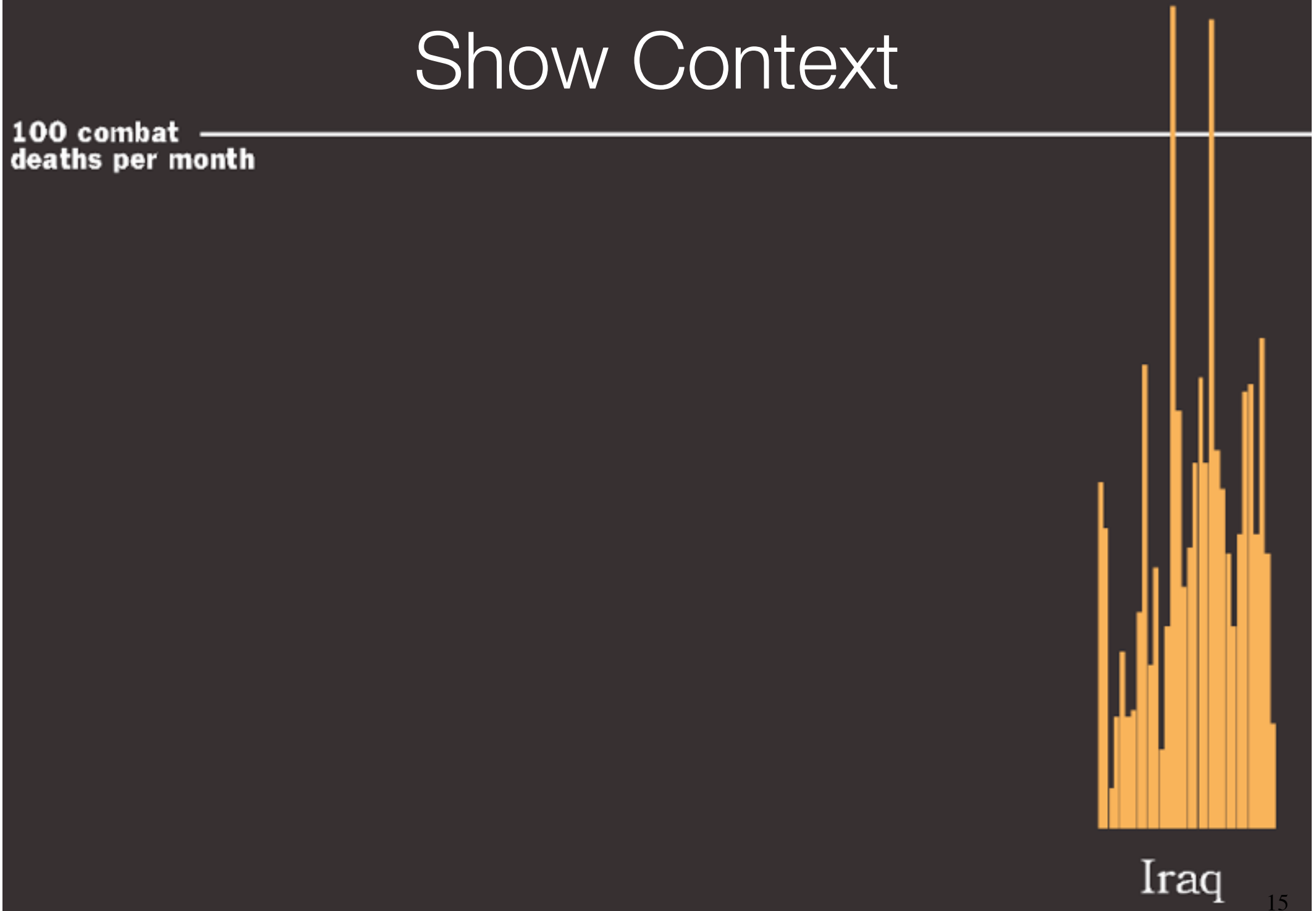
(Against) neutrality of visualization

- Another concern is that data visualization, by presenting the data (rather than the people behind the data), can result in “cruel” and “inhuman” charts. That is, by treating a chart of casualty figures as no different qualitatively than a chart of employment statistics, visualizations can hide the ethical and human suffering underlying the data.
- [recent] experiments … suggest that even designs where the human component of data are made more prominent can fail to significantly impact our empathy with human suffering.

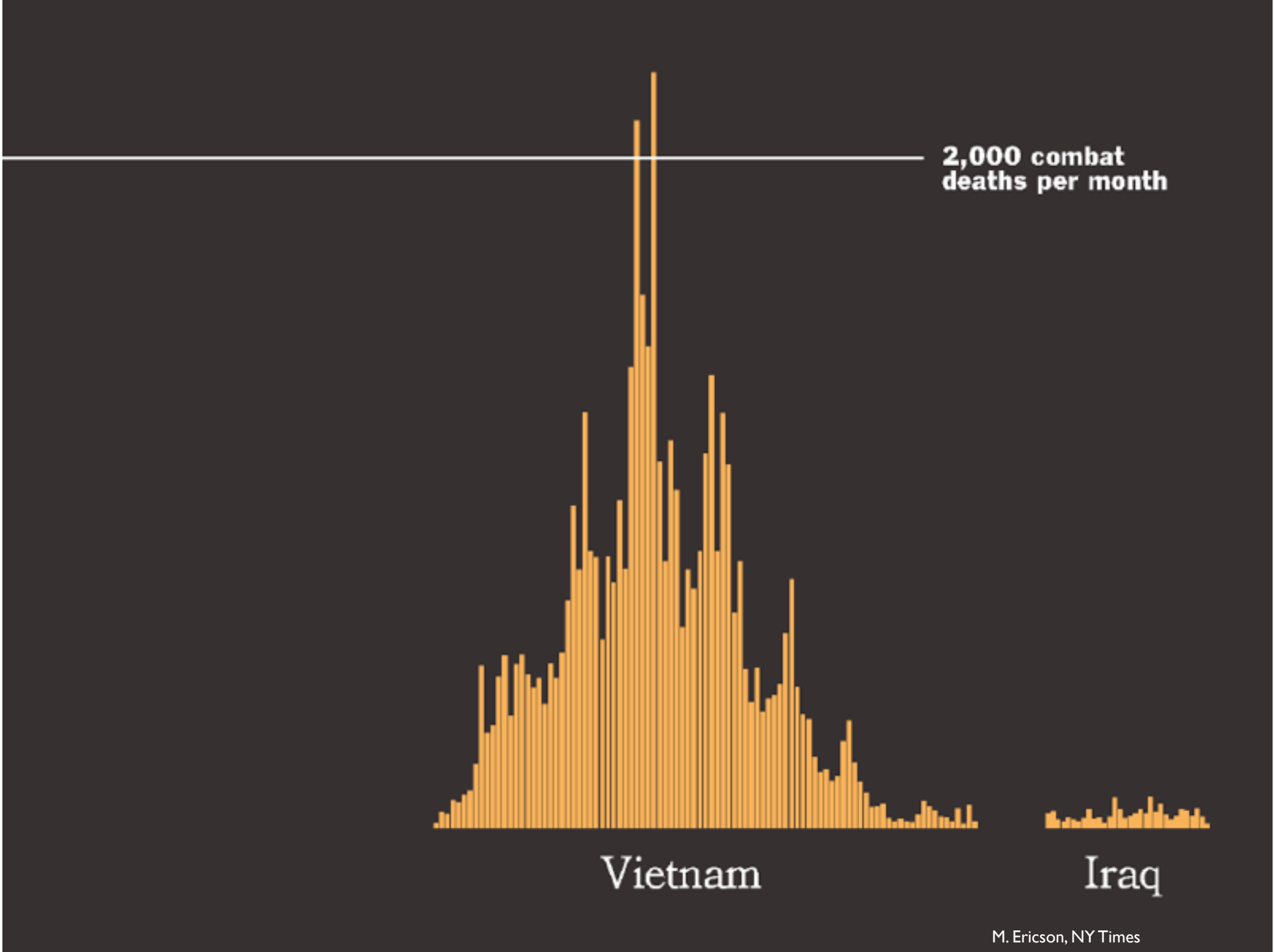
(Against) neutrality of visualization

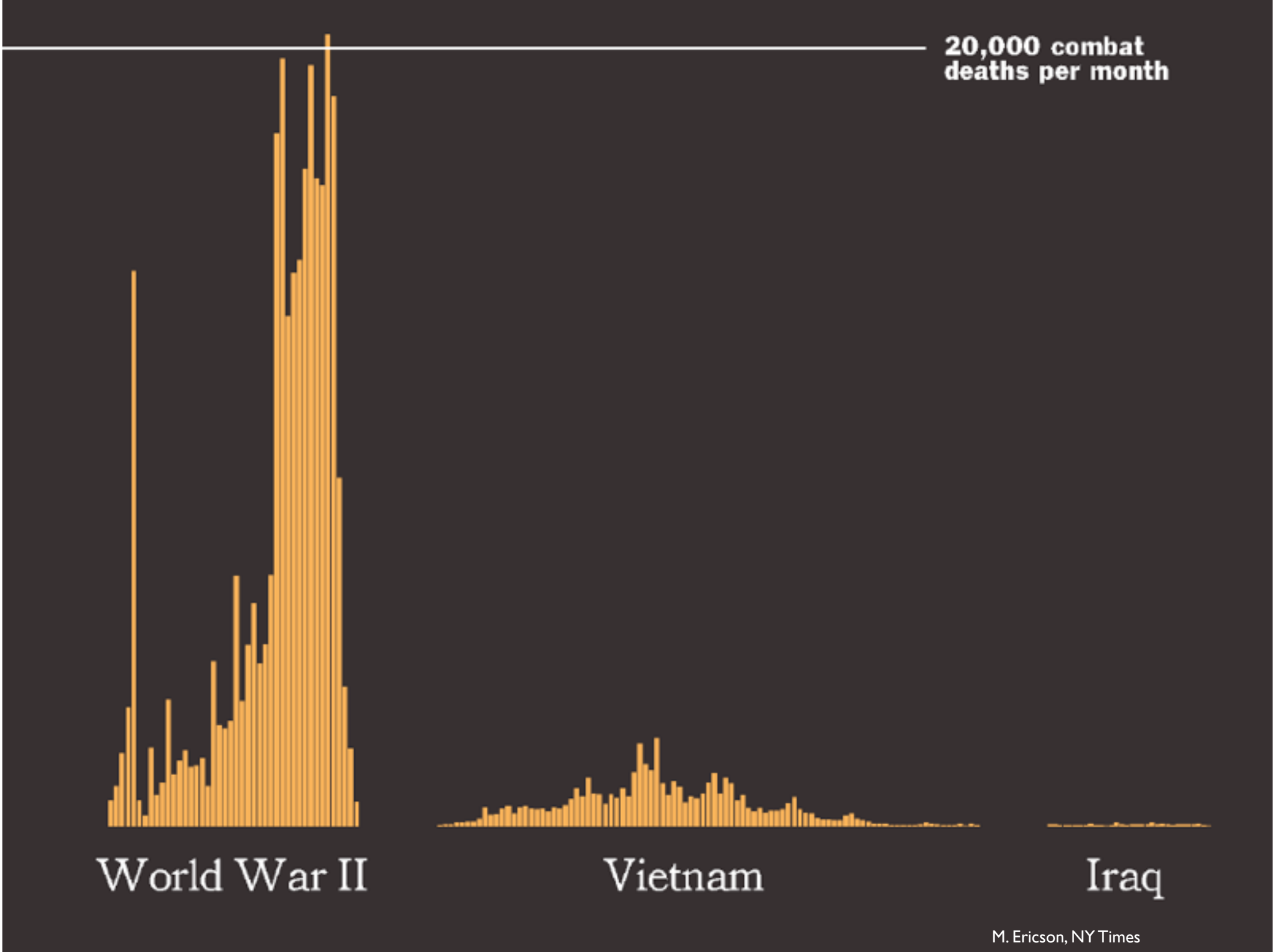
- All visualizations are rhetorical, and have the power to potentially persuade
- In our own work, the assumption that attempting to persuade with visualizations is only the goal of the propagandist, and that scientific visualization and statistical graphics are therefore above such considerations, cedes rhetorical ground to the groups that do not have such scruples.

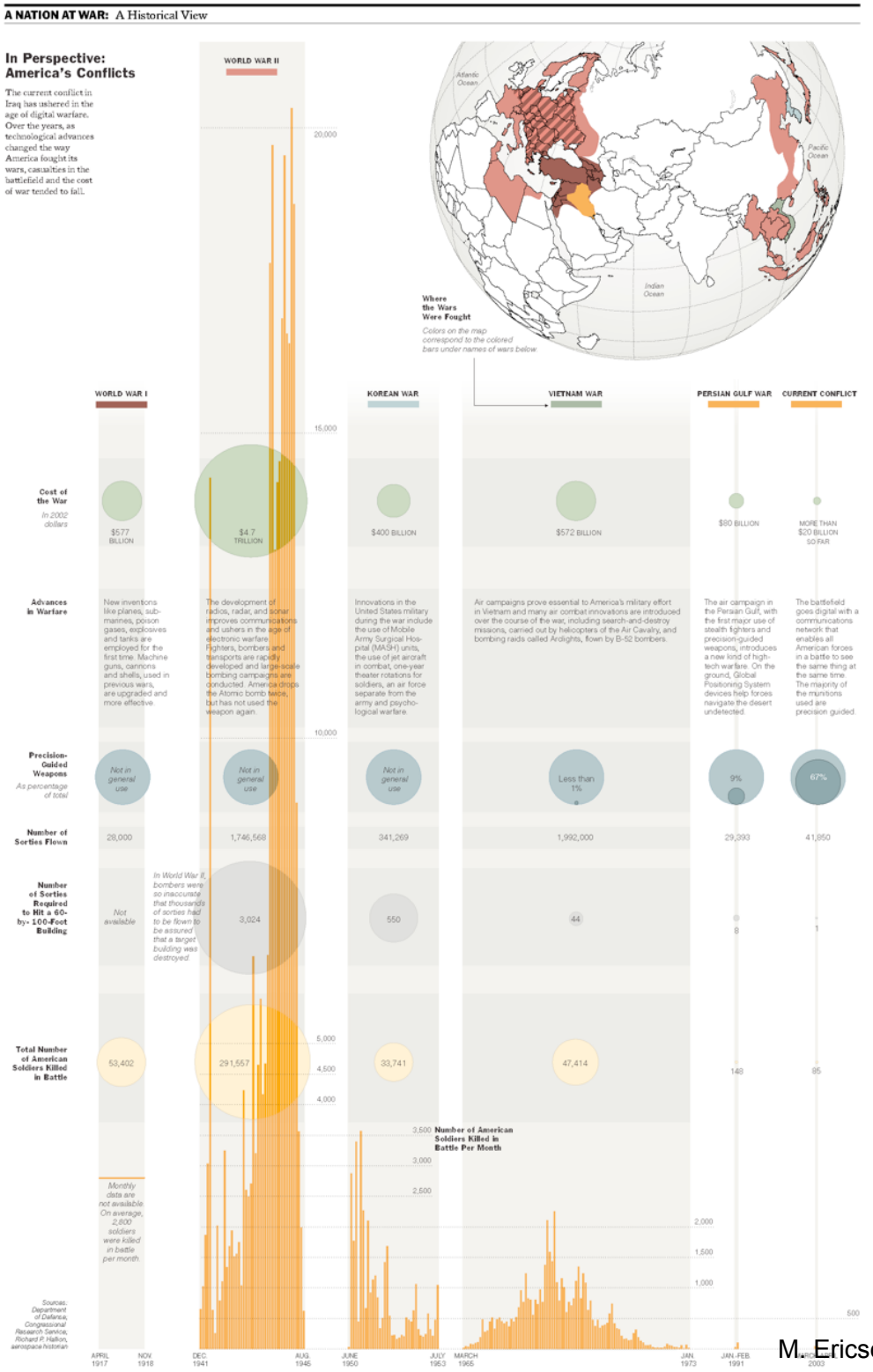
Show Context



M. Ericson, NY Times


2,000 combat deaths per month
Vietnam
Iraq
M. Ericson, NY Times

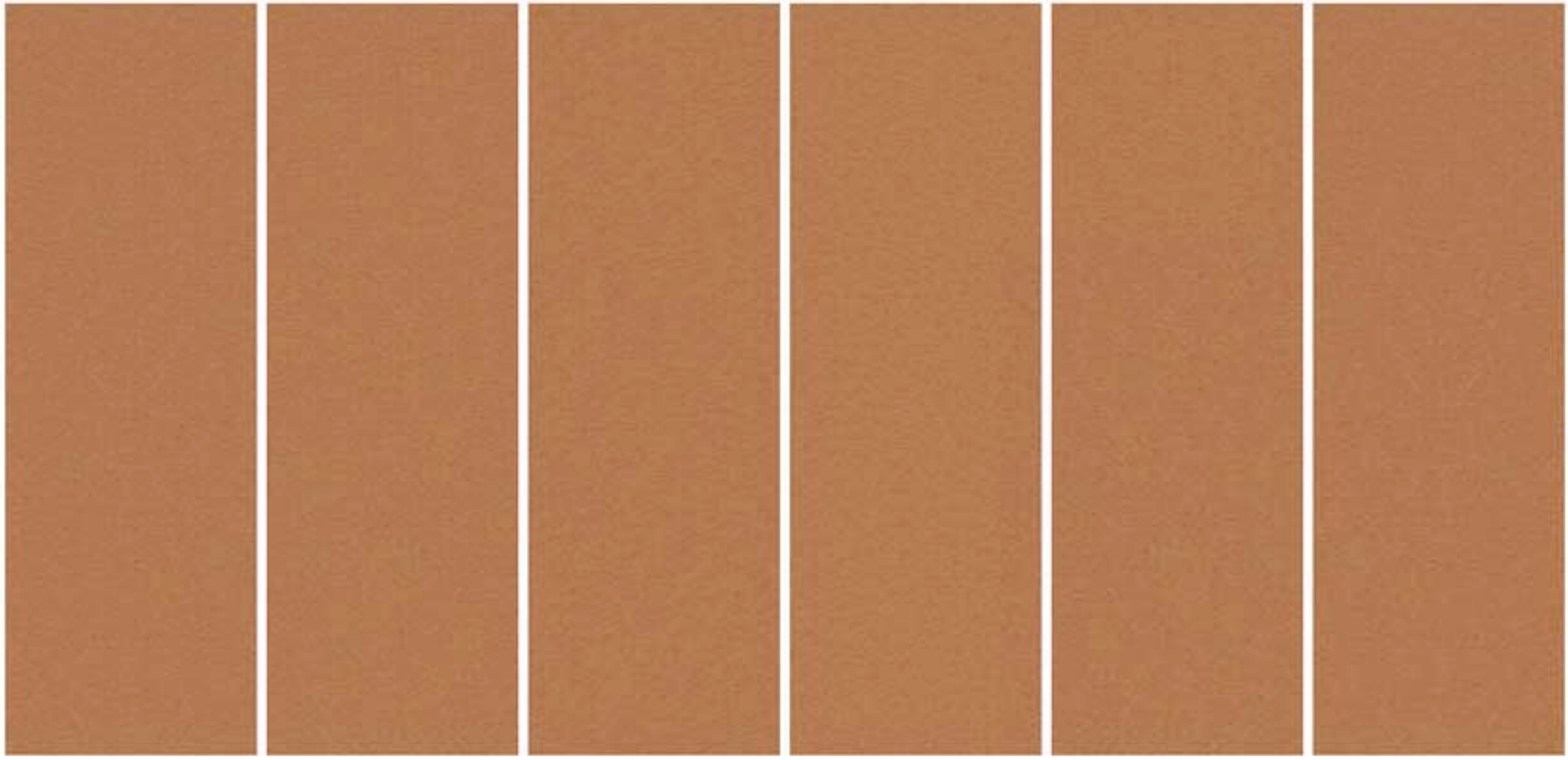

20,000 combat deaths per month
World War II
Vietnam
Iraq
M. Ericson, NY Times



M. Ericson, NY Times

Micro-Macro

Depicts 2.3 million folded prison uniforms, equal to the number of Americans incarcerated in 2005.



http://www.chrisjordan.com/current_set2.php

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Concerning trends in vis research

Concerning directions

full review of all topics of visualization research, and their associated ethical considerations, is out of the scope of this paper

- Automated Analysis
- Machine Learning
- Provenance

Automated analysis

- Vis recommendation engines
  - Hard to validate
  - P-hacking (incl visual p-hacking)
  - Examples: “Show Me” of Tableau or Voyager / Voyager 2
- automatic insights … can empower people without the time or expertise to discover these findings alone. Systems with excessive guidance or constraints also reduce the agency of the user. There is therefore a potential conflict between democratizing data analytics and promoting statistically sound decision-making.

Voyager

https://idl.cs.washington.edu/papers/voyager/
https://idl.cs.washington.edu/papers/voyager2/

Automated analysis

- Design Dilemmas: How much guidance should analytics systems provide to users? How prescriptive should such systems be in forbidding or advising against actions that are likely to lead to statistically spurious conclusions?

Machine Learning

- We have a moral duty (and, in some cases, a legal duty) to communicate decision- making based on ML to the populations that are impacted by it. Communication in this way provides much needed context for decisions that seem misguided or callous, and allow those impacted by the decisions to appeal their decisions or seek better outcomes.
- Legal scholars … have argued for the right to "Technological Due Process" in the face of opaque algorithmic decision-making.

Machine Learning

- much of the prominent work on visualizing ML focuses on expert users. An ethical concern is that we are therefore empowering the creators of ML models, but are not empowering the people affected by these models
- Even the very definition of what it means for an ML model to be “interpretable” is ill-defined and sometimes contradictory
- Full transparency in models, especially in models built from demographic data, can also compromise the privacy of those who have had their data collected (as in social network data).

Machine Learning

Design Dilemmas: How much abstraction or approximation should we use when communicating complex ML models? What standards or expectations should we cultivate when choosing which parts of algorithmic decision-making to display?

Provenance

- what steps an analyst took in order to produce a particular chart or to arrive at a particular conclusion
- unmet ethical challenge: to visualize the provenance of data and decision-making. Communicating the decisions that an analyst took, and affording different decisions, is a key component of both affording criticism and supporting transparency in data-driven decision-making
- Notebook-style interfaces (Jupyter and Observable) or literate programming environments such as R markdown: great but require programming
- In contrast, popular systems (Tableau, PowerBI, and Spotfire) heavily rely on GUIs and do not require coding expertise to use
- Hence, a gap between ease of analysis and ease of documentation, further muddying the waters between exploratory and confirmatory analytics.

Provenance

- Challenge: rhetorical one of how to convince viewers not to be taken in by unreliable data or information or how to mitigate cognitive biases in decision-making
- ethical balance between supporting the agency and desires of the viewer and the desire to communicate information that is both correct and useful

Provenance

Design Dilemmas: How, and how many, alternate design or analytical decisions should we surface to the user? Should we audit or structure the provenance of a visualization in order to surface irregularities?

Obligations of Vis researcher

- avoid breaches of consent and excesses of harm laid out in codes of research conduct such as the Declaration of Helsinki
- ethical obligations as engineers (for instance, to avoid doing shoddy work or work dangerous to the public good) as laid out in professional codes of conduct such as the ACM's code of ethics
- ethical obligations as journalists (for instance, to issue corrections and disclose conflicts of interest), as laid out in codes of conduct such as the SPJ's code of ethics
- we have a great deal of power over how people ultimately make use of data, both in the patterns they see and the conclusions they draw
- Visualizations systems we create also embody design principles concerning democratization, transparency, clarity, and automation that lend their use a unique moral signature
- Our ethics in relation to
  - visibility
  - privacy
  - power

Visibility

- visualize hidden labor
- visualize hidden uncertainty
- visualize hidden impacts, especially the potential negative impacts:
  - what harm could be done using the new classes of insights afforded by the visualization system?
  - What groups or individuals may be impacted by the work but do not fit the data model in use?
  - Are there immoral or predatory domains that could make use of the proposed techniques?
  - will people be harmed if and when the system ceases to be supported (a common occurrence for systems developed in academia)?
  - What are the opportunity costs (in terms of training, collaboration time, and student or developer labor) associated with the system?
  - Do all of the components of the ultimate value of the visualization [92] have a positive sign, from a consequentialist perspective?

Collect Data With Empathy

- Commercial interests of “if only we collect more, and more personal data”
- Visualization is well-positioned to explicitly push against the pressure to collect more and more data by better communicating data’s value and impact to analysts. We also have the option of contextualizing and curating data in a way that is respectful of our larger sets of shared values
- encourage “small data.”
  - bigger data are not always better data
  - communicate how much data is “enough,” and condition analysts to accept tradeoffs of accuracy or certainty in exchange for concision and protection
- anthropomorphize data
  - solutions to recenter human beings in data visualizations using person-shaped glyphs has not been shown to produce any additional empathic response

Collect Data With Empathy

- obfuscate data to protect privacy
  - inadvertent exposures of data, combined with the ability of visualizations to highlight previously unseen patterns and trends, can result in severe breaches of confidentiality and privacy
  - Preserving the privacy of the people in our dataset may involve novel designs or interactive workflows. Both of these classes of techniques involve aggregating, fuzzing, or otherwise restructuring data to preserve privacy. A related component of this obfuscation is then communicating the upper limit of accuracy or detail to analysts.

Challenge Structures of Power

- Vis + data analysis is expensive: only afforded by governments and organizations with money
- intended audience of a vis. is often those with high scientific, mathematic, and visual literacies rather than wider and more general audiences
- support data “due process”
  - design research and pedagogical responsibilities to ensure that we are giving people agency and representation in ways that are useful and understandable

Challenge Structures of Power

- act as data advocates
  - donate a portion of our expertise in the presentation of information to advocate or amplify causes we believe in
- pressure or slow unethical analytical behavior
  - In such cases where one is unwilling or unable to risk retaliation to stop or speak out against unethical work, other options are the intentional sabotage or slowdown of labor. Within the context of visualization work, this could be overestimation of budgets of money and time, underestimation of result quality, or un- necessary delays (say, for additional user testing or ablation studies). Such sabotage may involve a conflict between ethical, professional and perhaps even legal duties, and should not be undertaken lightly

The IEEE 7000 Standard (slides based on Sarah Spiekermann

Context

- Many value-principle listings have been put forth
- since 2016: Over 80 value lists accumulated
  - EU Commission's ALTAI list
  - OECD list
  - Microsoft, IBM and other corporates
  - IEEE 7010 list catalogue

Challenge 1: Software Quality

- non-transparent predictive analytics leads to wrong decisions by machines, unfair treatment of human actors and nonsensical system behavior due to wrong categorizations

Challenge 2: Hardware Quality

- Products are built to just function instead of being really good and reliable Innovations
- mentality of "problem fixing".

Challenge 3: Business Models

- Monetary value is pursued without any regard for human dignity or human rights
- Participation in the data economy
- It is all about cost minimization instead of quality
- A derogatory image of humans as suboptimal beings that have to be 'developed' or 'manipulated' through technology shows a lucrative trend (e.g., humans are "predictably irrational" or characterized by "mental inertia")

Challenge 4: Complexity

- Uncontrolled system-of-systems partners share opaque data and services

Challenge 5: Corporate Culture

- Priority of profit instead of values
- Support of non-transparency
- No time for diligence
- No room for conscientiousness

Challenge 6: Sustainability

- Enormous energy costs are required to build and operate digital infrastructure, but this is ignored
- Resource availability of components is overestimated
- Potential global conflicts over dwindling resources are not seen

Challenge 7: „Degrading humanity“

- Addiction and dependence on digital services leads to a change in social behavior, learning and thinking skills in children and adults.

Goal

- The 7000 standard embodies a path to better system design, anticipating impacts and addressing them IN the product or service.
  - IEEE 7000 gives organization's IT departments clear guidance on how to build 'valuable' technology in awareness of ethical issues.
  - IT's value issues are seen and addressed early on in the innovation process. Risk of building technology degrading humanity is greatly reduced.
  - Value-based Engineering with IEEE 7000 helps innovation teams to build social and human-friendly IT narratives departing from science fiction and transhumanism.
  - IEEE 7000 is challenging organizations to find AI-partners that give them access and sufficient control over their service.
  - IEEE 7000 can help companies to comply with the EU AI Regulation.
  - IEEE 7000 can help investors make better investment decisions.

How does VBE relate to IEEE 7000™?

WU Wirtschaftsuniversität Wien Vienna University of Economics and Business

IEEE Advancing Technology for Humanity

VBE is a tested way to implement IEEE 7000™

Concept & Context Exploration

- *SOI Context*
- *SOS Analysis*
- *Stakeholder Analysis*
- *External Partner Analysis*

Value Exploration

- *Value Elicitation & Clustering*
- *Core Value Prioritization*
- *Conceptual Analysis*
- *Ethical Value (EVR) Identification*

Ethically Aligned Design

- *Simple risk-based System Design*
- *Impact Assessment led System Design*
- *System Development & Launch*

Value-driven continuous system monitoring & improvement

Transparency Management, Stakeholder Management, Top-Management Involvement

3 Phases

- Preparing the Grounds
- Eliciting relevant Values
- Deriving value-based System Requirements

1st phase

- tries to understand the reality out there
- IEEE 7000 starts with a System of Interest (SOI), not needs!
- The real-world deployment space is explored
- Contextual diagrams visualize data flows to analyze SOI boundaries and vulnerabilities
- The System of System (SOS) partners need to be scrutinized;
- especially potential AI components
- Relevant direct and indirect stakeholders are identified in their various roles

Partner scrutiny

- The normative part of IEEE 7000 requires organizations to only line up with partners who are willing to give access to their systems.
- Acknowledged or directed form of partnership are recommended (see ISO 15288).

AI component selection

- For an external AI service to be integrable into a “good” system, the IEEE 7000 standard outlines that the necessary control over an AI system should only be presumed where there is control over the following:
- The quality of the data used in the AI system;
- The selection processes feeding the AI;
- The algorithm design;
- The evolution of the AI’s logic; and
- The best available techniques (BATs) for a sufficient level of transparency of how the AI is learning and reaching its conclusions.

2nd phase

- explores and analyzes the value space by going into „philosophical mode“
- VBE & IEEE 7000 wonder what value qualities a technology might contribute to a context & what value qualities might be destroyed
- Value Elicitation & Clustering
  - Core Value Prioritization
  - Conceptual Analysis
- VBE & IEEE 7000 have a ‘value ontology’
- The approach uses multiple moral philosophies to elicit relevant values & is sensitive to locality
- Values are not traded-off, but ranked
- Prioritized values are conceptually analyzed

- IEEE 7000 has a built-in value ontology taken from Scheler's Material Value Ethics
- Engineers responsibility is to build appropriate value dispositions into systems
- factor often underestimated is the negative value qualities fostered by systems in people
- At the moment our poorly build systems foster hate, envy and e-personalities
- This is why a central building block of value elicitation is the use of virtue ethics

Virtue ethics

- Core virtue ethical question in VBE with IEEE 7000:
  - What are the negative implications of the system for the character and/or personality of direct and indirect stakeholders—that is, which virtue harms or vices could result if the system was implemented at scale?

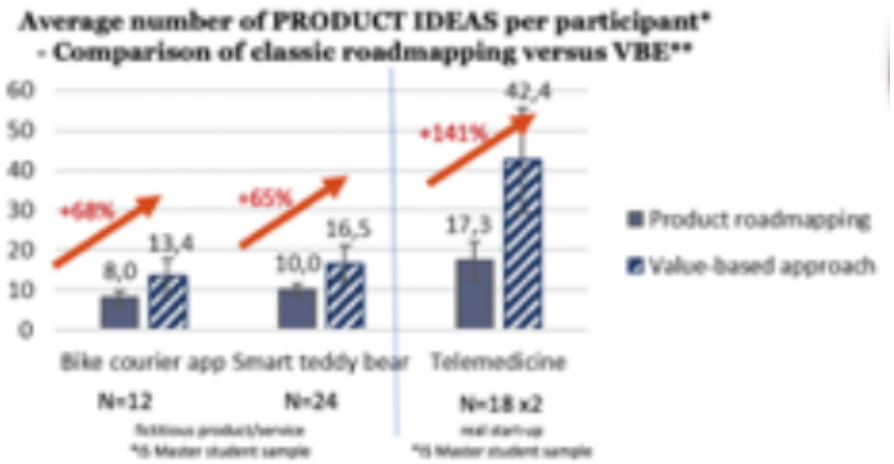
Utilitarianism & Duty Ethics

- In addition to virtue ethics, VBE with IEEE 7000 uses Utilitarianism and Duty Ethics for guidance.
- Utilitarianism:
  - What human, social, economic, or other values are affected, positively or negatively, by the SOI?
- Duty Ethics:
  - What personal maxims or value priorities does the project team see affected by the service that the project team members believe are so important that they want to preserve them in society?

Table G.1—Typical ethical values for systems design

Ethical value applicable to system design	Related value	Opposing value
Autonomy	Moral agency, dignity, independence, freedom, liberty, mobility, self-direction, power, self-actualization, ownership	Accountability, responsibility, responsiveness, reciprocity, paternalism, slavery
Care	Accountability to shareholders, investors, suppliers, and other stakeholders; understanding; compassion; love; empathy; protection of the vulnerable; affection; support; friendliness; beneficence; benevolence; generosity; gentleness; helpfulness; kindness; comfort; quality of life; paternalism	Torture, maleficence, persecution, machine capability, logic, objectivity
Control	Human responsibility, governance, usability, portability, logic, sense of accomplishment, moderation	Trust, accountability to stakeholders; imagination, reminding, obedience
Fairness	Responsible position on conflicts of interest, tolerance, justice, balance, equality (legal, gender, minority)	Bias, suspicion, discrimination, arbitrariness
Inclusiveness	Participation, partnership, solidarity, interdependence, compatibility, accessibility, diversity	Control, bias, detachment
Innovation	Modifiability, adventure, novelty, excitement, playfulness, diversity, development, learning, curiosity, creativity	Tradition, distraction
Perfection	Integrity, truth, honesty, achievement, transcendence, universalism, wisdom	Competence, feasibility, over-capacity,
Privacy	Respect for confidentiality, intimacy, anonymity	Transparency, inclusiveness, alerting
Respect	Politeness, courtesy, respect for environment and natural habitat, respect for information and confidentiality, respect for norms, reputation	Self-esteem, maleficence
Sustainability	Respect for environment and natural habitat, efficiency, maintainability, operability, supportability, reliability, durability, resilience, forgiveness, robustness, redundancy, reusability, re-configurability, simplicity, economy, renewability	Cost (extravagance), wastefulness, poverty, consumption
Transparency	Openness, cleanliness, explicability, explainabililty, access to data. auditability	Privacy, bribery, corruption
Trust	Predictability, dependability, veracity	Control
NOTE—Opposing values can be positive or negative.		

Case studies



- Using VBE/IEEE 7000 participants generate significantly more product ideas in response to moral challenges than in preparing a classical product roadmap.
- See Bednar, K., & Spiekermann, S. (2021). On the power of ethics: How value-based thinking fosters creative and sustainable IT innovation; Working Paper: https://epub.wu.ac.at/7841/